ORIGINAL

City of San Diego

CONTRACTOR'S NAME: L.H. Woods and Sons, Inc.
ADDRESS: 2115 La Mirada Dr., Vista, CA 92081
TELEPHONE NO.: 760-599-5500 **FAX NO.:** 760-599-5510
CITY CONTACT: Michelle Muñoz, Contract Specialist, Email: MichelleM@sandiego.gov
Phone No. (619) 533-3482, Fax No. (619) 533-3633
D.Abbey/A. Jaro/Lad

BIDDING DOCUMENTS

e - Bidding

FOR

TIERRASANTA PUMP STATION

BID NO.: **K-16-1431-DBB-3**
SAP NO. (WBS/IO/CC): **S-12040**
CLIENT DEPARTMENT: **2013**
COUNCIL DISTRICT: **7**
PROJECT TYPE: **BJ**

THIS CONTRACT WILL BE SUBJECT TO THE FOLLOWING:

- PHASED-FUNDING
- THE CITY'S SUBCONTRACTING PARTICIPATION REQUIREMENTS FOR SLBE PROGRAM.
- PREVAILING WAGE RATES: STATE ☒ FEDERAL ☐
- APPRENTICESHIP

BID DUE DATE:

2:00 PM
JULY 27, 2016
CITY OF SAN DIEGO
PUBLIC WORKS CONTRACTS
1010 SECOND AVENUE, 14th FLOOR, MS 614C
SAN DIEGO, CA 92101

ENGINEER OF WORK

The engineering Specifications and Special Provisions contained herein have been prepared by or under the direction of the following Registered Engineer:

Douglas B. Robison

6/17/16

Seal: 6/30/18

REGISTERED PROFESSIONAL ENGINEER DOUGLAS B. ROBISON NO. 37109 CIVIL STATE OF CALIFORNIA

1) Registered Engineer — Date

6/17/16

Seal

REGISTERED PROFESSIONAL ENGINEER ALEJANDRO G. GARCIA No. 51507 Exp 6/30/18 CIVIL STATE OF CALIFORNIA

2) For City Engineer — Date

TABLE OF CONTENTS

SECTION ..... **PAGE**

1. NOTICE INVITING BIDS 4
2. INSTRUCTIONS TO BIDDERS 7
3. PERFORMANCE AND PAYMENT BONDS 16
4. ATTACHMENTS:
   - A. SCOPE OF WORK 19
   - B. PHASED FUNDING PROVISIONS 21
   - C. EQUAL OPPORTUNITY CONTRACTING PROGRAM 24
   - D. PREVAILING WAGE 29
   - E. SUPPLEMENTARY SPECIAL PROVISIONS 33
   - TECHNICALS 70
     1. Appendix A – Final Mitigated Negative Declaration 770
     2. Appendix B - Fire Hydrant Meter Program 810
     3. Appendix C - Materials Typically Accepted by Certificate of Compliance 824
     4. Appendix D - Sample City Invoice 826
     5. Appendix E - Location Map 828
     6. Appendix F - Hydrostatic Discharge Form 830
     7. Appendix G - Hazardous Label/Forms 832
     8. Appendix H - Sample Archaeology Invoice 838
     9. Appendix I – Sample of Public Notices 841
   - F. INTENTIONALLY LEFT BLANK 843
   - G. CONTRACT AGREEMENT 844
5. CERTIFICATIONS AND FORMS 847

NOTICE INVITING BIDS

1. **SUMMARY OF WORK:** This is the City of San Diego's (City) solicitation process to acquire Construction services for **Tierrasanta Pump Station.** For additional information refer to Attachment A.

2. **FULL AND OPEN COMPETITION:** This contract is open to full competition and may be bid on by Contractors who are on the City's current Prequalified Contractors' List. For information regarding the Contractors Prequalified list visit the City's website: http://www.sandiego.gov.

3. **ESTIMATED CONSTRUCTION COST:** The City's estimated construction cost for this project is **$10,500,000.00.**

4. **BID DUE DATE AND TIME ARE: JULY 27, 2016 AT 2:00 PM.**

5. **PREVAILING WAGE RATES APPLY TO THIS CONTRACT:** Refer to Attachment D.

6. **LICENSE REQUIREMENT:** The City has determined that the following licensing classification(s) are required for this contract: A.

7. **SUBCONTRACTING PARTICIPATION PERCENTAGES:** The City has incorporated mandatory SLBE-ELBE subcontractor participation percentages to enhance competition and maximize subcontracting opportunities. For the purpose of achieving the mandatory subcontractor participation percentages, a recommended breakdown of the SLBE and ELBE subcontractor participation percentages based upon certified SLBE and ELBE firms has also been provided to achieve the mandatory subcontractor participation percentages:

1.	SLBE participation	**6.5%**
2.	ELBE participation	**15.8%**
3.	Total mandatory participation	**22.3%**

7.1. The Bid may be declared non-responsive if the Bidder fails the following mandatory conditions:

7.1.1. Attending the Pre-Bid Meeting as required in the Notice Inviting Bids of these documents.

7.1.2. Bidder's inclusion of SLBE-ELBE certified subcontractors at the overall mandatory participation percentage identified in this document; **OR**

7.1.3. Bidder's submission of Good Faith Effort documentation, saved in searchable Portable Document Format (PDF) and stored on Compact Disc (CD) or Digital Video Disc (DVD), demonstrating the Bidder made a good faith effort to outreach to and include SLBE-ELBE Subcontractors required in this document within **3 Working Days** of the Bid opening if the overall mandatory participation percentage is not met.

8. PRE-BID MEETING:

8.1. Prospective Bidders are encouraged to attend the Pre-Bid Meeting. The purpose of the meeting is to discuss the scope of the Project, submittal requirements, the pre-qualification process and any Equal Opportunity Contracting Program requirements and reporting procedures. To request a sign language or oral interpreter for this visit, call the Public Works Contracts Division at (619) 533-3450 at least 5 Working Days prior to the meeting to ensure availability. The Pre-Bid meeting is scheduled as follows:

Date: **June 30, 2016**
Time: **At 10:00 AM**
Location: **1010 Second Avenue, Suite 1400, San Diego, CA 92101**

Attendance at the Pre-Submittal Meeting will be evidenced by the Bidder's representative's signature on the attendance roster. It is the responsibility of the Bidder's representative to complete and sign the attendance roster.

9. AWARD PROCESS:

9.1. The Award of this contract is contingent upon the Contractor's compliance with all conditions of Award as stated within these documents and within the Notice of Intent to Award.

9.2. Upon acceptance of a Bid, the City will prepare contract documents for execution within approximately 21 days of the date of the Bid opening. The City will then award the Contract within approximately 14 days of receipt of properly signed Contract, bonds, and insurance documents.

9.3. This contract will be deemed executed and effective only upon the signing of the Contract by the Mayor or his designee and approval as to form the City Attorney's Office.

9.4. The low Bid will be determined by Base Bid alone.

9.5. Once the low bid has been determined, the City may, at its sole discretion, award the contract for the Base bid alone.

10. SUBMISSION OF QUESTIONS:

10.1. The Director (or designee), of the Public Works Department is the officer responsible for opening, examining, and evaluating the competitive Bids submitted to the City for the acquisition, construction and completion of any public improvement except when otherwise set forth in these documents. All questions related to this solicitation shall be submitted to:

Public Works Contracts
1010 Second Avenue, 14th Floor
San Diego, California, 92101
Attention: Michelle Muñoz, Contract Specialist

OR:

MichelleM@sandiego.gov

10.2. Questions received less than 14 days prior to the date for opening of Bids may not be considered.

10.3. Questions or clarifications deemed by the City to be material shall be answered via issuance of an addendum and posted to the City's online bidding service.

10.4. Only questions answered by formal written addenda shall be binding. Oral and other interpretations or clarifications shall be without legal effect. It is the Bidder's responsibility to be informed of any addenda that have been issued and to include all such information in its Bid.

11. **PHASED FUNDING:** For Phased Funding Conditions, see Attachment B.

INSTRUCTIONS TO BIDDERS

1. **PREQUALIFICATION OF CONTRACTORS:**

   1.1. Contractors submitting a Bid must be pre-qualified for the total amount proposed, including all alternate items, prior to the date of submittal. Bids from contractors who have not been pre-qualified as applicable and Bids that exceed the maximum dollar amount at which contractors are pre-qualified may be deemed **non-responsive** and ineligible for award. Complete information and links to the on-line prequalification application are available at:

   http://www.sandiego.gov/cip/bidopps/prequalification.shtml

   1.2. The completed application must be submitted online no later than 2 weeks prior to the bid opening. For additional information or the answer to questions about the prequalification program, contact David Stucky at 619-533-3474 or dstucky@sandiego.gov.

   1.3. Due to the City's fiduciary requirement to safeguard vendor data, City staff will not be able to provide information regarding contractors' prequalification status over the telephone. Contractors may access real-time information about their prequalification status via their vendor profile on PlanetBids™.

2. **ELECTRONIC FORMAT RECEIPT AND OPENING OF BIDS:** Bids will be received in electronic format (eBids) EXCLUSIVELY at the City of San Diego's electronic bidding (eBidding) site, at: http://www.sandiego.gov/cip/bidopps/index.shtml and are due by the date, and time shown on the cover of this solicitation.

   2.1. BIDDERS MUST BE PRE-REGISTERED with the City's bidding system and possess a system-assigned Digital ID in order to submit and electronic bid.

   2.2. The City's bidding system will automatically track information submitted to the site including IP addresses, browsers being used and the URLs from which information was submitted. In addition, the City's bidding system will keep a history of every login instance including the time of login, and other information about the user's computer configuration such as the operating system, browser type, version, and more. Because of these security features, Contractors who disable their browsers' cookies will not be able to log in and use the City's bidding system.

   2.3. The City's electronic bidding system is responsible for bid tabulations. Upon the bidder's or proposer's entry of their bid, the system will ensure that all required fields are entered. **The system will not accept a bid for which any required information is missing.** This includes all necessary pricing, subcontractor listing(s) and any other essential documentation and supporting materials and forms requested or contained in these solicitation documents.

   2.4. BIDS REMAIN SEALED UNTIL BID DEADLINE. eBids are transmitted into the City's bidding system via hypertext transfer protocol secure (https) mechanism using SSL 128-256 bit security certificates issued from Verisign/Thawte which encrypts data being transferred from client to server. Bids submitted prior to the "Bid Due Date and Time" are not available for review by anyone other than the submitter which has until the "Bid Due Date and Time" to change, rescind or retrieve its proposal should it

desire to do so.

2.5. BIDS MUST BE SUBMITTED BY BID DUE DATE AND TIME. Once the bid deadline is reached, no further submissions are accepted into the system. Once the Bid Due Date and Time has lapsed, bidders, proposers, the general public, and City staff are able to immediately see the results on line. City staff may then begin reviewing the submissions for responsiveness, EOCP compliance and other issues. The City may require any Bidder to furnish statement of experience, financial responsibility, technical ability, equipment, and references.

2.6. RECAPITULATION OF THE WORK. Bids shall not contain any recapitulation of the Work. Conditional Bids may be rejected as being non-responsive. Alternative proposals will not be considered unless called for.

2.7. BIDS MAY BE WITHDRAWN by the Bidder only up to the bid due date and time.

2.7.1. Important Note: Submission of the electronic bid into the system may not be instantaneous. Due to the speed and capabilities of the user's internet service provider (ISP), bandwidth, computer hardware and other variables, it may take time for the bidder's submission to upload and be received by the City's eBidding system. It is the bidder's sole responsibility to ensure their bids are received on time by the City's eBidding system. The City of San Diego is not responsible for bids that do not arrive by the required date and time.

2.8. ACCESSIBILITY AND AMERICANS WITH DISABILITIES ACT (ADA) COMPLIANCE. : To request a copy of this solicitation in an alternative format, contact the Public Works Contract Specialist listed in the cover of this solicitation at least five (5) working days prior to the Bid/Proposal due date to ensure availability.

3. ELECTRONIC BID SUBMISSIONS CARRY FULL FORCE AND EFFECT

3.1. The bidder, by submitting its electronic bid, acknowledges that doing so carries the same force and full legal effect as a paper submission with a longhand (wet) signature.

3.2. By submitting an electronic bid, the bidder certifies that the bidder has thoroughly examined and understands the entire Contract Documents (which consist of the plans and specifications, drawings, forms, affidavits and the solicitation documents), and that by submitting the eBid as its bid proposal, the bidder acknowledges, agrees to and is bound by the entire Contract Documents, including any addenda issued thereto, and incorporated by reference in the Contract Documents.

3.3. The Bidder, by submitting its electronic bid, agrees to and certifies under penalty of perjury under the laws of the State of California, that the certification, forms and affidavits submitted as part of this bid are true and correct.

3.4. The Bidder agrees to the construction of the project as described in Attachment "A–Scope of Work" for the City of San Diego, in accordance with the requirements set forth herein for the electronically submitted prices. The Bidder guarantees the Contract Price for a period of 120 days (90 days for federally funded contracts and contracts valued at $500,000 or less) from the date of Bid opening. The duration of the Contract Price guarantee shall be extended by the number of days required for the City to obtain all items necessary to fulfill all conditions precedent.

4. **BIDS ARE PUBLIC RECORDS:** Upon receipt by the City, Bids shall become public records subject to public disclosure. It is the responsibility of the respondent to clearly identify any confidential, proprietary, trade secret or otherwise legally privileged information contained within the Bid. General references to sections of the California Public Records Act (PRA) will not suffice. If the Contractor does not provide applicable case law that clearly establishes that the requested information is exempt from the disclosure requirements of the PRA, the City shall be free to release the information when required in accordance with the PRA, pursuant to any other applicable law, or by order of any court or government agency, and the Contractor will hold the City harmless for release of this information.

5. **CONTRACTOR REGISTRATION AND ELECTRONIC REPORTING SYSTEM:**

   5.1. **Prior** to the Award of the Contract or Task Order, you and your Subcontractors and Suppliers must register with the City's web-based vendor registration and bid management system. For additional information go to:

   http://www.sandiego.gov/purchasing/bids-contracts/vendorreg.shtml.

   5.2. The City may not award the contract until registration of all subcontractors and suppliers is complete. In the event this requirement is not met within the time frame specified in the Notice of Intent to Award letter, the City reserves the right to rescind the Notice of Award / Intent to Award and to make the award to the next responsive and responsible bidder / proposer.

6. **JOINT VENTURE CONTRACTORS:** Provide a copy of the Joint Venture agreement and the Joint Venture license to the City within 10 Working Days after receiving the Contract forms. See 2-1.1.2, "Joint Venture Contractors" in The WHITEBOOK for details.

7. **PREVAILING WAGE RATES WILL APPLY:** Refer to Attachment D.

8. **SUBCONTRACTING PARTICIPATION PERCENTAGES:** Subcontracting participation percentages apply to this contract. Refer to Attachment E.

9. **INSURANCE REQUIREMENTS:**

   9.1. All certificates of insurance and endorsements required by the contract are to be provided upon issuance of the City's Notice of Intent to Award letter.

   9.2. Refer to sections 7-3, "LIABILITY INSURANCE", and 7-4, "WORKERS' COMPENSATION INSURANCE" of the Supplementary Special Provisions (SSP) for the insurance requirements which must be met.

10. **REFERENCE STANDARDS:** Except as otherwise noted or specified, the Work shall be completed in accordance with the following standards:

Title	Edition	Document Number
Standard Specifications for Public Works Construction ("The GREENBOOK")	2012	PITS070112-01
City of San Diego Standard Specifications for Public Works Construction ("The WHITEBOOK")*	2012	PITS070112-02

Title	Edition	Document Number
City of San Diego Standard Drawings*	2012	PITS070112-03
Caltrans Standard Specifications	2010	PITS070112-04
Caltrans Standard Plans	2010	PITS070112-05
California MUTCD	2012	PITS070112-06
City Standard Drawings - Updates Approved For Use (when specified)*	Varies	Varies
Standard Federal Equal Employment Opportunity Construction Contract Specifications and the Equal Opportunity Clause Dated 09-11-84	1984	769023
NOTE: *Available online under Engineering Documents and References at: http://www.sandiego.gov/publicworks/edocref/index.shtml		

11. **CITY'S RESPONSES AND ADDENDA:** The City, at its discretion, may respond to any or all questions submitted in writing via the City's eBidding web site in the **form of an addendum**. No other responses to questions, oral or written shall be of any force or effect with respect to this solicitation. The changes to the Contract Documents through addendum are made effective as though originally issued with the Bid. The Bidders shall acknowledge the receipt of Addenda at the time of bid submission.

12. **CITY'S RIGHTS RESERVED:** The City reserves the right to cancel the Notice Inviting Bids at any time, and further reserves the right to reject submitted Bids, without giving any reason for such action, at its sole discretion and without liability. Costs incurred by the Bidder(s) as a result of preparing Bids under the Notice Inviting Bids shall be the sole responsibility of each bidder. The Notice Inviting Bids creates or imposes no obligation upon the City to enter a contract.

13. **CONTRACT PRICING:** This solicitation is for a Lump Sum contract with Unit Price provisions as set forth herein. The Bidder agrees to perform construction services for the City of San Diego in accordance with these contract documents for the prices listed below. The Bidder further agrees to guarantee the Contract Price for a period of 120 days from the date of Bid opening. The duration of the Contract Price guarantee may be extended, by mutual consent of the parties, by the number of days required for the City to obtain all items necessary to fulfill all contractual conditions.

14. **SUBCONTRACTOR INFORMATION:**

    14.1. **LISTING OF SUBCONTRACTORS.** In accordance with the requirements provided in the "Subletting and Subcontracting Fair Practices Act" of the California Public Contract Code, the Bidder shall provide the **NAME** and **ADDRESS** of each Subcontractor who will perform work, labor, render services or who specially fabricates and installs a portion [type] of the work or improvement, in an amount in excess of 0.5% of the Contractor's total Bid. The Bidder shall also state within the description, whether the subcontractor is a **CONSTRUCTOR**, **CONSULTANT** or **SUPPLIER**. The Bidder shall further state within the description, the **PORTION** of the work which will be performed by each subcontractor under this Contract. The Contractor shall list only one Subcontractor for each portion of the Work. The **DOLLAR VALUE** of the total Bid to be performed shall be stated for all subcontractors listed. Failure to comply with this requirement may result in the Bid being rejected

as **non-responsive** and ineligible for award. The Bidder's attention is directed to the Special Provisions - General; Paragraph 2-3 Subcontracts, which stipulates the percent of the Work to be performed with the Bidders' own forces. The Bidder shall list all SLBE, ELBE, DBE, DVBE, MBE, WBE, OBE, SDB, WoSB, HUBZone, and SDVOSB Subcontractors for which Bidders are seeking recognition towards achieving any mandatory, voluntary (or both) subcontracting participation goals.

14.2. **LISTING OF SUPPLIERS.** Any Bidder seeking the recognition of Suppliers of equipment, materials, or supplies obtained from third party Suppliers towards achieving any mandatory or voluntary (or both) subcontracting participation goals shall provide, at a minimum, the **NAME, LOCATION (CITY)** and the **DOLLAR VALUE** of each supplier. The Bidder will be credited up to 60% of the amount to be paid to the Suppliers for materials and supplies unless vendor manufactures or substantially alters materials and supplies, in which case, 100% will be credited. The Bidder is to indicate within the description whether the listed firm is a supplier or manufacturer. If no indication is provided, the listed firm will be credited at 60% of the listed dollar value for purposes of calculating the Subcontractor Participation Percentage.

14.3. **LISTING OF SUBCONTRACTORS OR SUPPLIERS FOR ALTERNATES.** For subcontractors or suppliers to be used on additive or deductive alternate items, in addition to the above requirements, bidder shall further note "ALTERNATE" and alternate item number within the description.

15. **SUBMITTAL OF "OR EQUAL" ITEMS:** See Section 4-1.6, "Trade Names or Equals" in The WHITEBOOK and as amended in the SSP.

16. **AWARD PROCESS:**

16.1. The Award of this contract is contingent upon the Contractor's compliance with all conditions precedent to Award.

16.2. Upon acceptance of a Bid, the City will prepare contract documents for execution within approximately 21 days of the date of the Bid opening and award the Contract approximately within 7 days of receipt of properly executed Contract, bonds, and insurance documents.

16.3. This contract will be deemed executed and effective only upon the signing of the Contract by the Mayor or his designee and approval as to form the City Attorney's Office.

17. **SUBCONTRACT LIMITATIONS:** The Bidder's attention is directed to Standard Specifications for Public Works Construction, Section 2-3, "SUBCONTRACTS" in The GREENBOOK and as amended in the SSP which requires the Contractor to self-perform not less than the specified amount. Failure to comply with this requirement shall render the bid **non-responsive** and ineligible for award.

18. **AVAILABILITY OF PLANS AND SPECIFICATIONS:** Contract Documents may be obtained by visiting the City's website: http://www.sandiego.gov/cip/. Plans and Specifications for this contract are also available for review in the office of the City Clerk or Public Works Contracts.

19. **ONLY ONE BID PER CONTRACTOR SHALL BE ACCCEPTED:** No person, firm, or corporation shall be allowed to make, file, or be interested in more than one (1) Bid for the same work unless alternate Bids are called for. A person, firm or corporation who has submitted a sub-

proposal to a Bidder, or who has quoted prices on materials to a Bidder, is not hereby disqualified from submitting a sub-proposal or quoting prices to other Bidders or from submitting a Bid in its own behalf. Any Bidder who submits more than one bid will result in the rejection of all bids submitted.

20. **SAN DIEGO BUSINESS TAX CERTIFICATE:** The Contractor and Subcontractors, not already having a City of San Diego Business Tax Certificate for the work contemplated shall secure the appropriate certificate from the City Treasurer, Civic Center Plaza, first floor and submit to the Contract Specialist upon request or as specified in the Contract Documents. Tax Identification numbers for both the Bidder and the listed Subcontractors must be submitted on the City provided forms within these documents.

21. **BIDDER'S GUARANTEE OF GOOD FAITH (BID SECURITY):**

21.1. For bids $250,000 and above, bidders shall submit Bid Security at bid time. Bid Security shall be in one of the following forms: a cashier's check, or a properly certified check upon some responsible bank; or an approved corporate surety bond payable to the City of San Diego for an amount of not less than 10% of the total bid amount.

21.2. This check or bond, and the monies represented thereby, will be held by the City as a guarantee that the Bidder, if awarded the contract, will in good faith enter into the contract and furnish the required final performance and payment bonds.

21.3. The Bidder agrees that in the event of the Bidder's failure to execute this contract and provide the required final bonds, the money represented by the cashier's or certified check will remain the property of the City; and the Surety agrees that it will pay to the City the damages, not exceeding the sum of 10% of the amount of the Bid, that the City may suffer as a result of such failure.

21.4. At the time of bid submission, bidders must upload and submit an electronic PDF copy of the aforementioned bid security. Whether in the form of a cashier's check, a properly certified check or an approved corporate surety bond payable to the City of San Diego, the bid security must be uploaded to the City's eBidding system. Within twenty-four (24) hours after the bid due date and time, the first five (5) apparent low bidders must provide the City with the original bid security.

21.5. Failure to submit the electronic version of the bid security at the time of bid submission AND failure to provide the original within twenty-four (24) hours may cause the bid to be rejected and deemed **non-responsive**.

22. **AWARD OF CONTRACT OR REJECTION OF BIDS:**

22.1. This contract may be awarded to the lowest responsible and reliable Bidder.

22.2. Bidders shall complete ALL eBid forms as required by this solicitation. Incomplete eBids will not be accepted.

22.3. The City reserves the right to reject any or all Bids, to waive any informality or technicality in Bids received, and to waive any requirements of these specifications as to bidding procedure.

22.4. Bidders will not be released on account of their errors of judgment. Bidders may be released only upon receipt by the City within 3 Working Days of the bid opening, written notice from the Bidder which shows proof of honest, credible, clerical error of a material nature, free from fraud or fraudulent intent; and of evidence that reasonable care was observed in the preparation of the Bid.

22.5. A bidder who is not selected for contract award may protest the award of a contract to another bidder by submitting a written protest in accordance with the San Diego Municipal Code.

22.6. The City of San Diego will not discriminate in the award of contracts with regard to race, religion creed, color, national origin, ancestry, physical handicap, marital status, sex or age.

22.7. Each Bid package properly signed as required by these specifications shall constitute a firm offer which may be accepted by the City within the time specified herein.

22.8. The City reserves the right to evaluate all Bids and determine the lowest Bidder on the basis of the base bid and any proposed alternates or options as detailed herein.

23. BID RESULTS:

23.1. The availability of the bids on the City's eBidding system shall constitute the public announcement of the apparent low bidder. In the event that the apparent low bidder is subsequently deemed non-responsive or non-responsible, a notation of such will be made on the eBidding system. The new ranking and apparent low bidder will be adjusted accordingly.

23.2. To obtain the bid results, view the results on the City's web site, or request the results by U.S. mail and provide a self-addressed, stamped envelope. If requesting by mail, be sure to reference the bid name and number. The bid tabulations will be mailed to you upon their completion. The results will not be given over the telephone.

24. THE CONTRACT:

24.1. The Bidder to whom award is made shall execute a written contract with the City of San Diego and furnish good and approved bonds and insurance certificates specified by the City within 14 days after receipt by Bidder of a form of contract for execution unless an extension of time is granted to the Bidder in writing.

24.2. If the Bidder takes longer than 14 days to fulfill these requirements, then the additional time taken shall be added to the Bid guarantee. The Contract shall be made in the form adopted by the City, which includes the provision that no claim or suit whatsoever shall be made or brought by Contractor against any officer, agent, or employee of the City for or on account of anything done or omitted to be done in connection with this contract, nor shall any such officer, agent, or employee be liable hereunder.

24.3. If the Bidder to whom the award is made fails to enter into the contract as herein provided, the award may be annulled and the Bidder's Guarantee of Good Faith will be subject to forfeiture. An award may be made to the next lowest responsible and reliable Bidder who shall fulfill every stipulation embraced herein as if it were the party to whom the first award was made.

24.4. Pursuant to the San Diego City Charter section 94, the City may only award a public works contract to the lowest responsible and reliable Bidder. The City will require the Apparent Low Bidder to (i) submit information to determine the Bidder's responsibility and reliability, (ii) execute the Contract in form provided by the City, and (iii) furnish good and approved bonds and insurance certificates specified by the City within 14 Days, unless otherwise approved by the City, in writing after the Bidder receives notification from the City, designating the Bidder as the Apparent Low Bidder and formally requesting the above mentioned items.

24.5. The award of the Contract is contingent upon the satisfactory completion of the above mentioned items and becomes effective upon the signing of the Contract by the Mayor or designee and approval as to form the City Attorney's Office. If the Apparent Low Bidder does not execute the Contract or submit required documents and information, the City may award the Contract to the next lowest responsible and reliable Bidder who shall fulfill every condition precedent to award. A corporation designated as the Apparent Low Bidder shall furnish evidence of its corporate existence and evidence that the officer signing the Contract and bond for the corporation is duly authorized to do so.

25. **EXAMINATION OF PLANS, SPECIFICATIONS, AND SITE OF WORK:** The Bidder shall examine carefully the Project Site, the Plans and Specifications, other materials as described in the Special Provisions, Section 2-7, and the proposal forms (e.g., Bidding Documents). The submission of a Bid shall be conclusive evidence that the Bidder has investigated and is satisfied as to the conditions to be encountered, as to the character, quality, and scope of Work, the quantities of materials to be furnished, and as to the requirements of the Bidding Documents Proposal, Plans, and Specifications.

26. **CITY STANDARD PROVISIONS:** This contract is subject to the following standard provisions. See The WHITEBOOK for details.

26.1. The City of San Diego Resolution No. R-277952 adopted on May 20, 1991 for a Drug-Free Workplace.

26.2. The City of San Diego Resolution No. R-282153 adopted on June 14, 1993 related to the Americans with Disabilities Act.

26.3. The City of San Diego Municipal Code §22.3004 for Pledge of Compliance.

26.4. The City of San Diego's Labor Compliance Program and the State of California Labor Code §§1771.5(b) and 1776.

26.5. Sections 1777.5, 1777.6, and 1777.7 of the State of California Labor Code concerning the employment of apprentices by contractors and subcontractors performing public works contracts.

26.6. The City's Equal Benefits Ordinance (EBO), Chapter 2, Article 2, Division 43 of The San Diego Municipal Code (SDMC).

26.7. The City's Information Security Policy (ISP) as defined in the City's Administrative Regulation 90.63.

27. PRE-AWARD ACTIVITIES:

27.1. The contractor selected by the City to execute a contract for this Work shall submit the required documentation as specified in the herein and in the Notice of Award. Failure to provide the information as specified may result in the Bid being rejected as **non-responsive.**

27.2. The decision that bid is non-responsive for failure to provide the information required within the time specified shall be at the sole discretion of the City.

Executed in triplicate

PERFORMANCE BOND, LABOR AND MATERIALMEN'S BOND

FAITHFUL PERFORMANCE BOND AND LABOR AND MATERIALMEN'S BOND:

L.H. Woods & Sons, Inc., a corporation, as principal, and Western Surety Company, a corporation authorized to do business in the State of California, as Surety, hereby obligate themselves, their successors and assigns, jointly and severally, to The City of San Diego a municipal corporation in the sum of ten million nine hundred ninety five thousand and no/100($10,995,000.00) for the faithful performance of the annexed contract, and in the sum of ten million nine hundred ninety five thousand and no/100* for the benefit of laborers and materialmen designated below. *($10,995,000.00)

Conditions:

If the Principal shall faithfully perform the annexed contract with the City of San Diego, California, then the obligation herein with respect to a faithful performance shall be void; otherwise it shall remain in full force.

If the Principal shall promptly pay all persons, firms and corporations furnishing materials for or performing labor in the execution of this contract, and shall pay all amounts due under the California Unemployment Insurance Act then the obligation herein with respect to laborers and materialmen shall be void; otherwise it shall remain in full force.

The obligation herein with respect to laborers and materialmen shall inure to the benefit of all persons, firms and corporations entitled to file claims under the provisions of Article 2. Claimants, (iii) public works of improvement commencing with Civil Code Section 9100 of the Civil Code of the State of California.

Changes in the terms of the annexed contract or specifications accompanying same or referred to therein shall not affect the Surety's obligation on this bond, and the Surety hereby waives notice of same.

PERFORMANCE BOND, LABOR AND MATERIALMEN'S BOND (continued)

The Surety shall pay reasonable attorney's fees should suit be brought to enforce the provisions of this bond.

Dated 09/27/2016

See attached California All-Purpose Acknowledgment

Approved as to Form

L.H. Woods & Sons, Inc.

Principal

By

JAMES O. WOODS JR.

Printed Name of Person Signing for Principal

Jan I. Goldsmith, City Attorney

By

Deputy City Attorney

Western Surety Company

Surety

By

Edith Garibay,
Attorney-in-fact

2020 Main Street, Suite 750

Local Address of Surety

Approved:

By:

James Nagelvoort
Director
Department of Public Works

Irvine, CA 92614

Local Address (City, State) of Surety

(949) 399-4970

Local Telephone No. of Surety

Premium $ $56,966

Bond No. 58739282

CALIFORNIA ALL-PURPOSE ACKNOWLEDGMENT **CIVIL CODE § 1189**

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of California)
County of San Diego)

On 28 Sept 2016 before me, Amanda Lutz, Notary public,
Date *Here Insert Name and Title of the Officer*

personally appeared James D. Woods Jr
Name(s) of Signer(s)

who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature
Signature of Notary Public

AEI-1 AMANDA LUTZ AEI-1
COMM #2138854
NOTARY PUBLIC-CALIFORNIA
SAN DIEGO COUNTY
My Comm. Expires Jan. 1 2020

Place Notary Seal Above

OPTIONAL

Though this section is optional, completing this information can deter alteration of the document or fraudulent reattachment of this form to an unintended document.

Description of Attached Document
Title or Type of Document: Performance Bond
Document Date: _____ Number of Pages: 1
Signer(s) Other Than Named Above: _____

Capacity(ies) Claimed by Signer(s)

Signer's Name: _____
☐ Corporate Officer — Title(s): _____
☐ Partner — ☐ Limited ☐ General
☐ Individual ☐ Attorney in Fact
☐ Trustee ☐ Guardian or Conservator
☐ Other: _____
Signer Is Representing: _____

Signer's Name: _____
☐ Corporate Officer — Title(s): _____
☐ Partner — ☐ Limited ☐ General
☐ Individual ☐ Attorney in Fact
☐ Trustee ☐ Guardian or Conservator
☐ Other: _____
Signer Is Representing: _____

©2015 National Notary Association • www.NationalNotary.org • 1-800-US NOTARY (1-800-876-6827) Item #5907

CALIFORNIA ALL-PURPOSE ACKNOWLEDGMENT **CIVIL CODE § 1189**

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of California)
County of Orange)

On SEP 27 2016 before me, R. Rivas, Notary Public,
Date *Here Insert Name and Title of the Officer*

personally appeared Edith Garibay
Name(s) of Signer(s)

who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

R. RIVAS
Commission # 2128505
Notary Public - California
Orange County
My Comm. Expires Oct 28, 2019

Signature
Signature of Notary Public

Place Notary Seal Above

OPTIONAL

Though this section is optional, completing this information can deter alteration of the document or fraudulent reattachment of this form to an unintended document.

Description of Attached Document

Title or Type of Document: _____ Document Date: _____

Number of Pages: _____ Signer(s) Other Than Named Above: None

Capacity(ies) Claimed by Signer(s)

Signer's Name: Edith Garibay
☐ Corporate Officer — Title(s): _____
☐ Partner — ☐ Limited ☐ General
☐ Individual ☒ Attorney in Fact
☐ Trustee ☐ Guardian or Conservator
☐ Other: _____
Signer Is Representing: _____

Signer's Name: _____
☐ Corporate Officer — Title(s): _____
☐ Partner — ☐ Limited ☐ General
☐ Individual ☐ Attorney in Fact
☐ Trustee ☐ Guardian or Conservator
☐ Other: _____
Signer Is Representing: _____

©2014 National Notary Association • www.NationalNotary.org • 1-800-US NOTARY (1-800-876-6827) Item #5907

Western Surety Company

POWER OF ATTORNEY APPOINTING INDIVIDUAL ATTORNEY-IN-FACT

Know All Men By These Presents, That WESTERN SURETY COMPANY, a South Dakota corporation, is a duly organized and existing corporation having its principal office in the City of Sioux Falls, and State of South Dakota, and that it does by virtue of the signature and seal herein affixed hereby make, constitute and appoint

William R Curtis, Rosa E Rivas, Eugene T Zondlo, Edith Garibay, Individually

of Irvine, CA, its true and lawful Attorney(s)-in-Fact with full power and authority hereby conferred to sign, seal and execute for and on its behalf bonds, undertakings and other obligatory instruments of similar nature

- In Unlimited Amounts -

and to bind it thereby as fully and to the same extent as if such instruments were signed by a duly authorized officer of the corporation and all the acts of said Attorney, pursuant to the authority hereby given, are hereby ratified and confirmed.

This Power of Attorney is made and executed pursuant to and by authority of the By-Law printed on the reverse hereof, duly adopted, as indicated, by the shareholders of the corporation.

In Witness Whereof, WESTERN SURETY COMPANY has caused these presents to be signed by its Vice President and its corporate seal to be hereto affixed on this 8th day of July, 2016.

WESTERN SURETY COMPANY

Paul T. Bruflat, Vice President

State of South Dakota
County of Minnehaha } ss

On this 8th day of July, 2016, before me personally came Paul T. Bruflat, to me known, who, being by me duly sworn, did depose and say: that he resides in the City of Sioux Falls, State of South Dakota; that he is the Vice President of WESTERN SURETY COMPANY described in and which executed the above instrument; that he knows the seal of said corporation; that the seal affixed to the said instrument is such corporate seal; that it was so affixed pursuant to authority given by the Board of Directors of said corporation and that he signed his name thereto pursuant to like authority, and acknowledges same to be the act and deed of said corporation.

My commission expires
June 23, 2021

J. MOHR
NOTARY PUBLIC
SOUTH DAKOTA

J. Mohr, Notary Public

CERTIFICATE

I, L. Nelson, Assistant Secretary of WESTERN SURETY COMPANY do hereby certify that the Power of Attorney hereinabove set forth is still in force, and further certify that the By-Law of the corporation printed on the reverse hereof is still in force. In testimony whereof I have hereunto subscribed my name and affixed the seal of the said corporation this 27th day of September, 2016.

WESTERN SURETY COMPANY

L. Nelson, Assistant Secretary

Form F4280-7-2012

Authorizing By-Law

ADOPTED BY THE SHAREHOLDERS OF WESTERN SURETY COMPANY

This Power of Attorney is made and executed pursuant to and by authority of the following By-Law duly adopted by the shareholders of the Company.

Section 7. All bonds, policies, undertakings, Powers of Attorney, or other obligations of the corporation shall be executed in the corporate name of the Company by the President, Secretary, and Assistant Secretary, Treasurer, or any Vice President, or by such other officers as the Board of Directors may authorize. The President, any Vice President, Secretary, any Assistant Secretary, or the Treasurer may appoint Attorneys in Fact or agents who shall have authority to issue bonds, policies, or undertakings in the name of the Company. The corporate seal is not necessary for the validity of any bonds, policies, undertakings, Powers of Attorney or other obligations of the corporation. The signature of any such officer and the corporate seal may be printed by facsimile.

ATTACHMENTS

ATTACHMENT A

SCOPE OF WORK

SCOPE OF WORK

1. **SCOPE OF WORK:** Construction of a new 14 Million Gallon per Day (MGD) pump station at the location of the existing Via Dominique Pump Station at 4701 Seda Drive. The project includes demolition of the existing Tierrasanta Temporary Pump Station located at 11100 Clairemont Mesa Blvd., and installation of approximately 2,800 feet of 20-inch PVC water main along Clairemont Mesa Blvd. The existing Via Dominique Pump Station will remain in place as a back-up pump station.

   1.1. The Work shall be performed in accordance with:

   1.1.1. The Notice Inviting Bids and Plans numbered **37228-01-D** through **37228-140-D**, and **37228-T01-D** through **37228-T15-D**, inclusive.

2. **LOCATION OF WORK: The location of the Work is as follows:**

   See Appendix E, Location Map.

3. **CONTRACT TIME:** The Contract Time for completion of the Work, including the Plant Establishment Period, shall be **484 Working Days.**

ATTACHMENT B

PHASED FUNDING PROVISIONS

PHASED FUNDING PROVISIONS

1. PHASED FUNDING:

1.1. For phased funded contracts, the City typically secures enough funds for the first 90 days of the contract prior to award. Within 10 Working Days after Bid opening date the Apparent Low Bidder must contact the Project Manager to discuss fund availability and the duration of the first phase and submit the Pre-Award Schedule to the City for approval and preparation of the first Phased Funding Schedule Agreement.

1.2. The Apparent Low Bidder will be required to provide a Pre-award Schedule in accordance with 6-1, "CONSTRUCTION SCHEDULE AND COMMENCEMENT OF THE WORK" and 9-3, "PAYMENT" prior to award of Contract.

1.3. If the Bid submitted by the Apparent Low Bidder is rejected by the City for any reason, the next Apparent Low Bidder is to provide the Pre-Award Schedule within 5 Working Days after receiving notice. This process will continue until the City has selects an Awardee or rejects all Bids.

1.4. The first Phased Funding Schedule Agreement must show the fund availability for the first phase. Upon selection of the Awardee and acceptance by the City of the Pre-Award Schedule, the City will present the first Phased Funding Schedule Agreement to you.

1.5. At the City's request, meet with the City's project manager before execution of the first Phased Funding Schedule Agreement to discuss their comments and requests for revision to the Pre-Award Schedule.

1.6. Your failure to perform the any of the following may result in the Bid being rejected as non-responsive:

1. Meet with the City's project manager, if requested to do so, to discuss and respond to the City's comments regarding the Pre-Award Schedule,
2. Revise the Pre-Award Schedule as requested by the City within the specified 22 Working Days timeframe, or
3. Execute the first Phased Funding Schedule Agreement within a day after receipt.

PHASED FUNDING SCHEDULE AGREEMENT

Check one:

☒First Phased Funding Schedule Agreement

☐Final Phased Funding Schedule Agreement

BID NUMBER: K-16-1431-DBB-3

CONTRACT OR TASK TITLE: Tierrasanta Pump Station

CONTRACTOR: LH Woods & Sons Inc.

Funding Phase	Phase Description	Phase Start	Phase Finish	Not-to-Exceed Amount
1	Submittals; General Construction including all labor, materials, supplies, coordination with City Forces, and equipment necessary to construct the Project in accordance with the Contract Documents. Mobilization; Materials Procurement; Traffic Control; SWPP, Excavation, Installation of New Water Mains, City Materials, Water Service, Valves; Temporary Resurfacing; Pump Station: Site Clearing, Grading, Yard Piping.	NTP	8-31-17	$5,675,400
2	Submittals; General Construction including all labor, materials, supplies, coordination with City Forces, and equipment necessary to construct the Project in accordance with the Contract Documents. Pump Station; Pumps, Piping, Structure and Electrical. Site Improvements; Retaining walls, Bio Basin, Hardscape and Landscaping. Curb Ramps; Permanent Resurfacing; Slurry Seal; Clean-up. Project Walkthrough; Punch-list; Completion.	09-01-17	Project Completion	$5,319,600
			Total	$10,995,000

Notes:

(1) City Supplement 9-3.6, "PHASED FUNDING COMPENSATION" applies.

(2) The total of all funding phases shall be equal to the TOTAL BID PRICE as shown on BID SCHEDULE 1 - PRICES.

(3) This PHASED FUNDING SCHEDULE AGREEMENT will be incorporated into the CONTRACT and shall only be revised by a written modification to the CONTRACT.

CITY OF SAN DIEGO

By: _____

Name: Dwayne Abbey

Project Manager

Department Name: Public Works Department

Date: 10-4-16

CONTRACTOR

By: _____

Name: JAMES D. WOODS JR.

Title: PRESIDENT

Date: 10-3-16

END OF PHASED FUNDING SCHEDULE AGREEMENT

ATTACHMENT C

EQUAL OPPORTUNITY CONTRACTING PROGRAM

EQUAL OPPORTUNITY CONTRACTING PROGRAM REQUIREMENTS

1. To The WHITEBOOK, Chapter 10, Sections D and E, DELETE each in its entirety, and SUBSTITUTE with the following:

D. CITY'S EQUAL OPPORTUNITY COMMITMENT.

1. Nondiscrimination in Contracting Ordinance.

1. The Contractor, Subcontractors and Suppliers shall comply with requirements of the City's Nondiscrimination in Contracting Ordinance, San Diego Municipal Code §§22.3501 through 22.3517.

   The Contractor shall not discriminate on the basis of race, gender, religion, national origin, ethnicity, sexual orientation, age, or disability in the solicitation, selection, hiring, or treatment of subcontractors, vendors, or suppliers. The Contractor shall provide equal opportunity for subcontractors to participate in subcontracting opportunities. The Contractor understands and agrees that violation of this clause shall be considered a material breach of the contract and may result in contract termination, debarment, or other sanctions.

   The Contractor shall include the foregoing clause in all contracts between the Contractor and Subcontractors and Suppliers.

2. Disclosure of Discrimination Complaints. As part of its Bid or Proposal, the Bidder shall provide to the City a list of all instances within the past 10 years where a complaint was filed or pending against Bidder in a legal or administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors, or suppliers, and a description of the status or resolution of that complaint, including any remedial action taken.

3. Upon the City's request, the Contractor agrees to provide to the City, within 60 days, a truthful and complete list of the names of all Subcontractors and Suppliers that the Contractor has used in the past 5 years on any of its contracts that were undertaken within San Diego County, including the total dollar amount paid by the Contractor for each subcontract or supply contract.

4. The Contractor further agrees to fully cooperate in any investigation conducted by the City pursuant to the City's Nondiscrimination in Contracting Ordinance, Municipal Code §§22.3501 through 22.3517. The Contractor understands and agrees that violation of this clause shall be considered a

material breach of the Contract and may result in remedies being ordered against the Contractor up to and including contract termination, debarment and other sanctions for violation of the provisions of the Nondiscrimination in Contracting Ordinance. The Contractor further understands and agrees that the procedures, remedies and sanctions provided for in the Nondiscrimination in Contracting Ordinance apply only to violations of the Ordinance.

E. EQUAL EMPLOYMENT OPPORTUNITY OUTREACH PROGRAM.

1. The Contractor, Subcontractors and Suppliers shall comply with the City's Equal Employment Opportunity Outreach Program, San Diego Municipal Code §§22.2701 through 22.2707.

   The Contractor shall not discriminate against any employee or applicant for employment on any basis prohibited by law. Contractor shall provide equal opportunity in all employment practices. Prime Contractor shall ensure their subcontractors comply with this program. Nothing in this section shall be interpreted to hold a prime contractor liable for any discriminatory practice of its subcontractors.

   The Contractor shall include the foregoing clause in all contracts between the Contractor and Subcontractors and Suppliers.

2. If the Contract is competitively solicited, the selected Bidder shall submit a Work Force Report (Form BB05), within 10 Working Days after receipt by the Bidder of Contract forms to the City for approval as specified in the Notice of Intent to Award letter from the City.

3. If a Work Force Report is submitted, and the City determines there are under-representations when compared to County Labor Force Availability data, the selected Bidder shall submit an Equal Employment Opportunity Plan.

4. If the selected Bidder submits an Equal Employment Opportunity Plan, it shall include the following assurances:

   1. The Contractor shall maintain a working environment free of discrimination, harassment, intimidation and coercion at all sites and in all facilities at which the Contractor's employees are assigned to work.

   2. The Contractor reviews its EEO Policy, at least annually, with all on-site supervisors involved in employment decisions.

   3. The Contractor disseminates and reviews its EEO Policy with all employees at least once a year, posts the policy statement and EEO posters on all company bulletin boards and job sites, and documents every dissemination, review and posting with

a written record to identify the time, place, employees present, subject matter, and disposition of meetings.

4. The Contractor reviews, at least annually, all supervisors' adherence to and performance under the EEO Policy and maintains written documentation of these reviews.

5. The Contractor discusses its EEO Policy Statement with subcontractors with whom it anticipates doing business, includes the EEO Policy Statement in its subcontracts, and provides such documentation to the City upon request.

6. The Contractor documents and maintains a record of all bid solicitations and outreach efforts to and from subcontractors, contractor associations and other business associations.

7. The Contractor disseminates its EEO Policy externally through various media, including the media of people of color and women, in advertisements to recruit, maintains files documenting these efforts, and provides copies of these advertisements to the City upon request.

8. The Contractor disseminates its EEO Policy to union and community organizations.

9. The Contractor provides immediate written notification to the City when any union referral process has impeded the Contractor's efforts to maintain its EEO Policy.

10. The Contractor maintains a current list of recruitment sources, including those outreaching to people of color and women, and provides written notification of employment opportunities to these recruitment sources with a record of the organizations' responses.

11. The Contractor maintains a current file of names, addresses and phone numbers of each walk-in applicant, including people of color and women, and referrals from unions, recruitment sources, or community organizations with a description of the employment action taken.

12. The Contractor encourages all present employees, including people of color and women employees, to recruit others.

13. The Contractor maintains all employment selection process information with records of all tests and other selection criteria.

14. The Contractor develops and maintains documentation for on-the-job training opportunities, participates in training programs, or both for all of its employees, including people of color and women, and establishes apprenticeship, trainee,

and upgrade programs relevant to the Contractor's employment needs.

15. The Contractor conducts, at least annually, an inventory and evaluation of all employees for promotional opportunities and encourages all employees to seek and prepare appropriately for such opportunities.

16. The Contractor ensures the company's working environment and activities are non-segregated except for providing separate or single-user toilets and necessary changing facilities to assure privacy between the sexes.

ATTACHMENT D

PREVAILING WAGE

1. **PREVAILING WAGE RATES:** Pursuant to San Diego Municipal Code section 22.3019, construction, alteration, demolition, repair and maintenance work performed under this Contract is subject to State prevailing wage laws. For construction work performed under this Contract cumulatively exceeding $25,000 and for alteration, demolition, repair and maintenance work performed under this Contract cumulatively exceeding $15,000, the Contractor and its subcontractors shall comply with State prevailing wage laws including, but not limited to, the requirements listed below.

1.1. **Compliance with Prevailing Wage Requirements.** Pursuant to sections 1720 through 1861 of the California Labor Code, the Contractor and its subcontractors shall ensure that all workers who perform work under this Contract are paid not less than the prevailing rate of per diem wages as determined by the Director of the California Department of Industrial Relations (DIR). This includes work performed during the design and preconstruction phases of construction including, but not limited to, inspection and land surveying work.

1.1.1. Copies of such prevailing rate of per diem wages are on file at the City and are available for inspection to any interested party on request. Copies of the prevailing rate of per diem wages also may be found at http://www.dir.ca.gov/OPRL/DPreWageDetermination.htm. Contractor and its subcontractors shall post a copy of the prevailing rate of per diem wages determination at each job site and shall make them available to any interested party upon request.

1.1.2. The wage rates determined by the DIR refer to expiration dates. If the published wage rate does not refer to a predetermined wage rate to be paid after the expiration date, then the published rate of wage shall be in effect for the life of this Contract. If the published wage rate refers to a predetermined wage rate to become effective upon expiration of the published wage rate and the predetermined wage rate is on file with the DIR, such predetermined wage rate shall become effective on the date following the expiration date and shall apply to this Contract in the same manner as if it had been published in said publication. If the predetermined wage rate refers to one or more additional expiration dates with additional predetermined wage rates, which expiration dates occur during the life of this Contract, each successive predetermined wage rate shall apply to this Contract on the date following the expiration date of the previous wage rate. If the last of such predetermined wage rates expires during the life of this Contract, such wage rate shall apply to the balance of the Contract.

1.2. **Penalties for Violations.** Contractor and its subcontractors shall comply with California Labor Code section 1775 in the event a worker is paid less than the prevailing wage rate for the work or craft in which the worker is employed.

1.3. **Payroll Records.** Contractor and its subcontractors shall comply with California Labor Code section 1776, which generally requires keeping accurate payroll records, verifying and certifying payroll records, and making them available for inspection. Contractor shall require its subcontractors to also comply with section 1776. Contractor and its subcontractors shall submit weekly certified payroll records online via the City's web-based Labor Compliance Program. Contractor is responsible for ensuring its subcontractors submit certified payroll records to the City.

1.3.1. For contracts entered into on or after April 1, 2015, Contractor and their subcontractors shall furnish records specified in Labor Code section 1776 directly to the Labor Commissioner in the manner required by Labor Code section 1771.4.

1.4. **Apprentices.** Contractor and its subcontractors shall comply with California Labor Code sections 1777.5, 1777.6 and 1777.7 concerning the employment and wages of apprentices. Contractor is held responsible for the compliance of their subcontractors with sections 1777.5, 1777.6 and 1777.7.

1.5. **Working Hours.** Contractor and their subcontractors shall comply with California Labor Code sections 1810 through 1815, including but not limited to: (i) restrict working hours on public works contracts to eight hours a day and forty hours a week, unless all hours worked in excess of 8 hours per day are compensated at not less than 1½ times the basic rate of pay; and (ii) specify penalties to be imposed on design professionals and subcontractors of $25 per worker per day for each day the worker works more than 8 hours per day and 40 hours per week in violation of California Labor Code sections1810 through 1815.

1.6. **Required Provisions for Subcontracts.** Contractor shall include at a minimum a copy of the following provisions in any contract they enter into with a subcontractor: California Labor Code sections 1771, 1771.1, 1775, 1776, 1777.5, 1810, 1813, 1815, 1860 and 1861.

1.7. **Labor Code Section 1861 Certification.** Contractor in accordance with California Labor Code section 3700 is required to secure the payment of compensation of its employees and by signing this Contract, Contractor certifies that "I am aware of the provisions of Section 3700 of the California Labor Code which require every employer to be insured against liability for workers' compensation or to undertake self-insurance in accordance with the provisions of that code, and I will comply with such provisions before commencing the performance of the work of this Contract."

1.8. **Labor Compliance Program.** The City has its own Labor Compliance Program authorized in August 2011 by the DIR. The City will withhold contract payments when payroll records are delinquent or deemed inadequate by the City or other governmental entity, or it has been established after an investigation by the City or other governmental entity that underpayment(s) have occurred. For questions or assistance, please contact the City of San Diego's Equal Opportunity Contracting Department at 619-236-6000.

1.9. Contractor and Subcontractor Registration Requirements. This project is subject to compliance monitoring and enforcement by the DIR. As of March 1, 2015, no contractor or subcontractor may be listed on a bid or proposal for a public works project unless registered with the DIR pursuant to Labor Code section 1725.5. As of April 1, 2015, a contractor or subcontractor shall not be qualified to bid on, be listed in a bid proposal, or enter into any contract for public work, unless currently registered and qualified to perform public work pursuant to Labor Code section 1725.5 By submitting a bid or proposal to the City, Contractor is certifying that he or she has verified that all subcontractors used on this public work project are registered with the DIR in compliance with Labor Code sections 1771.1 and 1725.5, and Contractor shall provide proof of registration to the City upon request.

1.9.1. A Contractor's inadvertent error in listing a subcontractor who is not registered pursuant to Labor Code section 1725.5 in response to a solicitation shall not be grounds for filing a bid protest or grounds for considering the bid non-responsive provided that any of the following apply: (1) the subcontractor is registered prior to bid opening; (2) within twenty-four hours after the bid opening, the subcontractor is registered and has paid the penalty registration fee specified in Labor Code section 1725.5; or (3) the subcontractor is replaced by another registered subcontractor pursuant to Public Contract Code section 4107.

ATTACHMENT E

SUPPLEMENTARY SPECIAL PROVISIONS

SUPPLEMENTARY SPECIAL PROVISIONS

The following Supplementary Special Provisions (SSP) modifies the following documents:

1) Standard Specifications for Public Works Construction (The GREENBOOK) currently in effect.

2) The City of San Diego Standard Specifications for Public Works Construction (The WHITEBOOK).

SECTION 1 – TERMS, DEFINITIONS, ABBREVIATIONS, UNITS OF MEASURE, AND SYMBOLS

1-2 TERMS AND DEFINITIONS.

Normal Working Hours. To the City Supplement, ADD the following:

The Normal Working Hours are 7:30 AM to 4:00 PM.

SECTION 2 - SCOPE AND CONTROL OF WORK

2-3.2 Self Performance. DELETE in its entirety and SUBSTITUTE with the following:

1. You must perform, with your own organization, Contract work amounting to at least 40% of the base bid alone or base bid and any additive or deductive alternate(s) that together when added or deducted form the basis of award.

2-5.3.1 General. To the City Supplement, ADD the following:

7. For products for which an AML is available, products listed in the AML shall be used. A submittal review will be conducted for products not identified on an AML on a case-by-case basis when:

   a) The product type or category is not in the AML.

   b) The AML does not list at least two available manufacturers of the product.

   c) The material or manufacturer listed in the AML is no longer available. Documentation to substantiate the product is no

longer available or in production is required as part of the submittal.

In the case of conducting a submittal review when required by the Plans or Special Provisions, or when requested by the Engineer, all submittals shall be accompanied by the City's submittal form.

The Product Submittal Form is available for download at:

http://www.sandiego.gov/publicworks/edocref/index.shtml

2-5.3.2 **Working Drawings.** To TABLE 2-5.3.2 (A), ADD the following:

Item	Section No.	Title	Subject
17	306-1.6	Water Valve Bypass for Mainlines 16" and Larger	SDW-154*

*Note: The distance dimensions shown between the bypass pipes and mainlines are subject to change to field conditions.

2-7 **SUBSURFACE DATA.** ADD the following:

4. In preparation of the Contract Documents, the designer has relied upon the following reports of explorations and tests of subsurface conditions at the Work Site:

   1. Soil Corrosivity Assessment Report, R.F. Yeager, Aug. 14, 2013.
   2. Report of Geotechnical Investigation, Tierrasanta PS, Allied Geotechnical Engineering, Aug. 9, 2013.

5. The reports listed above are available for review by contacting the Contract Specialist or visiting:

   ftp://ftp.sannet.gov/OUT/ECP/AEP/Tierrasanta%20Pump%20Station/Subsurface%20Data%20%20TSPS/

2-9.1 **Permanent Survey Markers.** To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

1. Pursuant to Division 3, Chapter 15 of the Business and Professions Code, you shall not disturb survey monuments that "control the location of subdivisions, tracts, boundaries, roads, streets, or highways, or provide horizontal or vertical survey control" until they have been tied out by a Registered Land Surveyor or Registered Civil Engineer authorized to practice land surveying within the State of California.
2. Monument Preservation shall be performed by the City's Construction Management and Field Services (CMFS) Division on all

Projects, unless permission is obtained for these services in writing by CMFS.

3. You shall submit to the Engineer a minimum of 7 Days prior to the start of the Work a list of controlling survey monuments which may be disturbed. CMFS shall do the following:

   a) Set survey points outside the affected Work area that reference and locate each controlling survey monument that may be disturbed.

   b) File a Corner Record or Record of Survey with the County Surveyor after setting the survey points to be used for re-establishment of the disturbed controlling survey monuments.

   c) File a Corner Record of Record of Survey with the County Surveyor after re-establishment of the disturbed controlling survey monuments.

SECTION 4 - CONTROL OF MATERIALS

4-1.3.3 **Inspection of Items Not Locally Produced.** ADD the following:

1. The Engineer will perform inspections of out-of-town manufacturers for the items of Work specified here: See Technical Specifications 11214 for inspection requirements for pumps.

4-1.3.4 **Inspection Paid For By the Contractor.** To the City Supplement, ADD the following:

All Special Inspection Listed on Sheet S-3, in the Project Construction Drawings.

4-1.3.6 **Preapproved Materials.** To the City Supplement, ADD the following:

3. You shall submit in writing a list of all products to be incorporated in the Work that are on the AML.

ADD:

4-1.3.7 **Testing Under the Direction of the Engineer.** When a bid item for "Testing under the Direction of the Engineer" is provided, then you shall employ and pay for the services of a qualified third party independent laboratory to perform the required testing. You will be reimbursed for the cost of testing under this bid item.

4-1.6 **Trade Names or Equals.** ADD the following:

14. You shall submit your list of proposed substitutions for an "equal" item **no later than 5 Working Days after the determination of the Apparent Low Bidder** and on the City's Product Submittal Form

available at:

http://www.sandiego.gov/publicworks/edocref/index.shtml

4-1.10 **Foreign Materials.** To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

1. Materials that are manufactured, produced, or fabricated outside of the United States shall be delivered to a distribution point in California, unless otherwise specified. Quality Control and related testing shall be performed to all applicable specified US standards. Manufacturer's testing and staff certification shall be traceable to a United States regulatory agency. Retain the materials for a sufficient period of time to permit inspection, sampling, and testing. You shall not be entitled to an extension of time for acts or events occurring outside of, at point of entry, or during transport to the United States.

5-2 **PROTECTION.** ADD the following:

1. You shall repair or replace traffic signal and lighting system equipment within 72 hours after notification of defects by the Engineer.
2. While working in or around meter boxes, you shall protect in place all Advanced Metering Infrastructure (AMI) devices attached to the water meter or located in or near water meter boxes, coffins, or vaults. This includes any antenna installed through the meter box lid.
   a) Avoid damaging the antenna, cable, and endpoints when removing the meter box lid and when disconnecting AMI endpoints from the register on top of the water meter.
   b) If meters or AMI devices need to be removed or relocated, the AMI endpoints shall be reinstalled with the Encoder/Receiver/Transmitter (ERT) pointing upwards.
   c) Because the AMI equipment is uniquely matched to each service location and to specific meter serial numbers, any AMI devices that are removed or disconnected shall be reinstalled on the same service lateral as well as to the same meter serial number it was attached to originally.
   d) Do not change or modify the lid if the lid has an antenna drilled through it.
   e) If you encounter damaged, disconnected, buried, or broken AMI endpoints, cables between the registers, antennae, lids, or ERTs, notify the Engineer within 24 hours.
   f) Any AMI equipment damaged by you shall be repaired or replaced by City Forces at your expense.

SECTION 6 - PROSECUTION, PROGRESS AND ACCEPTANCE OF WORK

6-1.1 **Construction Schedule.** To item 20, ADD the following:

The 120 Calendar Day for the Plant Establishment Period is included in the stipulated Contract Time.

6-7.1 **General.** To the City Supplement, ADD the following:

5. For Water projects where shutdowns of 16 inch and larger pipes are required, there is a shutdown moratorium from May until October. Contractor shall plan and schedule work accordingly. No additional payment or working days will be granted for delays due to this moratorium.

6. 30 Working days for full depth asphalt final mill and resurfacing work required per SDG-107.

SECTION 7 - RESPONSIBILITIES OF THE CONTRACTOR

7-3 **LIABILITY INSURANCE.** DELETE in its entirety and SUBSTITUTE with the following:

The insurance provisions herein shall not be construed to limit your indemnity obligations contained in the Contract.

7-3.1 **Policies and Procedures.**

1. You must procure the insurance described below, at its sole cost and expense, to provide coverage against claims for loss including injuries to persons or damage to property, which may arise out of or in connection with the performance of the Work by you, your agents, representatives, officers, employees or Subcontractors.

2. Insurance coverage for property damage resulting from your operations is on a replacement cost valuation. The market value will not be accepted.

3. You shall maintain this insurance for the duration of this Contract and at all times thereafter when you are correcting, removing, or replacing Work in accordance with this Contract. Your liabilities under the Contract, e.g., your indemnity obligations, is not deemed limited to the insurance coverage required by this Contract.

4. The payment for insurance shall be included in the Contract Price as bid by you. Except as specifically agreed to by the City in writing, you are not entitled to any additional payment. Do not begin any Work under this Contract until you have provided and the City has approved all required insurance.

5. Policies of insurance shall provide that the City is entitled to 30 Days (10 Days for cancellation due to non-payment of premium) prior written notice of cancellation or non-renewal of the policy. Maintenance of specified insurance coverage is a material element of the Contract. Your failure to maintain or renew coverage or to provide evidence of renewal during the term of the Contract may be treated by the City as a material breach of the Contract.

7-3.2 Types of Insurance.

7-3.2.1 Commercial General Liability Insurance.

1. Commercial General Liability Insurance must be written on the current version of the ISO Occurrence form CG 00 01 07 98 or an equivalent form providing coverage at least as broad.

2. The policy shall cover liability arising from premises and operations, XCU (explosions, underground, and collapse), independent contractors, products/completed operations, personal injury and advertising injury, bodily injury, property damage, and liability assumed under an insured's contract (including the tort liability of another assumed in a business contract).

3. There shall be no endorsement or modification limiting the scope of coverage for either "insured vs. insured" claims or contractual liability. You shall maintain the same or equivalent insurance for at least 10 years following completion of the Work.

4. All costs of defense shall be outside the policy limits. Policy coverage shall be in liability limits of not less than the following:

General Annual Aggregate Limit	Limits of Liability
Other than Products/Completed Operations	$2,000,000
Products/Completed Operations Aggregate Limit	$2,000,000
Personal Injury Limit	$1,000,000
Each Occurrence	$1,000,000

7-3.2.2 Commercial Automobile Liability Insurance.

1. You shall provide a policy or policies of Commercial Automobile Liability Insurance written on the current version of the ISO form CA 00 01 12 90 or later version or equivalent form providing coverage at least as broad in the amount of $1,000,000 combined single limit per accident, covering bodily injury and property damage for owned, non-owned, and hired automobiles ("Any Auto").

2. All costs of defense shall be outside the limits of the policy.

7-3.2.5 **Contractors Builders Risk Property Insurance.**

1. You shall provide at your expense, and maintain until Final Acceptance of the Work, a Special Form Builders Risk Policy or Policies. This insurance shall be in an amount equal to the replacement cost of the completed Work (without deduction for depreciation) including the cost of excavations, grading, and filling. The policy or policies limits shall be 100% of this Contract value of the Work plus 15% to cover administrative costs, design costs, and the costs of inspections and construction management.

2. Insured property shall include material or portions of the Work located away from the Site but intended for use at the Site and shall cover material or portions of the Work in transit. The policy or policies shall include as insured property scaffolding, falsework, and temporary buildings located at the Site. The policy or policies shall cover the cost of removing debris, including demolition.

3. The policy or policies shall provide that all proceeds thereunder shall be payable to the City as Trustee for the insured, and shall name the City, the Contractor, Subcontractors, and Suppliers of all tiers as named insured. The City, as Trustee, will collect, adjust, and receive all monies which may become due and payable under the policy or policies, may compromise any and all claims thereunder, and will apply the proceeds of such insurance to the repair, reconstruction, or replacement of the Work.

4. Any deductible applicable to the insurance shall be identified in the policy or policies documents and responsibility for paying the part of any loss not covered because of the application of such deductibles shall be apportioned among the parties except for the City as follows: if there is more than one claimant for a single occurrence, then each claimant shall pay a pro-rata share of the per occurrence deductible based upon the percentage of their paid claim to the total paid for insured. The City shall be entitled to 100% of its loss. You shall pay the City any portion of that loss not covered because of a deductible at the same time the proceeds of the insurance are paid to the City as trustee.

5. Any insured, other than the City, making claim to which a deductible applies shall be responsible for 100% of the loss not insured because of the deductible. Except as provided for under California law, the policy or policies shall provide that the City is entitled to 30 Days prior written notice (10 Days for cancellation due to non-payment of premium) of cancellation or non-renewal of the policy or policies.

7-3.3 **Rating Requirements.** Except for the State Compensation Insurance Fund, all insurance required by this Contract as described herein shall be carried only by responsible insurance companies with a rating of, or equivalent to, at least "A-, VI" by A.M. Best Company, that are authorized by the California Insurance Commissioner to do business in the State, and that have been approved by the City.

7-3.3.1 **Non-Admitted Carriers.** The City will accept insurance provided by non-admitted, "surplus lines" carriers only if the carrier is authorized to do business in the State and is included on the List of Approved Surplus Lines Insurers (LASLI list).

All policies of insurance carried by non-admitted carriers shall be subject to all of the requirements for policies of insurance provided by admitted carriers described herein.

7-3.4 **Evidence of Insurance.** Furnish to the City documents e.g., certificates of insurance and endorsements evidencing the insurance required herein, and furnish renewal documentation prior to expiration of this insurance. Each required document shall be signed by the insurer or a person authorized by the insurer to bind coverage on its behalf. We reserve the right to require complete, certified copies of all insurance policies required herein.

7-3.5 **Policy Endorsements.**

7-3.5.1 **Commercial General Liability Insurance**

7-3.5.1.1 **Additional Insured.**

a) You shall provide at your expense policy endorsement written on the current version of the ISO Occurrence form CG 20 10 11 85 or an equivalent form providing coverage at least as broad.

b) To the fullest extent allowed by law e.g., California Insurance Code §11580.04, the policy shall be endorsed to include the City and its respective elected officials, officers, employees, agents, and representatives as additional insured.

c) The additional insured coverage for projects for which the Engineer's Estimate is $1,000,000 or more shall include liability arising out of:

   a) Ongoing operations performed by you or on your behalf,

   b) your products,

   c) your Work, e.g., your completed operations performed by you or on your behalf, or

   d) premises owned, leased, controlled, or used by you.

d) The additional insured coverage for projects for which the Engineer's Estimate is less than $1,000,000 shall include liability arising out of:

   a) Ongoing operations performed by you or on your behalf,

   b) your products, or

   c) premises owned, leased, controlled, or used by you.

7-3.5.1.2 **Primary and Non-Contributory Coverage.** The policy shall be endorsed to provide that the coverage with respect to operations, including the completed operations, if appropriate, of the Named Insured is primary to any insurance or self-insurance of the City and its elected officials, officers,

employees, agents and representatives. Further, it shall provide that any insurance maintained by the City and its elected officials, officers, employees, agents and representatives shall be in excess of your insurance and shall not contribute to it.

7-3.5.1.3 **Project General Aggregate Limit.** The policy or policies shall be endorsed to provide a Designated Construction Project General Aggregate Limit that will apply only to the Work. Only claims payments which arise from the Work shall reduce the Designated Construction Project General Aggregate Limit. The Designated Construction Project General Aggregate Limit shall be in addition to the aggregate limit provided for the products-completed operations hazard.

7-3.5.2 **Commercial Automobile Liability Insurance.**

7-3.5.2.1 **Additional Insured.** Unless the policy or policies of Commercial Auto Liability Insurance are written on an ISO form CA 00 01 12 90 or a later version of this form or equivalent form providing coverage at least as broad, the policy shall be endorsed to include the City and its respective elected officials, officers, employees, agents, and representatives as additional insured, with respect to liability arising out of automobiles owned, leased, hired or borrowed by you or on your behalf. This endorsement is limited to the obligations permitted by California Insurance Code §11580.04.

7-3.5.5 **Builders Risk Endorsements.**

7-3.5.5.1 **Waiver of Subrogation.** The policy or policies shall be endorsed to provide that the insurer will waive all rights of subrogation against the City, and its respective elected officials, officers, employees, agents, and representatives for losses paid under the terms of the policy or policies and which arise from Work performed by the Named Insured for the City.

7-3.5.5.2 **Builders Risk – Partial Utilization.** If the City desires to occupy or use a portion or portions of the Work prior to Acceptance in accordance with this Contract, the City will notify you and you shall immediately notify your Builder's Risk insurer and obtain an endorsement that the policy or policies shall not be cancelled or lapse on account of any such partial use or occupancy. You shall obtain the endorsement prior to the City's occupation and use.

7-3.6 **Deductibles and Self-Insured Retentions.** You shall pay for all deductibles and self-insured retentions. You shall disclose deductibles and self-insured retentions to the City at the time the evidence of insurance is provided.

7-3.7 **Reservation of Rights.** The City reserves the right, from time to time, to review your insurance coverage, limits, deductibles and self-insured retentions to determine if they are acceptable to the City. The City will reimburse you, without overhead, profit, or any other markup, for the cost

of additional premium for any coverage requested by the Engineer but not required by this Contract.

7-3.8 **Notice of Changes to Insurance.** You shall notify the City 30 Days prior to any material change to the policies of insurance provided under this Contract.

7-3.9 **Excess Insurance.** Policies providing excess coverage shall follow the form of the primary policy or policies e.g., all endorsements.

7-4 **WORKERS' COMPENSATION INSURANCE.** DELETE in its entirety and SUBSTITUTE with the following:

7-4.1 **Workers' Compensation Insurance and Employers Liability Insurance.**

1. In accordance with the provisions of §3700 of the California Labor Code, you shall provide at your expense Workers' Compensation Insurance and Employers Liability Insurance to protect you against all claims under applicable state workers compensation laws. The City, its elected officials, and employees will not be responsible for any claims in law or equity occasioned by your failure to comply with the requirements of this section.

2. Limits for this insurance shall be not less than the following:

Workers' Compensation	Statutory Employers Liability
Bodily Injury by Accident	$1,000,000 each accident
Bodily Injury by Disease	$1,000,000 each employee
Bodily Injury by Disease	$1,000,000 policy limit

3. By signing and returning the Contract you certify that you are aware of the provisions of §3700 of the Labor Code which requires every employer to be insured against liability for worker's compensation or to undertake self-insurance in accordance with the provisions of that code and you shall comply with such provisions before commencing the Work as required by §1861 of the California Labor Code.

7-4.1.1 **Waiver of Subrogation.** The policy or policies shall be endorsed to provide that the insurer will waive all rights of subrogation against the City and its respective elected officials, officers, employees, agents, and representatives for losses paid under the terms of the policy or policies and which arise from Work performed by the Named Insured for the City.

7-5 **PERMITS, FEES, AND NOTICES.** To the City Supplement, ADD the following:

The City will obtain, at no cost to you, the following permits:

1. Building Permit, City of San Diego.

7-8.6 **Water Pollution Control.** ADD the following:

1. Based on a preliminary assessment by the City, the Contract is subject to WPCP.

7-10.5.3 **Steel Plate Covers.** Table 7-10.5.3 (A), REVISE the plate thickness for 5'-3" trench width to read 1¾".

7-15 **INDEMNIFICATION AND HOLD HARMLESS AGREEMENT.** To the City Supplement, Paragraph (4), Sentence (3), DELETE in its entirety and SUBSTITUTE with the following:

Your duty to indemnify and hold harmless does not include any claims or liability arising from the established active or sole negligence, or willful misconduct of the City, its officers, or employees.

7-16 **COMMUNITY LIAISON.** To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

ADD:

7-16 **COMMUNITY OUTREACH.**

7-16.1 **General.**

1. To ensure consistency with the City's community outreach plan for the project, the City shall work with you to inform the public (which includes, but shall not be limited to, property owners, renters, homeowners, business owners, recreational users, and other community members and stakeholders) of construction impacts. Your efforts to mitigate construction impacts by communicating with the public require close coordination and cooperation with the City.
2. You shall perform the community outreach activities required throughout the Contract Time. You shall assign a staff member who shall perform the required community outreach services.
3. You shall closely coordinate the Work with the businesses, institutions, residents, and property owners impacted by the Project.
4. Your example duties include notifying businesses, institutions, and residents of the commencement of construction activities not less than 5 Days in advance, coordinating access for vehicular and pedestrian traffic to businesses, institutions, and residences impacted by the Project, reporting activities at all Project progress meetings scheduled by the Engineer, attending the Project Pre-construction meeting, attending 2 community meetings, responding to community questions and complaints related to your activities, and documenting, in writing, as well as logging in all inquiries and

complaints received into the City's internal public contact tracking system.

5. You shall execute the Information Security Policy (ISP) Acknowledgement Form - For Non-City Employees within 15 Days of the award of the Contract if any of the following apply:

   a) Your contact information is made available on any outreach materials.

   b) You will be the primary point of contact to resolve project related inquiries and complaints.

6. Electronic Communication.

   a) All inquiries and complaints shall be logged in to the City's internal public contact tracking system within 24 hours of receipt of inquiries and complaints.

   b) Any updates or a resolution of inquiries and complaints shall be documented in the City's internal public contact tracking system within 24 hours.

   c) Copies of email communications shall be saved individually on to the City's internal public contact tracking system in an Outlook Message Format (*.msg).

   d) All graphics, photos, and other electronic files associated with inquiries and/or complaints shall be saved into the individual records, located within the City's internal public contact tracking system.

7-16.1.1 Quality Assurance.

1. During the course of community outreach, you shall ensure that the character of all persons that conduct community outreach (distributing door hangers, attending community meetings, interacting with the public, and etc.) on your behalf shall:

   a. Have the ability to speak and comprehend English and/or Spanish, as appropriate for the community or public they are informing.

   b. Possess and display easily verifiable and readable personal identification that identifies the person as your employee.

   c. Have the interpersonal skills to effectively, professionally, and tactfully represent you, the project, and the City to the public.

7-16.1.2 Submittals.

1. You shall submit to the Resident Engineer, for review and approval, all drafts of letters, notices, postcards, door hangers, signs, mailing lists, proposed addresses for hand-delivery, and any other notices and letters that are to be mailed and or distributed to the public.

   a. Prior to distributing or mailing, you shall submit final drafts of letters, notices, postcards, door hangers, signs, and any other

notices and letters to the Resident Engineer for final review and approval. Submit a PDF copy of the approved door hangers to the Engineer.

b. After distributing or mailing, you shall submit verification of delivery and any copies of returned notices to the Resident Engineer. Submit a PDF copy of the approved letters and notices to the Engineer.

2. You shall use the City's internal public contact tracking system to identify and summarize communications (via phone, in person, and email) with the public within 24 hours of receipt, even if your response to the individual is still incomplete. You shall upload to the City's internal public contact tracking system copies of all written, electronic, and verbal communications and conversations with the public.

7-16.1.3 **Weekly Updates Recipients.** Submit a weekly correspondence with updates, traffic control issues and locations, lane closures, and any other pertinent information (with additional contact names given during award process) to the following recipients:

Alex Garcia, Senior Engineer, agarcia@sandiego.gov

Dwayne Abbey, Project Manager, dabbey@sandiego.gov

Resident Engineer, TBD.

7-16.2 **Community Outreach Services.**

7-16.2.1 **Public Notice by Contractor.**

1. Post Project Identification Signs in accordance with 7-10.6.2, "Project Identification Sign".

2. Notify businesses, institutions, property owners, residents or any other impacted stakeholders, within a minimum 300 feet (90 m) radius of the Project, of construction activities and utility service interruptions not less than 5 Days in advance.

3. Furnish and distribute public notices in the form of door hangers using the City's format to all occupants and/or property owners along streets:

   a. Where Work is to be performed at least 5 Days before starting construction or survey activities or impacting the community as approved by the Resident Engineer.

   b. Within 5 Days of the completion of your construction activities where Work was performed, you shall distribute public notices in the form of door hangers, which outlines the anticipated dates of Asphalt Resurfacing or Slurry Seal.

   c. No less than 48 hours in advance and no more than 72 hours in advance of the scheduled resurfacing.

4. Leave the door hanger notices on or at the front door of each dwelling and apartment unit and at each tenant of commercial buildings

abutting each of the street block segments. Where the front doors of apartment units are inaccessible, distribute the door hanger notices to the apartment manager or security officer.

5. Door Hanger Material: You shall use Blanks/USA brand, Item Number DHJ5B6WH, 1¼ inch (31.8 mm) Holes (removed), 2-up Jumbo Door Hanger in Bristol White, or approved equal.

6. Mailed Notice Material: You shall use Cougar by Domtar, Item Number 2834, or approved equal.

7. For all Work on private property, contact each owner and occupant individually a minimum of 15 Days prior to the Work. If the Work has been delayed, re-notify owners and occupants of the new Work schedule, as directed by the Resident Engineer.

8. A sample of public notices is included in the Contract Appendix.

7-16.2.2 Communications with the Public.

1. Coordinate access for vehicular and pedestrian traffic to businesses, institutions, and residences impacted by the Project.

2. You shall provide updates on construction impacts to the Resident Engineer. You shall notify the Resident Engineer in advance about time-sensitive construction impacts and may be required to distribute construction impact notices to the public on short notice.

3. You shall incorporate community outreach activities related to construction impacts in the baseline schedule and update the Resident Engineer with each week's submittal of the Three-Week Look Ahead Schedule.

4. At the request of the Resident Engineer, you shall attend and participate in project briefings at community meetings.

5. You shall coordinate with the Resident Engineer on all responses and actions taken to address public inquiries and complaints within the 24 hours that they are received.

7-16.2.3 Communications with Media.

1. The City may allow members of the media access to its construction site(s) on a case-by-case basis only.

2. Occasionally, uninvited members of the media may show up at construction Sites. Members of the media (including, but not limited to newspapers, magazines, radios, television, bloggers, and videographers) do not have the legal right to be in the construction Site without the City's permission.

3. In the event that media representatives arrive near or on the construction Site(s), you shall keep them off the Site(s) in a courteous and professional manner until a Public Information Officer is available to meet them at an approved location.

4. You shall report all visits from members of the media to the Resident Engineer as quickly as possible so that the City's Public Information

Officer can meet with the members of the media at the construction Site(s).

5. If the City allows members of the media to access a construction Site, you shall allow the City to escort the media representatives while they are on the construction Site and shall ensure their safety.

6. You shall require media representatives to sign in and out of the Site Visitor Log and to use personal protective equipment.

7. You have a right to speak to members of the media about your company and its role on the project. All other questions shall be referred to the City.

7-16.3 Exclusive Community Liaison Services.

1. You shall retain an Exclusive Community Liaison for the Project whose sole responsibilities shall be to implement 7-16.2, "Community Outreach Services" and the following:

    1. Develop a contact list of community, tenants, property owners, and agencies with a stake in the project.

    2. Prepare and present of materials in coordination with the Resident Engineer.

    3. Respond to community questions and complaints related to your activities.

    4. Write, edit, update, or produce brochures, pamphlets, and news releases.

    5. Provide standard telephone inquiries and e-mail responses.

        a) Respond to telephone calls and e-mails from the public.

        b) Record calls and e-mails on to the City's internal public contact tracking system.

    6. Provide a monthly summary report of all inquiries and complaints, including the name of the person, source of inquiry (via information line or email), phone number, address, date, and time of inquiry, who responded, and a summary of resolutions or pending resolutions to the Resident Engineer.

    7. Report Exclusive Community Liaison activities at all progress meetings scheduled by the Resident Engineer.

    8. Attendance at Pre-construction, community and stakeholders meetings.

7-16.3.1 Exclusive Community Liaison Work Plan. The Work plan for the Exclusive Community Liaison shall address the items of Work specified in these specifications. Present your Exclusive Community Liaison and submit your exclusive community outreach plan in writing within 15 Days of the Award of the Contract.

7-16.4 **Payment.**

1. The payment for the community outreach services shall be included in the Contract Price.
2. The payment for the exclusive community liaison services shall be included in the Bid item for "Exclusive Community Liaison Services".

7-20 **ELECTRONIC COMMUNICATION.** ADD the following:

1. Virtual Project Manager will be used on this contract.

SECTION 9 - MEASUREMENT AND PAYMENT

9-3.2.5 **Withholding of Payment.** To the City Supplement, item 1, subsection i), DELETE in its entirety and SUBSTITUTE with the following:

i) Your failure to comply with 7-2.3, "PAYROLL RECORDS" and 2-16, "CONTRACTOR REGISTRATION AND ELECTRONIC REPORTING SYSTEM".

ADD:

9-3.7 **Compensation Adjustments for Price Index Fluctuations.** To the City Supplement, subsection c), item 2, DELETE in its entirety and SUBSTITUTE with the following:

2) In the event of an overrun of Contract time, adjustment in compensation for asphalt binder included in estimates during the overrun period shall be determined using the California Statewide Crude Oil Price Index in effect on the first business day of the month within the pay period in which the overrun began.

ADD the following:

e) This Contract is not subject to the provisions of The WHITEBOOK for Compensation Adjustments for Price Index Fluctuations for the paving asphalt.

SECTION 203 – BITUMINOUS MATERIALS

203-15 **RUBBER POLYMER MODIFIED SLURRY (RPMS).** To the City Supplement, CORRECT section numbering as follows:

OLD SECTION NUMBER	TITLE	NEW SECTION NUMBER
203-15	RUBBER POLYMER MODIFIED SLURRY (RPMS)	203-16
203-15.1	General	203-16.1
203-15.2	Materials	203-16.2
203-15.3	Composition and Grading	203-16.3
203-15.4	Mix Design	203-16.4

ADD the following:

RPMS shall be used on this contract.

SECTION 207 – PIPE

207-9.2.3 **Fittings.** To the City Supplement, ADD the following:

8. Flange gaskets shall be 3.2 mm (1/8 inch) thick acrylic or aramid fibers bound with nitrile for all sizes of pipe. Gaskets shall be full-face type with pre-punched holes free of asbestos material. All insulating flange kits shall require full face gaskets.

207-9.2.4 **Lining and Coating.** To the City Supplement, Item 4, DELETE in its entirety and SUBSTITUTE with the following:

4. The fitting shall be lined with cement mortar and tar (seal) in accordance with AWWA C104/A21.4. The interior of bells shall be lined. You shall provide double thickness lining and shall use cement conforming to ASTM C150 Type II. Coating on Interior bells shall be holiday free.

207-9.2.6 **Polyethylene Encasement for External Corrosion Protection.** To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

1. When soils have been determined to be mildly corrosive through resistivity testing as specified in the City of San Diego Sewer and Water Design Guides, the outside surfaces of ductile iron pipe and fittings for general use shall be coated with bituminous coating 1 mil (25 um) thick in accordance with AWWA C151 or AWWA C110. Polyethylene encasement shall be provided in accordance with AWWA C105.

207-17.2.3 **Pipe Manufacturer.** To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

1. PVC products, C900 and C905, as manufactured or distributed by J-M Manufacturing Company or JM Eagle shall not be used on the Contract for pressurized pipe.

207-26.4 **Butterfly Valves.** To the City Supplement, Paragraph (2), DELETE the last sentence.

To the City Supplement, Paragraph (3), DELETE in its entirety and SUBSTITUTE with the following:

3. The operator shall be manual with a 2 inch (50 mm) square operating nut and shall open the valve when turned counterclockwise.

SECTION 209 – STREET LIGHTING AND TRAFFIC SIGNAL MATERIALS

209-6.4 **Induction Cobra Head Luminaire.** To the City Supplement, CORRECT section numbering as follows:

OLD SECTION NUMBER	TITLE	NEW SECTION NUMBER
209-6.4.7	Luminaire Identification	209-6.4.8
209-6.4.8	Photometric Documentation	209-6.4.9
209-6.4.9	Quality Assurance	209-6.4.10

SECTION 212 - LANDSCAPE AND IRRIGATION MATERIALS

212-1.2.4 **Organic Soil Amendment.** ADD the following:

Type 4 organic soil amendment (compost) shall be derived from Green Material (yard waste and/or food waste) that is composted in accordance with California Code of Regulations, Title 14, Chapter 3 Article 7, 17868.3 (15 Day Process to Further Reduce Pathogens and kill weed and other seeds). Incorporated into the soil, compost improves soil texture; increases both nutrient and water holding capacity; and reduces the need for commercial fertilizer. Where applicable, Organic Soil Amendment can qualify as a component of LEED certification.

Type 4 organic soil amendment must come from a compost facility that tests its compost on a quarterly basis and meets the requirements listed in Table 212-1.2.4(B). Contractor shall provide a copy of the most recent quarterly test results, and a current representative sample of the compost to be used on the project, to the City, prior to approval and the compost being used.

The City of San Diego's Miramar Greenery produces Type 4 organic soil amendment (compost) and complies with the U.S. Composting Council's Seal of Testing Assurance Program. The Miramar Greenery is located within the City's Miramar Landfill at State Hwy. 52 and Convoy St. in San Diego.

http://www.sandiego.gov/environmental-services/miramar/greenery/

Table 212-1.2.4 (B)

Test Criteria	Acceptable Range	Unit of Measure	TMCC Test Method
pH	6.0 - 8.0		04.11-A 1:5 Slurry pH
Soluble salts	0 - 10	dS/m (mmhos/cm)	04.10-A 1:5 Slurry Method
Organic Matter	30 - 75%	% dry weight basis	05.07-A Loss-on-ignition Organic Matter Method (LOI)
Stability	≤ 8	mg CO_2/g OM/day	05.08-B carbon Dioxide Evolution Rate
Maturity	> 80% emergence	average % of control	05.05-A Germination and vigor
Pathogens			
Fecal coliform	Pass	Pass/Fail per U.S. EPA Class A standard, 40CFR 503.32(a)	07.01-B Fecal coliforms

Test Criteria	Acceptable Range	Unit of Measure	TMCC Test Method
Salmonella	Pass	Pass/Fail per U.S. EPA Class A standard, 40CFR 503.32(a)	07.02 Salmonella
Heavy Metal	Pass	Pass/Fail per U.S. EPA Class A standard, 40CFR 503.13(a) Tables 1 and 3.	04.06-Heavy Metals standards, and Hazardous Elements.
Particle Size	≥ 90%	% dry weight passing through 11mm	02.02-B Sample Sieving for Aggregate Size Classification

ADD:

212-3.2.2.3 **Trench Marker Tape.** To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

1. Trench marker tape shall be installed in accordance with Standard Drawing SDM-105, "Warning/Identification Tape Installation".

ADD:

212-4 **BIORETENTION SOIL MEDIA (BSM).**

212-4.1 **General.** Bioretention Soil Media (BSM) is a formulated soil mixture that is intended to filter storm water and support plant growth while minimizing the leaching of chemicals found in the BSM itself. BSM consists of 70% to 85% by volume washed sand and 15% to 30% by volume compost or alternative organic amendment. Alternative proportions may be justified under certain conditions. BSM shall be mixed thoroughly using a mechanical mixing system at the plant site prior to delivery. In order to reduce the potential for leaching of nutrients, the proportion of compost or alternative organic amendment shall be held to a minimum level that will support the proposed vegetation in the system.

212-4.1.1 **Sand for Bioretention Soil Media.** The sand shall conform to ASTM C33 "fine aggregate concrete sand" requirements. A sieve analysis shall be performed in accordance with ASTM C 136, ASTM D 422, or approved equivalent method to demonstrate compliance with the gradation limits shown in Table 212-4.1.1 (A). The sand shall be thoroughly washed to remove fines, dust, and deleterious materials prior to delivery. Fines passing the No. 200 sieve shall be non-plastic.

Table 212-4.1.1 (A) Sand Gradation Limits

Sieve Size (ASTM D422)	Percent Passing (by weight)	
	Minimum	Maximum
3/8 inch	100	100
#4	95	100
#8	80	100
#16	50	85
#30	25	60
#50	5	30
#100	0	10
#200	0	5

Note: Coefficient of Uniformity (Cu = D60/D10) equal to or greater than 4

212-4.1.2 **Compost.** Compost shall be certified by the U.S. Composting Council's Seal of Testing Assurance Program or an approved equivalent program. Compost shall comply with the following requirements:

1. Organic Material Content shall be 35% to 75% by dry weight.
2. Carbon to nitrogen (C:N) ratio shall be between 15:1 and 40:1, preferably above 20:1 to reduce the potential for nitrogen leaching/washout.
3. Physical contaminants (manmade inert materials) shall not exceed 1% by dry weight.
4. pH shall be between 6.0 and 7.5.
5. Soluble Salt Concentration shall be less than 10 dS/m (Method TMECC 4.10-A, USDA and U.S. Composting Council).
6. Maturity (seed emergence and seedling vigor) shall be greater than 80% relative to positive control (Method TMECC 5.05-A, USDA and U.S. Composting Council)
7. Stability (Carbon Dioxide evolution rate) shall be less than 2.5 mg CO_2-C per g compost organic matter (OM) per day or less than 5 mg CO_2-C per g compost carbon per day, whichever unit is reported.

(Method TMECC 5.08-B, USDA and U.S. Composting Council). Alternatively a Solvita rating of 6 or higher is acceptable.

8. Moisture shall be 25%-55% wet weight basis.

9. Select Pathogens shall pass US EPA Class A standard, 40 CFR Section 503.32(a).

10. Trace Metals shall pass US EPA Class A standard, 40 CFR Section 503.13, Tables 1 and 3.

11. Shall be within gradation limits in Table 800-4.1.2 (ASTM D 422 sieve analysis or approved equivalent).

Table 212-4.1.2 Compost Gradation Limits

Sieve Size	Percent Passing (by weight)
16 mm (5/8")	99 to 100
6.3 mm (1/4")	40 to 95
2 mm	40 to 90

212-4.1.3 **Alternative Mix Components and Proportions.** Alternative mix components and proportions may be utilized, provided that the whole blended mix (212-4.2) conforms to agricultural, chemical, and hydraulic suitability criteria, as applicable. Alternative mix designs may include alternative proportions, alternative organic amendments and/or the use of natural soils. Alternative mixes are subject to approval by the City Engineer.

Alternative mixtures may be particularly applicable for systems with underdrains in areas where phosphorus is associated with a water quality impairment or a Total Maximum Daily Load (TMDL) in a downstream receiving water. BSM with 15% to 30% compost by volume (as specified in 212-4.1.2) will likely contribute to increased phosphorus in effluent. Alternative organic amendments, such as coco coir pith, in place of compost should be considered in these areas. A sand or soil substrate with low plant available phosphorus (< 5 mg/kg) should also be considered. The use of compost in these mixes should be limited to the top three to six inches of soil and limited to the minimum level needed to augment fertility. Additionally, an activated alumina polishing layer can be considered to control phosphorus leaching.

Additional mix components, such as granular activated carbon, zeolite, and biochar may be considered to improve performance for other parameters.

212-4.2 **Whole BSM Testing Requirements and Criteria.** You shall submit the following information to the City Engineer at least 30 Days prior to ordering materials:

1. Source/supplier of BSM,
2. Location of source/supplier,
3. A physical sample,
4. Available supplier testing information,
5. Whole BSM test results from a third party independent laboratory,
6. Description of proposed methods and schedule for mixing, delivery, and placement of BSM.

Test results shall be no older than 120 Days and shall accurately represent the materials and feed stocks that are currently available from the supplier.

Test results shall demonstrate conformance to agricultural suitability criteria (212-4.2.1), chemical suitability criteria (212-4.2.2), and hydraulic suitability criteria (212-4.2.3). No delivery, placement, or planting of BSM shall begin until test results confirm the suitability of the BSM. You shall submit a written request for approval which shall be accompanied by written analysis results from a written report of a testing agency. The testing agency shall be registered by the State for agricultural soil evaluation which indicates compliance stating that the tested material proposed source complies with these specifications.

212-4.2.1 **BSM Agricultural Suitability.** The BSM shall be suitable to sustain the growth of the plants specified and shall conform to the following requirements:

a) pH shall be between 6.0-7.5.

b) Salinity shall be less than 3.0 milliohm/cm (as measured by electrical conductivity).

c) Sodium adsorption ration (SAR) shall be less than 3.0.

d) Chloride shall be less than 150 ppm.

The test results shall show the following information:

a) Date of testing

b) Project name

c) The Contractor's name

d) Source of materials and supplier's name

e) pH

f) E_C

g) Total and plant available elements (mg/kg particle concentration): phosphorus, potassium, iron, manganese, zinc, copper, boron, calcium, magnesium, sodium, sulfur, molybdenum, nickel, aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, mercury, selenium, silver, strontium, tin, and vanadium. Plant available concentration shall be assessed based on weak acid extraction(ammonium Bicarbonate/DTPA soil analysis or similar)

h) Soil adsorption ratio

i) Carbon/nitrogen ratio

j) Cation exchange capacity

k) Moisture content

l) Organic content

m) An assessment of agricultural suitability based on test results

n) Recommendations for adding amendments, chemical corrections, or both.

BSM which requires amending to comply with these specifications shall be uniformly blended and tested in its blended state prior to testing and delivery

212-4.2.2 **BSM Chemical Suitability.** For systems with underdrains, the BSM shall exhibit limited potential for leaching of pollutants that are at levels of concern. Potential for pollutant leaching shall be assessed using either the Saturated Media Extract Method (aka, Saturation Extract) that is commonly performed by agricultural laboratories or the Synthetic Precipitation Leaching Procedure (SPLP) (EPA SW-846, Method 1312). The referenced tests express the criteria in terms of the pollutant concentration in water that is in contact with the media. In areas in which a pollutant or pollutants are associated with a water quality impairment or a TMDL, BSM in systems with underdrains shall conform to the following Saturation Extract or SPLP criteria for applicable pollutant(s):

1. Nitrate < 3 mg/L
2. Phosphorus < 1 mg/L*
3. Zinc < 0.1 mg/L
4. Copper < 0.025 mg/L
5. Lead < 0.025 mg/L
6. Arsenic < 0.02 mg/L
7. Cadmium < 0.01 mg/L
8. Mercury < 0.01 mg/L
9. Selenium < 0.01 mg/L

Criteria shall be met as stated where a pollutant is associated with a water quality impairment or Total Maximum Daily Load (TMDL) in any downstream receiving water. Criteria may be waived or modified, at the discretion of the City Engineer, where a pollutant does not have a nexus to a water quality impairment or TMDL of downstream receiving water(s). Criteria may also be modified at the discretion of the City Engineer if the you demonstrate that suitable BSM materials cannot be feasibly sourced within a 50 mile radius of the project site and a good faith effort has been undertaken to investigate available materials.

Note that Saturation Extract and SPLP tests are expected to result in somewhat more leaching than would be experienced with real stormwater; therefore a direct comparison to water quality standards or effluent limitations is not relevant.

*Note: Alternative BSM mixtures should be considered for systems with underdrains in areas where phosphorus is associated with a water quality impairment or a TMDL or where the BSM does not achieve the Saturation Extract or SPLP criteria of < 1 mg/L total phosphorus as specified. Details regarding alternative mixtures requirements and potential components are included in 212-4.1.3.

The chemical suitability criteria listed in this section do not apply to systems without underdrains, unless groundwater is impaired or susceptible to nutrient contamination.

212-4.2.3 BSM Hydraulic Suitability.

1. The saturated hydraulic conductivity or infiltration rate of the whole BSM shall be measured by one of the following methods:
   a. Measurement of hydraulic conductivity (USDA Handbook 60, method 34b) (commonly available as part of standard agronomic soil evaluation), or
   b. ASTM D2434 Permeability of Granular Soils (at approximately 85% relative compaction Standard Proctor, ASTM D698)
2. BSM shall conform to hydraulic criteria associated with the BMP design configuration that best applies to the facility where the BSM will be installed.
   a) **Systems with unrestricted underdrain system (i.e., media control).** For systems with underdrains that are not restricted, the BSM shall have a minimum measured hydraulic conductivity of 8 inches per hour to ensure adequate flow rate through the BMP and longevity of the system. The BSM should have a maximum measured hydraulic conductivity of no more than 20 inches per hour. BSM with higher measured hydraulic conductivity may be accepted at the discretion of the City Engineer. In all cases, an upturned elbow system on the underdrain, measuring 9 to 12 inches above the invert of the underdrain, should be used to

control velocities in the underdrain pipe and reduce potential for solid migration through the system.

b) **Systems with restricted underdrain system (i.e., outlet control).** For systems in which the flowrate of water through the media is controlled via an outlet control device (e.g., orifice or valve) affixed to the outlet of the underdrain system, the hydraulic conductivity of the media should be at least 15 inches per hour and not more than 40 inches per hour. The outlet control device should control the flowrate to between 5 and 12 inches per hour. This configuration reduces the sensitivity of system performance to the hydraulic conductivity of the material, reduces the likelihood of preferential flow through media, and allows more precise design and control of system flow rates. *For these reasons, outlet control should be considered the preferred design option.*

c) **Systems without underdrains.** For systems without underdrains, the BSM shall have a hydraulic conductivity at least 4 times higher than the underlying soil infiltration rate, but shall not exceed 12 inches per hour.

212-4.3 **Delivery, Storage and Handling.** You shall not deliver or place soils in frozen, wet, or muddy conditions. You shall protect soils and mixes from absorbing excess water and from erosion at all times. You shall not store materials unprotected during large rainfall events (>0.25 inches). If water is introduced into the material while it is stockpiled, you shall allow the material to drain to the acceptance of the City Engineer before placement.

BSM shall be thoroughly mixed prior to delivery using mechanical mixing methods such as a drum mixer. BSM shall be lightly compacted and placed in loose lifts approximately 12 inches (300 mm) to ensure reasonable settlement without excessive compaction. Compaction within the BSM area shall not exceed 75 to 85% standard proctor within the designed depth of the BSM. Machinery shall not be used in the bioretention facility to place the BSM. A conveyor or spray system shall be used for media placement in large facilities. Low ground pressure equipment may be authorized for large facilities at the discretion of the City Engineer.

Placement methods and BSM quantities shall account for approximately 10% loss of volume due to settling. Planting methods and timing shall account for settling of media without exposing plant root systems.

The Engineer may request up to three double ring infiltrometer tests (ASTM D3385) or approved alternative tests to confirm that the placed material meets applicable hydraulic suitability criteria (212-4.2.3). In the event that the infiltration rate of placed material does not meet applicable criteria, the City Engineer may require replacement and/or decompaction of materials.

212-4.4 **Quality Control and Acceptance.** Close adherence to the material quality controls herein are necessary in order to support healthy vegetation, minimize pollutant leaching, and assure sufficient permeability to infiltrate/filter runoff during the life of the facility. Amendments may be included to adjust agronomic properties. Acceptance of the material will be based on test results certified to be representative. Test results shall be conducted no more than 120 Days prior to delivery of the blended BSM to the project site. For projects installing more than 100 cubic yards of BSM, batch-specific tests of the blended mix shall be provided to the City Engineer for every 100 cubic yards of BSM along with a site plan showing the placement locations of each BSM batch within the facility.

212-4.5 **Integration with Other Specifications.** This specification includes, is related to, and may depend or have dependency on other specifications, including but not limited to:

- Plantings and Hydroseed
- Mulch
- Aggregate (choking stone, drainage stone, energy dissipation)
- Geotextiles
- Underdrains
- Outlet control structures
- Excavation

Execution of this specification requires review and understanding of related specifications. Where conflicts with other specifications exist or appear to exist, you shall consult with the City Engineer to determine which specifications prevail.

212-4.6 **Aggregate Materials for Bsm Drainage Layers.**

212-4.6.1 Drainage of BSM requires the use of specific aggregate materials for filter course (aka choking layer) materials and for an underlying drainage and storage layer.

212-4.6.1.1 **Rock and Sand Products for Use in BSM Drainage.** Size classifications detailed in Tables 212-4.6.1 (A) and 212-4.6.1 (B) shall apply with respect to BSM drainage materials. All sand and stone products used in BSM drainage layers shall be clean and thoroughly washed.

Table 212-4.6.1 (A) Crushed Rock and Stone Gradation Limits

Sieve Size	Percent Passing Sieves	
	AASHTO No. 57[1]	ASTM No. 8[1]
3 in	-	-
2.5 in	-	-
2 in	-	-
1.5 in	100	-
1 in	95 – 100	-
0.75 in	-	-
0.5 in	25 – 60	100
0.375 in	-	85 – 100
No. 4	10 max.	10 – 30
No. 8	5 max.	0 – 10
No. 16		0 – 5
No. 50		-

Table 212-4.6.1 (B) Sand Gradation Limits

Sieve Size	Percent Passing Sieves
	Choker Sand - ASTM C33
0.375 in	100
No. 4	95 – 100
No. 8	80 – 100
No. 16	50 – 85
No. 30	25 – 60
No. 50	5 – 30
No. 100	0 – 10

No. 200	0 – 3

212-4.6.1.2 **Graded Aggregate Choker Stone.** Graded aggregate choker material is installed as a filter course to separate BSM from the drainage rock reservoir layer. This ensures that no migration of sand or other fines occurs. The filter course consists of two layers of choking material increasing in particle size. The top layer of the filter course shall be constructed of thoroughly washed ASTM C33 fine aggregate sand material conforming to gradation limits contained in Table 212-4.6.1(B). The bottom layer of the filter course shall be constructed of thoroughly washed ASTM No. 8 aggregate material conforming to gradation limits contained in Table 212-4.6.1(A).

SECTION 300 – EARTHWORK

300-1.4 **Payment.** To the City Supplement, item 2, DELETE in its entirety and SUBSTITUTE with the following:

2. Payment for existing pavement removal and disposal of up to 12 inches thick, within the excavation e.g., trench limits, shall be included in the Bid item for the installation of the mains or the Work item that requires pavement removal.

SECTION 302 – ROADWAY SURFACING

302-3 **PREPARATORY REPAIR WORK.** To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

302-3 **PREPARATORY REPAIR WORK.**

1. Prior to the placement of asphalt concrete or the application of slurry, you shall complete all necessary preparation and repair Work to the road segment.
2. Unless otherwise specified, preparatory Work shall include tree trimming, weed spray, weed abatement, crack sealing, asphalt repair, mill and pave, hump removal, miscellaneous asphalt patching, removal of raised pavement markers, and removal of pavement markings.
3. You shall repair areas of distressed asphalt concrete pavement by milling or removing damaged areas of pavement to a minimum depth of 2 inches (50.8 mm) for residential streets and a minimum depth of 3 inches (76.2 mm) for all others to expose firm and unyielding pavement.
4. You shall prepare subgrade as needed and install a minimum of 2 inches (50.8 mm) for residential streets and a minimum of 3 inches (76.2 mm) for all other streets of compacted asphalt concrete pavement over compacted native material as directed by the Engineer.

5. If the base material is exposed in order to achieve the minimum specified depth, the material shall be compacted to 95% relative compaction (dig out). Compaction tests shall be made to ensure compliance with the specifications.

6. The Engineer shall determine when and where the test shall occur. The City will pay for the soils testing required by the Engineer which meets the required compaction. You shall reimburse the City for the cost of retesting failing compaction tests. If additional base material is required, you shall use Class 2 Aggregate Base in accordance with 200-2.2, "Crushed Aggregate Base".

7. Recycled base material shall conform to crushed miscellaneous base material in accordance with 200-2.4, "Crushed Miscellaneous Base".

8. Prior to replacing asphalt, the area shall be cleaned by removing all loose and damaged material, moisture, dirt, and other foreign matter and shall be tack coated in accordance with 302-5.4, "Tack Coat".

9. You shall install new asphalt within the repair area or for patches in accordance with 302-5, "Asphalt Concrete Pavement". Asphalt concrete shall be C2-PG 64-10 in compliance with 400-4, "Asphalt Concrete".

10. No preparatory asphalt Work shall be done when the atmospheric temperature is below 50° F (10° C) or during unsuitable weather.

11. Following the asphalt placement, you shall roll the entire area of new asphalt in both directions at least twice. The finished patch shall be level and smooth in compliance with 302-5.6.2, "Density and Smoothness". After placement and compaction of the asphalt patch, you shall seal all finished edges with a 4 inch (101.6 mm) wide continuous band of SS-1H.

12. The minimum dimensions for each individual repair shall be 4 feet by 4 feet (1.2 m by 1.2 m) and shall be subject to the following conditions:

    a) If the base material is exposed to achieve the required minimum removal thickness, the base material shall be prepared conforming to 301-1, "SUBGRADE PREPARATION".

    b) When additional base material is required, then you shall use Class 2 Aggregate Base in accordance with 200-2.2, "Crushed Aggregate Base". Recycled base material shall conform to crushed miscellaneous aggregate base material in accordance with 200-2.4, "Crushed Miscellaneous Base".

    c) You may use grinding as a method for removal of deteriorated pavement when the areas indicated for removal are large enough (a minimum of the machine drum width) and when approved by the Engineer.

d) For both scheduled and unscheduled base repairs, failed areas may be removed by milling or by excavation provided that the edges are cut cleanly with a saw. The areas shall be cleaned and tack coated in accordance with 302-5.4, "Tack Coat" before replacing the asphalt. The areas for scheduled repairs have been marked on the street.

e) Base Repairs with RAC. Areas where failed paving is removed either by cold milling or by excavation shall be restored to existing pavement grade with ¾ inch (19.1 mm) RAC at 8 inch (203.2 mm) depth unless otherwise directed by the Engineer. These areas have been marked on the street as "DO". The asphalt concrete shall be B3-PG 64-10 as specified in 400-4, "Asphalt Concrete". Preliminary quantities are identified in the Contract Appendix but may need to be increased and approved by the Engineer at the time of construction. Base repairs shall not exceed 15% RAP in content.

f) Unscheduled Base Repair with RAC. If paving operations cause damage outside of your control and require additional base repair, the areas shall be removed either by cold milling or by excavation and shall be restored to existing pavement grade with ¾ inch (19.1 mm) RAC at 8 inch (203.2 mm) depth unless otherwise directed by the Engineer. The asphalt concrete shall be B3-PG 64-10 as specified in 400-4, "Asphalt Concrete". Unscheduled base repairs shall not exceed 15% RAP.

g) A base repair is considered unscheduled when it is not identified on the pavement with a "DO" or when you are directed by the Engineer to perform a base repair for the proper placement of an asphalt overlay.

302-3.1 Asphalt Patching.

1. Asphalt patching shall consist of patching potholes, gutter-line erosions, and other low spots in the pavement that are deeper than ½ inch (12.7 mm) in accordance with 302-5.6.2, "Density and Smoothness".

2. The areas requiring patching have been identified in the Contract Documents, marked on the streets, or as directed by the Engineer. You shall identify any new areas that may require patching prior to slurry Work to ensure the smoothness and quality of the finished product.

3. You shall identify and repair any areas that may require patching prior to the placement of slurry seal for a smooth and finished product.

4. Asphalt overlay shall not be applied over deteriorating pavement. Preparatory asphalt Work shall be completed and approved by the Engineer before proceeding with asphalt overlay.

5. You shall remove distressed asphalt pavement either by saw cutting or milling to expose firm and unyielding pavement, prepare subgrade (as needed), and install compacted asphalt concrete pavement over compacted native material as directed by the Engineer.

6. Prior to replacing asphalt, the area shall be cleaned and tack coated in accordance with 302-5.4, "Tack Coat".

7. Following the asphalt placement, you shall roll the entire patch in both directions and shall cover the patch at least twice.

8. After placement and compaction of the asphalt patch, you shall seal all finished edges with a 4 inch (101.6 mm) wide continuous band of SS-1H.

9. Base repairs shall not exceed 15% RAP in content.

302-3.2 Payment.

1. The payment for the replacement of existing pavement when required shall be included in the Contract Unit Price for "Asphalt Pavement Repair" for the total area replaced and no additional payment shall be made regardless of the number and size of replacements completed. No payment shall be made for areas of over-excavation or outside trench areas in utility Works unless previously approved by the Engineer. No payment for pavement replacement will be made when the damage is due to your failure to protect existing improvements. You shall reimburse the City for the cost of retesting all failing compaction tests.

2. The areas and quantities shown on the road segments and in the appendices are given only for your aid in planning the Work and preparing Bids. The Engineer will designate the limits to be removed and these designated areas shall be considered to take precedence over the area shown in an Appendix to the Contract Documents. The quantities shown in the appendices are based on a street assessment survey and may vary.

3. At the end of each day, you shall submit to the Engineer an itemized list of the asphalt pavement repair Work completed. The list shall include the location of the Work and the exact square footage of the repair.

4. The payment for preparatory repair Work and tack coating shall be paid at the Contract Unit Price for "Asphalt Pavement Repair".

5. The payment for milling shall be included in the Bid item for "Asphalt Pavement Repair" unless Bid items for asphalt milling Work has been provided.

6. The payment for miscellaneous asphalt patching shall be included in the Contract Unit Price for the slurry Work and no additional payment shall be made, unless a Bid item for "Miscellaneous Asphalt Patching" has been provided.

302-5.1.1 **Damaged AC Pavement Replacement.** To the City Supplement, DELETE in its entirety.

302-5.1.2 **Measurement and Payment.** To the City Supplement, DELETE in its entirety.

302-5.2.1 **Measurement and Payment.** To the City Supplement, item c), ADD the following:

Imported Subgrade material shall be paid per bid item "Imported Backfill".

SECTION 306 – UNDERGROUND CONDUIT CONSTRUCTION

306-1 **OPEN TRENCH OPERATIONS.** To the City Supplement, CORRECT section numbering as follows:

OLD SECTION NUMBER	TITLE	NEW SECTION NUMBER
306-1.8	House Connection Sewer (Laterals) and Cleanouts	306-1.9
306-1.7.1	Payment	306-1.9.1
306-1.7.2	Sewer Lateral with Private Replumbing	306-1.9.2
306-1.7.2.1	Location	306-1.9.2.1
306-1.7.2.2	Permits	306-1.9.2.2
306-1.7.2.3	Submittals	306-1.9.2.3
306-1.7.2.4	Trenchless Construction	306-1.9.2.4
306-1.7.2.5	Payment	306-1.9.2.5
306-1.7.3.6	Private Pump Installation	306-1.9.2.6
306-1.7.3.7	Payment	306-1.9.2.7

306-1.4.5 **Water Pressure Test.** To the City Supplement, Paragraph (2), DELETE in its entirety and SUBSTITUTE with:

2. Pressure testing of pipe and fittings at the lowest elevation shall be performed at 150% of the specified test pressure and no less than 100% of the specified test pressure at the highest elevation.

   Specified test pressure for Class 235 pipe will be 150 psi

   Specified test pressure for Class 305 pipe will be 200 psi

306-1.6 **Basis of Payment for Open Trench Installations.** To the City Supplement, ADD the following:

8. The payment for imported backfill when you elect to import material from a source outside the project limits and when authorized by the Engineer shall be included in the Bid item for "Imported Backfill". The price shall include the removal and disposal of unsuitable materials.

306-1.8.3 **Polyurethane Lining.** To the City Supplement, item 5, DELETE in its entirety.

306-20.8 **Carrier Pipe.** To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

Carrier pipe materials shall be approved by the Engineer. You shall use only HDPE. You shall furnish and install a structurally sound, leak-proof, fusible high density polyethylene pipe for all piping identified for installation by horizontal directional drilling. You shall be responsible for the sizing of the carrier pipe to withstand all installation forces, curvature, residual forces, and final in-place loading. The selected material shall have an inside diameter no less than stated on the Plans. Individual pipe lengths shall be assembled by butt-fusion unless otherwise specified.

SECTION 308 – LANDSCAPE AND IRRIGATION INSTALLATION

ADD:

308-2.5 **Bioretention Soil Media.**

308-2.5.1 **Spreading.** Imported BSM drainage material shall be delivered to the BMP system installation site as uniform mixtures and each layer shall be spread in one operation. Segregation within each aggregate layer shall be avoided and the layers shall be free from pockets of coarse or fine material.

Aggregate shall be deposited on underlying layers at a uniform quantity per linear foot (meter), which quantity will provide the required compacted thickness within the tolerances specified herein without resorting to spotting, picking up, or otherwise shifting the aggregate material.

The thickness of the aggregate storage layer (AASHTO No. 57) will depend on site specific design and shall be detailed in contract documents.

The bottom layer of the filter course (ASTM No.8) shall be installed to a thickness of 3 inches (75 mm). The layer shall be spread in one layer. The top layer of the filter course (ASTM C33) shall be installed to a thickness of 3 inches (75 mm). The layer shall be spread in one layer. Marker stakes should be used to ensure uniform lift thickness.

308-2.5.2 **Compacting.** Filter course material and aggregate storage material shall be lightly compacted to approximately 80% standard proctor without the use of vibratory compaction.

308-7 **GUARANTEE.** To the City Supplement, DELETE in its entirety.

308-7 **PAYMENT.** ADD the following:

1. Work related to tree maintenance shall be included in the Bid items as follows:
   - Tree Trimming (EA)
   - Root Pruning (EA)
   - Root Barrier (EA)
2. Third party independent laboratory tests shall be paid for by you.
3. Quantities of graded aggregate choker material and open-graded aggregate storage material will be measured as shown in the Bid. The volumetric quantities of graded aggregate choker stone material and open-graded storage material shall be those placed within the limits of the dimensions shown on the Plans.
   a) The weight of material to be paid for will be determined by deducting (from the weight of material delivered to the Work) the weight of water in the material (at the time of weighing) in excess of 1% more than the optimum moisture content. No payment will be made for the weight of water deducted.

308-8 **PAYMENT.** To the City Supplement, DELETE in its entirety.

SECTION 700 – EXTENDED REVEGETATION, MAINTENANCE, AND MONITORING

700-1.7.2 **Project Biologist.** To the City Supplement, ADD the following:

The City will retain a qualified Project Biologist to perform biological monitoring work for this contract. You shall coordinate your activities and Schedule with the activities and schedules of the Project Biologist.

SECTION 705 – WATER DISCHARGES

705-1 **Hydrostatic Discharge Requirements.** To the City Supplement, ADD the following:

3. The discharge of hydrostatic test water and/or potable water shall not contain constituents in excess of the following:

Table 705-1 (A) Effluent Limitations

Parameter	Units	Effluent Limitations
Total Residual Chlorine	mg/L	0.1
pH	units	Within the limits of 6.0 and 9.0 at all times

4. Compliance with the effluent limitation shown in Table 705-1 (A) shall be determined based on the 90th percentile of all samples obtained during the discharge event. Non-compliance for each event will be considered separately.

705-2.6.1 **General.** To the City Supplement, item 3, CORRECT reference to Section 803 to read "Section 703".

705-2.6.3 **Community Health and Safety Plan.** To the City Supplement, DELETE in its entirety and SUBSTITUTE with the following:

705-2.6.3 **Community Health and Safety Plan.** See 703-2, "Community Health and Safety Plan."

SECTION 707 – RESOURCE DISCOVERIES

ADD:

707-1.1 **Environmental Document.** The City of San Diego Environmental Analysis Section (EAS) of the Development Services Department has prepared a Final Mitigated Negative Declaration for Tierrasanta (Via Dominique) Pump Station, Project No. 317092, as referenced in the Contract Appendix A. You must comply with all requirements of the Mitigated Negative Declaration set forth in the Contract Appendix A.

Compliance with the City's environmental document shall be included in the Contract Price, unless bid items has been provided.

END OF SUPPLEMENTARY SPECIAL PROVISIONS (SSP)

TECHNICALS

TIERRASANTA PUMP STATION
TABLE OF CONTENTS for TECHNICAL SPECIFICATIONS

DIVISION 1 – GENERAL REQUIREMENTS

01025 Measurement and Payment
01300 Contractor Submittals
01400 Quality Control
01510 Temporary Utilities
01660 Facility Start-Up and Operator Training
01680 Physical Checkout; Shop, Field, and Functional Testing
01700 Contract Closeout
01730 Operation and Maintenance Information
01750 Spare Parts and Maintenance Materials

DIVISION 2 – SITEWORK

02050 Demolition
02100 Site Preparation
02200 Earthwork
02620 Subdrainage
02644 PVC Nonpressure Pipe
02645 PVC Pressure Pipe (4 in. and Smaller)
02650 Steel Pipe, Lined and Coated
02831 Chain Link Fence and Gates

DIVISION 3 – CONCRETE

03100 Concrete Formwork
03200 Reinforcement Steel
03280 Joints in Site Work Concrete
03290 Joints in Concrete Structures
03300 Cast-in-Place Concrete
03310 Cast-in-Place Site Work Concrete
03315 Grout
03400 Precast Concrete

DIVISION 4 – MASONRY

04232 Reinforced Concrete Block Masonry
04815 Glass Unit Masonry Assemblies

DIVISION 5 – METALS

05120 Structural Steel
05220 Concrete Bolts
05310 Steel Deck and Wall Panels
05500 Miscellaneous Metals

DIVISION 6 – MISCELLANEOUS CARPENTRY

06105 Miscellaneous Carpentry

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

07100 Waterproofing
07210 Building Insulation
07321 Concrete Roof Tiles
07600 Flashing and Sheet Metal
07720 Roof Accessories
07920 Sealants and Caulking

DIVISION 8 – DOORS AND WINDOWS

08110 Steel Doors and Frames
08347 Sound Control Door Assemblies
08620 Unit Skylights
08710 Finish Hardware
08800 Glazing

DIVISION 9 – FINISHES

09511 Acoustical Panel Ceilings
09800 Protective Coating
09900 Architectural Paint Finishes

DIVISION 10 – SPECIALTIES

10210 Outside Noise Barrier
10400 Identifying Devices
10520 Fire Extinguishers

DIVISION 11 – EQUIPMENT

11000 Equipment General Provisions
11033 Variable Frequency Drives
11175 Pumps General
11214 Vertical Turbine Pumps
11346 Submersible Sump Pumps
11870 Surge Tank and Control System

DIVISION 13 – SPECIAL CONSTRUCTION

13110 Galvanic Anode Cathodic Protection
13300 Instrumentation and Control
13301 Instrumentation and Control Descriptions
13314 In-Line Flow Measuring Systems
13325 Level Detection Switches
13334 Pressure Measuring Systems
13335 Pressure Detection Switches
13344 Temperature Measuring Systems
13370 Control Panels
13374 Control Panel Instrumentation
13400 Communications
13825 Automatic Gate Operator

DIVISION 14 – CONVEYING SYSTEMS

14600 Hoist and Cranes, General
14605 Electric Monorail Systems

DIVISION 15 – MECHANICAL

15000 Piping Components
15020 Pipe Supports
15030 Pipe Identification Systems
15050 Vibration Isolation
15100 Valves, General
15101 Valve and Gate Operators
15102 Gate Valves
15104 Butterfly Valves
15113 Air Release and Vacuum Valves
15114 Pressure Regulating Valves
15117 Pump Control Valves
15118 Spring-Loaded Swing Check Valves
15250 Pipe and Equipment Insulation
15990 Testing, Adjusting and Balancing

DIVISION 16 – ELECTRICAL

16040 Electric Motors
16050 Basic Electrical Materials and Methods
16200 Engine Generator
16290 Power Monitor
16400 Low Voltage Electrical Service and Distribution
16421 Surge Arrestor
16431 Short Circuit Study Protective Device Coordination and Arc Flash Analysis Report
16480 Motor Control Center
16485 Local Control Panels
16500 Lighting
16926 Automatic Transfer Switches
16950 Electrical Tests

SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. Payment for the various items of the Bid Schedule, as further specified herein, shall only apply for work within Pump Station property. Bid Schedule as specified herein, shall include all compensation to be received by the CONTRACTOR for furnishing all tools, equipment, supplies, manufactured articles, and for all labor and services, operations, and incidentals appurtenant to the items of Work being described, as necessary to complete the various items of the Work all in accordance with the requirements of the Contract Documents, including all appurtenances thereto, and including all cost of permits and cost of compliance with the regulations of public agencies having jurisdiction, including Safety and Health Requirements of the California Division of Industrial Safety and the Occupational Safety and Health Administration of the U.S. Department of Labor (OSHA). No separate payment will be made for any item that is not specifically set forth in the Bid Schedule for the various appurtenant items of Work.

B. Payment references for all work within public right of way shall be per Standard Specifications for Public Works Construction (Greenbook), City of San Diego Standard Specifications for Public Works Construction (Whitebook), and Project Supplementary Special Provisions. Bid schedule for these items are detailed in the Volume 2 Contract Documents.

1.2 MEASUREMENT - GENERAL

Items of work indicated to be paid on a Lump Sum, L.S. basis will be measured in the most logical units for the item as indicated on the accepted Schedule of Values.

1.3 CONSTRUCT TIERRASANTA PUMP STATION (BID ITEM NO. 1) LUMP SUM

A. No measurement shall be made for this item.

B. Payment for construction of the pump station complete in place, including but not limited to all grading, rock excavation and removal, dewatering, construction of all retaining walls, excavation and construction of all yard piping, all site work, mechanical equipment, architectural, structural, plumbing, landscaping, testing and start up and all other work necessary to complete this item of work will be made at the lump sum price named in the Bid Schedule under Item No. 1.

1.4 DEMOLITION OF TIERRASANTA TEMPORARY PUMP STATION (BID ITEM NO. 2) LUMP SUM

A. No measurement shall be made for this item.

B. Payment for the demolition of Tierrasanta Temporary Pump Station shall include but not limited to removal and/or abandonment of existing water facilities, structure demolition, below-grade demolition, disposal of demolished materials, patching, repairing, cleaning and all other work necessary to complete this item of work will be made at the lump sum price named in the Bid Schedule under Item No.2.

1.5 SECURITY SURVEILLANCE AND ACCESS CONTROL (BID ITEM NO. 6) ALLOWANCE

A. No measurement shall be made for this item.

B. The Special System Plan drawings detailing the Tierrasanta pump station's security layout are removed from the bidding package and will be awarded to the winning Contractor. An allowance shall be set aside to provide, furnish, install and complete an operable security surveillance and access control system. The required allowance amount is shown on the Bid Schedule under Item No. 6.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

*** END OF SECTION ***

SECTION 01300

CONTRACTOR SUBMITTALS

PART 1 - GENERAL

1.1 GENERAL

A. This section of the Contract Documents outlines requirements for submittals during Construction phase. Specific submittal requirements during Construction are also included in the pertinent Technical Specifications sections.

B. All submittals by the CONTRACTOR shall be submitted to the OWNER'S REPRESENTATIVE.

C. Unless otherwise noted, within 14 days after the date of commencement as stated in the Notice to Proceed, the CONTRACTOR shall submit the following items to the OWNER'S PROJECT MANAGER for review:

1. The Project Management Plan as described in the Supplementary General Requirements.

2. A list of submittals with scheduled submission dates. This list shall include specification section number, description of the submittal, scheduled submission date and anticipated approval date.

3. A list of all permits and licenses the CONTRACTOR is required to obtain indicating the agency required to grant the permit, the expected date of submittal for the permit and required date for receipt of the permit.

4. Project Schedule.

1.2 SHOP DRAWINGS

A. Wherever called for in the CONTRACT DOCUMENTS, the CONTRACTOR shall furnish six (6) copies, plus one reproducible copy, of each shop drawing submittal to the OWNER'S REPRESENTATIVE. Prior to submittal to the OWNER'S REPRESENTATIVE, each shop drawing submittal shall be reviewed and approved by the OWNER's Engineer of Record, and certified by an authorized representative of the CONTRACTOR. The OWNER'S REPRESENTATIVE will not review shop drawings; however, the OWNER'S REPRESENTATIVE will utilize the approved shop drawing submittals as a basis for inspecting the work pertaining to the shop drawing submittal. No work on a particular item shall commence until the shop drawing for that item has been reviewed by the OWNERS's Engineer of Record and submitted to the OWNER'S REPRESENTATIVE. No payment for any item of work shall be made until the shop drawing for that item of work has been submitted to the OWNER'S REPRESENTATIVE.

B. The term "Shop Drawings" as used herein shall be understood to include detail design calculations, shop drawings, fabrication and installation drawings, erection drawings, lists, graphs, catalog sheets, data sheets, and other submittal requirements indicated by the technical specifications. The CONTRACTOR shall submit, as applicable, the following for all prefabricated or manufactured structural, mechanical, electrical, plumbing, and process systems and equipment:

1. Wiring and control diagrams of systems and equipment.

2. Complete manufacturer's specifications, including materials description and paint system.

3. Samples of finish colors for selection.

4. Requirements for storage and protection prior to installation.

5. Installation procedures.

6. List of all requested exceptions to the Contract Documents and/or variations from the specified equipment.

C. All shop drawing submittals shall be accompanied by the OWNER'S REPRESENTATIVE'S standard submittal transmittal form. The form may be obtained in quantity from the OWNER'S REPRESENTATIVE. Any submittal not accompanied by such a form, or where all applicable items on the form are not completed, will be returned for resubmittal.

1. Sequentially number the transmittal forms. Re-submittals shall have original number with an alphabetic suffix.

2. Identify Contract, CONTRACTOR, Sub Contractor, and/or Supplier; pertinent drawing sheet and detail number(s), as appropriate. On standard drawings or data sheets, clearly indicate model and option being proposed and strike out all non-relevant data.

3. All submittals must be capable of being scanned electronically for filing on a computer file.

D. Normally, a separate transmittal form shall be used for each specific item or class of material or equipment for which a submittal is required. Transmittal of a submittal of various items using a single transmittal form will be permitted only when the items taken together constitute a manufacturer's "package" or are so functionally related that expediency indicates review of the group or package as a whole. A multiple-page submittal shall be collated into sets, and each set shall be stapled or bound, as appropriate, prior to transmittal to the OWNER'S REPRESENTATIVE.

E. Fabrication of a manufactured item or field installation shall be commenced only after the OWNER's Engineer of Record has reviewed and approved the shop drawing submittals and the CONTRACTOR has submitted copies of the approved submittal to the OWNER'S REPRESENTATIVE.

F. All CONTRACTOR shop drawing submittals shall be carefully reviewed by an authorized representative of the CONTRACTOR, prior to submission to the OWNER'S REPRESENTATIVE. Each submittal shall be dated, signed, and certified by the CONTRACTOR, as being correct and in strict conformance with the Contract Documents. In the case of shop drawings, each sheet shall be so dated, signed, and certified. All non- certified submittals will be returned to the CONTRACTOR, and any delays caused thereby shall be the total responsibility of the CONTRACTOR.

G. The CONTRACTOR shall assume all responsibility and risk for any misfits due to any errors in CONTRACTOR submittals. The CONTRACTOR shall be responsible for the dimensions and the design of adequate connections and details.

H. Any deviations from the Technical Specification shall be noted by the Engineer of Record in writing and submitted to the OWNER'S REPRESENTATIVE for OWNER review and approval.

1.3 SAMPLES

A. Whenever, in the CONTRACT DOCUMENTS, samples are required, the CONTRACTOR shall submit not less than 4 samples of each such item or material to the OWNER'S REPRESENTATIVE for review.

B. Samples, as required herein, shall be submitted for acceptance a minimum of 30 days prior to ordering such material for delivery to the job site, and shall be submitted in an orderly sequence so that dependent materials or equipment can be assembled and reviewed without causing delays in the WORK.

C. All samples submitted to the OWNER'S REPRESENTATIVE shall be individually and indelibly labeled or tagged, indicating thereon all specified physical characteristics and the Manufacturer's name for identification. Upon acceptance, 2 sets of the samples will be returned to the CONTRACTOR. One set of samples will be retained by the OWNER, and one set of samples shall remain at the job site with the OWNER'S REPRESENTATIVE until completion of the WORK.

D. Unless indicated otherwise, all colors and textures of specified items presented in sample submittals shall be from the manufacturer's standard colors and standard materials, products, or equipment lines. If the samples represent non-standard colors, materials, products, or equipment lines and their selection will require an increase in contract time or price, the CONTRACTOR will clearly indicate same on the transmittal page of the submittal.

1.4 OPERATIONS AND MAINTENANCE MANUALS

A. General: The CONTRACTOR shall prepare Operations and Maintenance manuals (O&M Manuals) in accordance with the criteria specified in this section.

1. Terminology: the words described below, when used in the context of the O&M Manuals shall have the associated meaning:

a. O&M Manual: the complete set of Volume I, Volume II and Volume III of the O&M Manual for this facility.

b. OPERATIONS MANUAL: the complete set of Volume I and Volume II of the O&M Manual for this facility. Volume I will contain process information. Volume II will contain standard operating procedures.

c. MAINTENANCE MANUAL: the complete Volume III of the O&M Manual which contains all of the maintenance information for this facility.

d. Volume: any of the complete sets of information comprising the specific OPERATIONS MANUAL and the specific Maintenance Manual. Each Volume may contain one or more Parts.

e. Part: a Part is wholly contained within one binder. Each Part may contain one or more Sections. If any Volume is too thick for a single binder, it shall be divided into Parts, with each Part in a binder.

f. Section: a subdivision of any Volume.

g. Subsection: a subdivision of any Section.

2. Organization:

a. The O&M Manual shall be divided into three separate Volumes as described below.

b. If a Volume exceeds the maximum 2-inch or 300-page requirement, then it shall be split into two or more Parts.

c. If a Volume is split into Parts, the split must occur between Sections and not within a Section.

d. Each Part shall not exceed 2 inches or 300 pages in size.

e. Volumes shall be numbered using Roman numerals, I, 11, and 111.

f. Parts will be lettered using capital letters; A, B, C...., AA, BB, etc.

g. Sections within each Part shall be separated with a tabbed divider on heavy card stock, with each page uniquely numbered (e.g. 1 -1, 1-2,..., 2-1, 2-2, etc.,).

h. Subsections shall be separated by a colored sheet of paper indicating the title of the Section and Subsection.

i. Appendices shall be located at the end of the Volume in which they are referenced.

3. Content:

a. All data contained within the O&M Manuals must be clear and legible; facsimiles or copies of facsimiles will not be accepted.

b. No color reproduction is allowed.

c. Lettering for drawings shall be no less than 1/8 inch in size.

B. Volume I of the O&M Manual, Process Information Manual:

1. General: Volume I and Volume II of the O&M Manual will comprise the OPERATIONS MANUAL. All information presented in the OPERATIONS MANUAL shall be directed at the operations staff assigned to the facility. The information will allow the operations staff to startup, operate, and shutdown the equipment and processes used in the facility.

2. Format: The standard section format for each process shall be composed of four main subsections: Introduction, Process Components and Operation, Process Analysis and Control, and Safety.

3. Content:

a. Introduction: Each section shall begin with at least a two-paragraph introduction. The first paragraph will state the purposes of the process and will discuss briefly the theory or concept of the process. The second paragraph will be a brief description of the process and its relationship with other processes.

b. Process Components and Operation: This section shall present a description of each system and component of the process.

c. Process Analysis and Control: This section shall be composed of five subsections: process description/objectives; process parameters; physical observations; process laboratory monitoring requirements; and process troubleshooting guide.

d. Safety: this section shall describe the safety precautions to take when working around this process. It should describe, as a minimum, safety as it relates to equipment (electrical or mechanical), confined spaces, chemicals (liquid and vapor), tripping or falling hazards, and other hazards.

e. Appendices: Appendices shall be used to reference materials that need not be placed within the individual sections.

C. Volume II of the O&M Manual, Standard Operating Procedures:

1. General: A Standard Operating Procedure (SOP) is a detailed statement of actions which must be performed to properly operate a unit process within a specific treatment process as well as the associated parts of the entire treatment process.

2. Format: The Standard Operating Procedures shall contain the following:

a. Main Section:

(1) Introduction

(2) Safety procedures including appropriate warnings and cautions

(3) Startup procedures

(4) Routine operational procedures

(5) Shutdown procedures

(6) Abnormal operational procedures

(7) Headers stating it is a Standard Operating Procedure and which unit process the SOP is about -

(8) Footers stating the SOP is for the Water Department, date of printing, draft number or final, file path name and page number of total number of pages

b. Master copies of all forms and checklists

c. The written information directed to all employees actually operating the facilities

d. The information addressing major plant components and unit processes

e. Information presented in graphic format which will include:

(1) Flow schematics

(2) Exploded equipment views

(3) Cut-away equipment views

(4) Simplified plans and sections of plant units

(5) Equipment photographs

3. Content: In addition to the sections listed above, staff expects to receive the items as described below:

a. Safety Precautions: this Subsection shall start with a tabular list of all safety precautions associated with the SOP. These can include confined

spaces, chemical safety for specific chemicals, electrical hazards, mechanical hazards, lifting safety, etc. Following the tabular list will be a detailed discussion of each safety precaution.

b. Startup Procedures: the normal startup mode should be confirmed with the OWNER and it will most likely be DCS controlled. The procedures shall list all of the manual operational tasks which need to be accomplished prior to the DCS taking over the operations.

c. Routine Operational Procedures: This section shall itemize the routine responsibilities to be performed by the Operator. Reporting logs are to be developed by the CONTRACTOR and included in O&M Manual in Volume I.

d. Shutdown Procedures: The shutdown of the system shall be described step- by-step, in the order required to effect a smooth shutdown of the process. The procedures should include how to stop the equipment for short periods of time (minutes to hours) and for extended periods of time (days to months). The resultant effect on other equipment or processes shall be discussed. The final step should advise the Operator to lock out/tag out any units which are to be isolated for any reason.

e. Operational Procedures for Abnormal Conditi0ns:a description of abnormal conditions, such as equipment and power failures control system failures, annunciated alarm conditions, etc., shall be discussed. Total loss of each system within a process and the total loss of the process itself shall also be discussed.

D. Volume III of the O&M Manual, Maintenance Manual Specifications:

1. General: The CONTRACTOR shall submit technical operation and maintenance information for each item of mechanical, electrical and instrumentation equipment in an organized manner in the MAINTENANCE MANUAL. The MAINTENANCE MANUAL shall be written so that it can be used and understood by the OWNER'S operation and maintenance staff.

2. Index:

a. The CONTRACTOR shall prepare a general index, contained in a separate binder at the beginning of Volume III. This index will indicate specification number, tag number, name, process application and MCC for each item of equipment. The electronic version of this index shall be sortable by any category.

b. Each MAINTENANCE MANUAL shall contain an index of the manufacturers and equipment that conforms to the eight "Sections" shown below. The sections of all MAINTENANCE MANUALS shall appear in the same order. If any section is not applicable to a piece of equipment, indicate as such on the index.

3. Subdivisions: The MAINTENANCE MANUAL shall be subdivided into "Parts." first by manufacturer, and second by equipment name. Manuals will be arranged in alphabetical order by manufacturer's name. If a manufacturer provides more than one piece of equipment, the manuals will be arranged within each manufacturer's group of binders alphabetically by equipment name. "Sections" within each "Part" shall be separated with a tabbed divider on heavy card stock,

with each page uniquely numbered (e.g. 1-1, 1-2,..., 2-1,2-2, etc.), and conform to the following:

a. Section 1 -Equipment Summary:

(1) Summary: A summary sheet shall indicate the following:

(a) Equipment name

(b) Equipment number

(c) Process area(s) in which the equipment is installed

(d) Specification section number(s)

(e) Manufacturer/Vendor name, address, phone and facsimile numbers,e-mail address, and web site address

(f) Local Representative/service Provider name, address, phone and facsimile numbers, e-mail address, and web site address

(g) Material Identifier/Vendor Job Reference Number

(h) Brief description of site specific modifications (if applicable)

b. Section 2 -Operational Procedures:

(1) Procedures: Manufacturer-recommended procedures for the following shall be included in Section 2:

(a) Installation

(b) Adjustment

(c) Start-up Location of controls, special tools or other equipment required Related instrumentation needed for operation

(d) Operating Procedures

(e) Load Changes

(f) Calibration

(g) Shutdown

(h) Troubleshooting

(i) Disassembly

(j) Reassembly

(k) Realignment

(l) Testing to determine performance efficiency

(m) Tabulation of proper settings for all pressure relief valves, low and high pressure switches and other protection devices

(n) List of all electrical relay settings including alarm and contact settings

c. Section 3 -Preventive Maintenance Procedures:

(1) Procedures: Preventive maintenance procedures shall include all manufacturer- recommended procedures to be performed on a periodic basis. both by removing and replacing the equipment or component and by leaving the equipment in place.

(2) Schedules: Recommended frequency of preventive maintenance procedures shall be included. Lubrication schedules, including lubricant SAE grade and type, and temperature ranges shall be covered.

d. Section 4 -Parts List and Exploded View Drawings:

(1) Parts List: A complete parts list shall be furnished, including a generic description and manufacturer's identification number for each part. Addresses and telephone numbers of the nearest supplier and parts warehouse shall be included.

(2) Drawings: Cross-sectional or exploded view drawings shall accompany the parts list.

e. Section 5 -Wiring Diagrams:

(1) Diagrams: Section 5 shall include complete internal and connection wiring diagrams for electrical equipment items.

f. Section 6 -Shop Drawings:

(1) Drawings: This Section shall include approved shop or fabrication drawings, complete with dimensions.

g. Section 7-Safety:

(1) Procedures: This Section describes the safety precautions to be taken when operating and maintaining the equipment or working near it.

h. Section 8 –Documentation:

(1) All equipment warranties, affidavits, and certifications required by the Technical Specifications shall be placed in this Section.

4. Data Sheet: For certain items designated during design, a Data Sheet, containing all of the information identified in the Equipment Summary above, shall be submitted in lieu of a complete MAINTENANCE Manual, along with Vendor supplied catalogues or literature. These items, such as ceramic tile or PVC non-pressure pipe, shall be identified with the input and direction of the OWNER'S REPRESENTATIVE and the OWNER during design phase.

E. O&M Manual Submittal Requirements:

1. General:

a. Binders: Each manual shall be bound in a standard size, 3-ring, loose leaf vinyl plastic hard cover binder suitable for bookshelf storage. Binder ring size shall not exceed 2 inches or 300 pages. Pages shall turn freely in the binders. If additional binders are required for a piece of equipment they will be clearly marked as lof 2, 2 of 2, etc. Manuals that must be divided

among multiple binders shall be divided at logical points, and not in the middle of sections.

b. Identifying Marks: Each binder shall be clearly labeled identifying the Volume number and contents of the binder. For MAINTENANCE MANUALS, the name of the manufacturer and equipment name shall be clearly displayed vertically w on the spine from top to bottom.

2. Operations Manual:

a. Draft: The CONTRACTOR shall furnish to the OWNER'S REPRESENTATIVE four (4) identical copies of a draft OPERATIONS MANUAL, including preliminary figures and tables no later than 75 percent completion of construction completion date.

b. Final: The CONTRACTOR shall furnish to the OWNER'S REPRESENTATIVE four (4) identical copies of the OPERATIONS MANUAL, incorporating City comments as agreed, no later than 95 percent of construction completion date. All discrepancies found by the OWNER'S REPRESENTATIVE in the OPERATIONS MANUALS shall be corrected by the CONTRACTOR within 30 days from the date of written notification by the OWNER'S REPRESENTATIVE.

3. Maintenance Manual:

a. The CONTRACTOR shall furnish to the OWNER'S REPRESENTATIVE four (4) identical MAINTENANCE MANUALS.

b. MAINTENANCE MANUALS shall be submitted in final form to the OWNER'S REPRESENTATIVE no later than the 75 percent of construction completion date. All discrepancies found by the OWNER'S REPRESENTATIVE in the MAINTENANCE MANUALS shall be corrected by the CONTRACTOR within 30 days from the date of written notification by the OWNER'S REPRESENTATIVE.

c. Incomplete or unacceptable MAINTENANCE MANUALS at the 75 percent construction completion point shall constitute sufficient justification to withhold the amount stipulated in Section 01700 from any monies due the CONTRACTOR.

4. Electronic Submittal Requirements: The O&M Manuals shall be submitted in accordance with the electronic document submittal requirements described below.

1.5 ELECTRONIC DOCUMENT SUBMITTAL REQUIREMENTS

A. General:

1. All final submittals are required in both paper and electronic format. Four (4) copies of each final submittal shall be provided on Compact Disk media (CD-ROM).

2. Where preliminary submittals are required in electronic format, three (3) copies of the preliminary submittal shall be provided on CD-ROM for review.

3. CD-ROM disks shall be on high-quality CD-R media. CDs shall have printed paper labels with the project name, CIP Number, CONTRACTOR. and content. CD-RW (CD- rewritable) disks are not acceptable. CDs shall be provided with a

case and a case insert label displaying the same information shown on the CD label.

4. The CD-ROM data format shall comply with IS0 9660 (1988) with Joliet extensions.

5. Deviation from this standard will be accepted only if advance approval is given by the OWNER'S REPRESENTATIVE.

B. Documents: Electronic submittals for the following types of documents are required as a minimum.

1. Operations and Maintenance:

a. Facility design O&M manuals

(1) Volume I -process information

(2) Volume II -standard operating procedures (SOP)

(3) Volume III -all maintenance information for the facility

(a) Manufacturer O&M manuals

(b) Facility Loop and Wiring Diagrams

C. Format:

1. Construction drawings and record drawings developed under the Contract shall be in Bentley Microstation (.DGN) format.

2. Other than construction drawings and record drawings, documents shall be in Adobe Acrobat PDF format, using the Acrobat version as specified by the CONTRACT MANAGER. Documents that are submitted in Acrobat Image Only format will not be accepted.

3. Electronic Conversion: Vendor and CONTRACTOR shop drawings developed under the Contract shall be in Bentley Microstation (.DGN) format. Documents in electronic format (WordPerfect. Microsoft Word, Excel, Lotus, etc.) shall be converted to standard PDF format using the Acrobat printer driver or other direct conversion software. The Acrobat PDF sub-format for electronically converted documents shall be the Acrobat Standard PDF file format which includes both image and text information.

4. Documents not available in electronic format shall be scanned at 300 dpi, bitonal (black and white) and converted into Adobe Acrobat (PDF). Image enhancement software shall be used during scanning. The Acrobat PDF sub-format for scanned documents shall be the Original Image with Hidden Text format.

5. All PDF documents shall be reviewed, and corrected if necessary, for orientation and legibility.

6. Individual document files shall not exceed 3 megabytes in size. Large documents shall be broken down by subsections to facilitate this requirement.

D. Document Organization and Indexing:

1. Electronic submittals shall be logically organized. File names shall be in UPPERCASE only, use a maximum of 64 characters, contain no spaces, and clearly indicate the file contents.

2. Supplier's submittals that include O&M documentation for more than one equipment type shall be divided into separate documents for each equipment type.

3. Each document's Table of Contents shall contain PDF bookmarks which actively link to the referenced sections within the document.

4. A master PDF index file shall be included, with a master Table of Contents, and active internal links to individual document files. The master PDF index file shall be clearly identifiable. External PDF link file names shall be in uppercase only.

5. A table shall be provided and submitted in spreadsheet format which includes the information about each document file. The contents of the table shall be submitted and approved by the OWNER'S REPRESENTATIVE. An example of information to be provided is as follows: (This is an example only)

   a. Document file name

   b. Document title and description

   c. Hard Copy Catalog No. (Used by facility document coordinator)

   d. Document Type: (see above)

   e. Facility Name

   f. Specification Number

   g. Process Name

   h. Unit Process Number

   i. Manufacturer's Name (if applicable) Co Supplier's Name (if applicable)

   j. EMPAC asset number (if applicable)

   k. Asset Description (if applicable)

      (1) Keyword

      (2) Qualifier

1.6 SPARE PARTS LIST

A. The CONTRACTOR shall furnish to the OWNER'S REPRESENTATIVE copies of spare parts information for all mechanical, electrical, and instrumentation equipment. The spare parts list shall include the current list price of each spare part. The spare parts list shall be limited to those spare parts which each manufacturer recommends be maintained by the OWNER in inventory at the plant site. Each manufacturer or supplier shall indicate the name, address, and telephone number of its nearest outlet of spare parts to facilitate the OWNER in ordering. The CONTRACTOR shall cross-reference all spare parts lists to the equipment numbers designated in the Contract Documents.

B. The spare parts lists shall be labeled and bound in standard size, 3-ring, loose leaf, vinyl plastic hard cover binders suitable for bookshelf storage. Binder ring size shall not exceed 2.5 inches.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SCHEDULING FOR SUBMITTALS

A. The CONTRACTOR is to recognize the time and sequence related to the submittals required by the contract documents. Therefore, the CONTRACTOR shall demonstrate competency in preparing and delivering submittals. The CONTRACTOR will not be allowed any additional contract time or compensation due to delays associated with submittals or re-submittals. In addition, the costs associated with expedited review of a submittal or a submittal conference may be withheld from monies due the CONTRACTOR by the OWNER to cover additional costs of the OWNER'S REPRESENTATIVE'S and the OWNER'S review.

B. The CONTRACTOR shall meet with the Building Official's and the City staff early to ensure timely building/grading permit issuance for the final design to meet the project final design/permit milestone.

*** END OF SECTION ***

SECTION 01400
QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall produce Work meeting the quality required by the CONTRACT DOCUMENTS and shall perform the quality control efforts necessary to ensure those requirements are met. The RESIDENT ENGINEER's inspection of any Work will not relieve the CONTRACTOR of the primary responsibility for such efforts.

B. Specific quality control requirements for the Work are indicated throughout the Contract Documents. The requirements of this Section are primarily related to performance of the Work beyond furnishing of manufactured products. The term "Quality Control" includes inspection, sampling and testing, and associated requirements.

1.2 PROJECT QUALITY CONTROL PLAN

A. The CONTRACTOR shall submit a Quality Control Plan for review and acceptance as part of the CONTRACT DOCUMENTS. The submittal must be accepted before construction Work begins. The Quality Control Plan will include:

1. A description of the workings and structure of the CONTRACTOR's Quality Control Plan that will be implemented to assure quality Work will be done.

2. A contract specific Inspection Plan that lists and describes the inspections that the CONTRACTOR will conduct, their frequency, acceptance criteria, and who will conduct each inspection. The Inspection Plan shall include the Work to be performed by sub-contractors of the CONTRACTOR's team, fabricators, and suppliers.

3. Identification of the individuals within the CONTRACTOR's organization who are responsible for quality assurance including their role and authority.

B. After completion of the RESIDENT ENGINEER's review of the CONTRACTOR's Quality Control Plan, the CONTRACTOR and RESIDENT ENGINEER will meet to discuss and define quality standards and expectations and to coordinate the RESIDENT ENGINEER's inspection efforts with the CONTRACTOR's planned efforts.

C. The CONTRACTOR will be obligated to accommodate procedural changes to contract required quality control issues requested by the RESIDENT ENGINEER.

1.3 SAMPLING AND TESTING

A. Unless otherwise indicated, all sampling and testing shall be the responsibility of the CONTRACTOR and performed in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and nature of the material, product, or equipment considered. The OWNER reserves the right to use any generally-accepted system of sampling and testing to verify that the quality of the workmanship is in full agreement with the CONTRACT DOCUMENTS.

B. Any waiver by the OWNER of any specific testing or other quality assurance measures, whether or not such waiver is accompanied by a guarantee of substantial performance as a relief from the specified testing or other quality assurance requirements as originally specified, and whether or not such guarantee is accompanied by a performance bond to assure execution of any necessary corrective or remedial work, shall not be construed as a waiver of any requirements of the CONTRACT DOCUMENTS.

1.4 INSPECTION AND TESTING LABORATORY SERVICE

A. The CONTRACTOR will provide and pay for the services of a testing laboratory to perform testing of earth work and concrete at the site, provide special inspection services and perform all other field tests as specified in the CONTRACT DOCUMENTS.

B. The OWNER's testing laboratory will perform other inspections, testings, and other services specified in the Contract Documents, to be performed by the OWNER, or as required by the RESIDENT ENGINEER. The cost of these services will be paid for by the OWNER.

C. Test reports will be submitted by the CONTRACTOR to the RESIDENT ENGINEER in duplicate, indicating observations and results of tests, and indicating compliance or non-compliance with CONTRACT DOCUMENTS.

D. The CONTRACTOR shall cooperate with the RESIDENT ENGINEER and OWNER's testing laboratory by furnishing samples of materials, concrete design mix, equipment, tools, storage and other assistance as requested.

E. The CONTRACTOR shall notify the RESIDENT ENGINEER 48 hours prior to any inspection and laboratory testing services.

F. Retesting required because of non-conformance to specified requirements shall be performed by the same testing laboratory. The CONTRACTOR shall bear all costs from such retesting at no additional cost to the OWNER.

G. For samples and tests required for the CONTRACTOR's use, the CONTRACTOR shall make arrangements with an independent firm for payment and scheduling of testing. The cost of sampling and testing for the CONTRACTOR's use shall be paid by the CONTRACTOR.

1.5 SPECIAL INSPECTION

A. The California Building Code requires that special inspections be performed on certain structural elements of the project. The CONTRACTOR will perform all on-site special inspections required by latest version of the California Building Code. The cost of these services will be paid for by the CONTRACTOR.

PART 2 - PRODUCTS (Not Used)

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Inspection: The CONTRACTOR shall inspect materials or equipment upon arrival on the job site and immediately prior to installation. The CONTRACTOR shall reject damaged and defective items. This inspection shall include a review of Contract requirements; a check to assure that all materials and/or equipment have been tested, submitted, and approved; examination of the work area to ascertain that all preliminary work has been completed; and a physical examination of materials and equipment to assure that they conform to reviewed shop drawings or submittal data. This inspection shall also include instruction as necessary to assure that workmen know the requirements of the Contract as they pertain to the feature, an examination of the quality of workmanship, as well as a review of control testing for compliance with the CONTRACT DOCUMENTS.

B. Measurements: The CONTRACTOR shall verify measurements and dimensions of the Work, as an integral step of starting each installation.

C. Special Procedures: Methods and facilities shall be provided to assure conformance with requirements for special process specifications such as welding, heat treating and nondestructive testing of materials. Certifications for personnel, procedures, and equipment shall be maintained as required to meet the requirement of the Contract Documents and all applicable codes.

D. Manufacturer's Instructions: Where installations include manufactured products, the CONTRACTOR shall comply with manufacturer's applicable instructions and recommendations for installation, to whatever extent these are more explicit or more stringent than applicable requirements indicated in Contract Documents.

3.2 MANUFACTURER'S FIELD INSTALLATION SERVICES AND REPORTS

A. When specified in individual specification sections, the CONTRACTOR shall require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, (test, adjust, and balance of equipment) and to provide instructions when necessary.

B. The CONTRACTOR shall report to the RESIDENT ENGINEER in writing any observations and site decisions or instructions given by the manufacturers' representative to the CONTRACTOR that are supplemental or contrary to manufacturers' written instructions.

C. The CONTRACTOR shall submit manufacturer representative's reports (in duplicate) within 10 days of each field visit, to the RESIDENT ENGINEER for review. If duration of field visit is greater than one week, submit weekly reports. The final report shall certify that equipment or system has been satisfactorily installed and is functioning correctly.

*** END OF SECTION ***

SECTION 01510
TEMPORARY UTILITIES

PART 1 --GENERAL

1.1 GENERAL REQUIREMENTS

A. The CONTRACTOR shall make arrangements with the appropriate utility agencies for temporary connections to the utilities needed to complete the work in accordance with the CONTRACT DOCUMENTS. The CONTRACTOR shall be responsible for extending any utility services to the required point of use and all associated costs.

1.2 WATER SUPPLY

A. General:

1. The CONTRACTOR shall coordinate with the City's Water Department for obtaining a temporary water service connection, and shall allow a three month notice to the Water Department. The CONTRACTOR shall provide all facilities necessary to convey the water from the source to the points of use in accordance with the requirements of the CONTRACT DOCUMENTS.

2. The water capacity charge and the wet tap fees shall be paid by the OWNER, for all permanent facilities. The CONTRACTOR shall pay the fee for the tempoary water meter, water usage, and other miscellaneous charges for water use.

*** END OF SECTION ***

SECTION 01660

FACILITY START-UP AND OPERATOR TRAINING

PART 1 -GENERAL

1.1 START-UP SERVICES

A. General:

1. Start-up is defined as the initial operation of the pump station, and the pumping of potable water.

2. The CONTRACTOR shall be required to start up the facility, under direction of the OWNER, operate it, and pass a 14 -day test prior to Substantial Completion. All equipment must properly run continuously 24 hours per day for the test period at rates indicated by the OWNER'S REPRESENTATIVE. If any item malfunctions during the test, the item shall be repaired and the test restarted at day zero with no credit given for the operating time before the malfunction.

3. The City's Public Utilities Department System Operations Division will operate and maintain the existing pump station until such time as the replacement station has completed continuous fourteen (14) day 24/7 operational performance testing period (substantial completion) and is ready to be placed into full-time service. By that time, the existing pump station will be put on standby and the Water Branch Operations will assume day -to-day operational responsibility of the new station.

4. The purpose of this 14 -day test is to:

   a. Provide the environment by which the OWNER can place equipment and systems into service with assistance from the CONTRACTOR

   b. Expose flaws or defects in workmanship, systems, equipment, or materials, not previously discovered that are the responsibility of the CONTRACTOR to repair, correct, modify, or replace, at the option of the OWNER'S REPRESENTATIVE, prior to Final Acceptance.

1.2 ROLES AND RESPONSIBILITIES DURING START-UP:

A. The CONTRACTOR's responsibilities for the facility start-up period include:

1. Prepare specific start-up plan(s) and specific start-up schedule(s).

2. Schedule and coordinate with the OWNER'S REPRESENTATIVE for start-up of equipment and systems.

3. Review procedures for facility start-up.

4. Review outstanding punch list items with the OWNER'S REPRESENTATIVE 15 days prior to the scheduled start-up; and complete, correct, or resolve at the option of the OWNER'S REPRESENTATIVE, any items which impact or interfere with the facility start-up.

5. Attend meetings related to the review of start-up plan(s).

6. Clarify submittals, testing requirements, schedules, or other items related to the start-up of the equipment and facilities specified and indicated in the Contract Documents.

7. Provide all start-up materials and operating supplies for 30 operating days. Supplies include lubricants and specialized fluids to maintain continuous operation for 30 days.

8. Provide Supplier's authorized representatives as required to supervise placing equipment or systems in operation and provide guidance during the start-up period.

9. Provide to the OWNER'S REPRESENTATIVE a list of 24 hour, "on call" representative supervisory persons who will monitor the facility start-up, and serve as a liaison for the OWNER'S REPRESENTATIVE and the OWNER.

10. Provide the necessary craft or labor assistance full time during the day shift and as required at other times in the event of an emergency requiring immediate attention. An emergency is defined as a failure that precludes the further operation of a critical segment of; or the whole of the WORK. The response time shall be not less than four hours from the time of notification.

11. Correct all failures or equipment problems identified during start-up when notified by the OWNER'S REPRESENTATIVE. Repairs deemed the responsibility of the CONTRACTOR shall be made at no additional cost to the OWNER.

12. Provide training of OWNER'S personnel as specified.

B. The OWNER'S REPRESENTATIVE'S responsibilities for the facility start-up period include the following:

1. Participate in the start-up.

2. Review specific start-up plan(s) and schedule prepared by the CONTRACTOR.

3. Verify the results of performance tests and any retesting.

4. Direct the CONTRACTOR to repair defective workmanship, materials, and equipment.

1.4 INSTRUCTION OF OWNER'S PERSONNEL

A. General

1. In addition to the Vendor Training required in Section 01300, CONTRACTOR Submittals, the CONTRACTOR shall be required to train Water Department Operations staff in the operation and maintenance of project facilities during the 14-day start-up testing period.

*** END OF SECTION ***

SECTION 01680

PHYSICAL CHECKOUT; SHOP, FIELD, AND FUNCTIONAL TESTING

PART 1 -GENERAL

1.1 DESCRIPTION

A. The physical inspection and testing requirements in this Section are in addition to those requirements defined in Division 2 through 16 of the Technical Specifications. This testing shall be performed prior to substantial completion.

B. Provide the following checkout and testing activities:

1. Physical checkout and inspection of equipment and materials to verify conformance of the installed equipment and materials as indicated and as specified.

2. Shop Testing of equipment as specified in Divisions 2 through 16 and as specified herein.

3. Field Testing of equipment as specified in Divisions 2 through 16 and as specified herein.

4. Functional Testing of equipment as specified in Divisions 2 through 16 and as specified herein.

C. Provide a Checkout Plan covering the entire checkout and testing process as specified herein.

1.2 DEFINITIONS:

A. Shop Testing: Defined as testing that is done by the Supplier either at the place of manufacture, the place of assembly, or at another location where the required testing apparatus is located, for the purpose of proving that the Products meet the requirements of the pertinent technical specification(s). The administrative procedures for shop testing are specified in paragraph 1.7 of this Section, while the technical requirements are included in the pertinent technical specification(s). The minimum acceptable test criteria are specified in paragraph 1.5 of this Section.

B. Field Testing: Defined as testing that is performed by the CONTRACTOR, and/or Sub Contractors with Supplier assistance, on Products after they have been installed, and after the performance of physical checkout, for the purpose of proving that the tested Products meet the requirements of the pertinent technical specifications. Field testing is required regardless of whether or not shop testing was performed on the same piece of equipment or material. The administrative requirements for field testing are specified in paragraph 1.8 of this Section, while the technical requirements are contained in the pertinent technical specification(s). The minimum acceptable test criteria are specified in paragraph 1.5 of this Section.

C. Physical Checkout: Defined as the process of physically inspecting Products after they have been installed to determine if the Products have been properly and completely installed, and are ready for Field and for Functional Testing. The requirements for Physical Checkout are contained in the pertinent technical specification(s) (if applicable) and in paragraph 1.9 of this Section.

D. Functional Testing: Defined as testing performed by the CONTRACTOR on a "system" normally comprised of two or more pieces of equipment, after the equipment has been installed, and after Physical Checkout and Field Testing have been completed, for the purpose of proving that the system meets requirements as specified and as indicated. The administrative requirements for Functional Testing are specified in paragraph 1.10of this Section, while the technical requirements are specified in Appendix A of this Section if applicable.

E. The Supplier's Representative or Manufacturer's Representative: Defined as a person, or persons provided by the Supplier, who is qualified by having the training and experience, to provide technical and/or process related advice, and/or assistance, relating to the installation or utilization of the Products provided by that same Supplier.

F. The Testing and Checkout Coordinator: Defined as the person provided by the CONTRACTOR to coordinate and oversee the total spectrum of testing and inspection activities required by the Contract Documents.

1.3 ROLES and RESPONSIBILITIES:

A. The CONTRACTOR shall provide all outside services, materials, labor, supplies, test equipment and other items necessary to perform the testing specified herein. In addition the CONTRACTOR shall arrange for and provide the participation or assistance of survey crews, engineers, quality control technicians, Suppliers' representative(s), and required governmental agency representatives.

B. The CONTRACTOR shall provide the services of the Supplier's representative(s) as follows:

1. Assistance during installation as specified in the specifications in Divisions 2 through16.

2. Shop Testing as specified in the specifications in Divisions 2 through 16, and as specified herein.

3. Field Testing as specified in the specifications in Divisions 2 through 16, and as specified herein.
4. Functional Testing as specified in the specifications in Divisions 2 through 16, and as specified herein.

C. The Supplier's representative activities required by this Section are in addition to the requirements for vendor training and other services specified elsewhere in the Contract Documents. Timing for the performance of these services shall be defined in the Checkout Plan, specified herein.

D. The OWNER'S REPRESENTATIVE will review and comment on the CONTRACTOR's deliverables, participate in the physical inspection activities, witness the shop and field testing, witness functional testing, and provide verification of conformance to the specifications.

1.4 CHECKOUT PLAN

A. The CONTRACTOR shall submit a Checkout Plan based upon the requirements defined herein to the OWNER'S REPRESENTATIVE. Six copies of the preliminary Checkout Plan shall be submitted for review not later than 90 days prior to the proposed date of the first test, whichever occurs first. The plan shall define:

1. The logical and systematic performance of physical inspections, shop, field and functional tests including:

   a. A chronological schedule of all testing and inspection activities.

   b. A checklist of all inspection and testing activities broken down by location, discipline, system, and device or item.

   c. All blank forms proposed by the CONTRACTOR for verification or recording of the shop testing.

   d. An index which cross references the forms to their intended application(s).

   e. A list of all shop tests, and supplier certifications, including those required by the applicable technical specifications. Provisions shall also be included for re- testing, in the event it is required.

2. Participants in the testing.

3. Special test equipment.

4. Sources of the test media (water, power, air.)

5. The proposed method of delivery of the media to the equipment to be tested.

6. Temporary or interim connections for the sequencing of multiple units.

7. Ultimate disposal of the test media.

B. The plan will be reviewed by the OWNER'S REPRESENTATIVE, modified or revised as necessary by the CONTRACTOR, then approved by the OWNER'S REPRESENTATIVE. The CONTRACTOR shall continue to update the Checkout Plan, working in conjunction with the OWNER'S REPRESENTATIVE prior to the start of the

scheduled equipment checkout and functional testing activities. Each specific element of the plan must receive written approval by the OWNER'S REPRESENTATIVE at least two weeks prior to the actual commencement of testing.

C. The CONTRACTOR shall designate, in the Checkout Plan, a Testing and Checkout Coordinator, to coordinate and manage the activities defined in the checkout plan, as approved by the OWNER'S REPRESENTATIVE.

1.5 MINIMUM SHOP AND FIELD TESTING REQUIREMENTS

A. In the event of no reference to procedures are made, or no procedures for shop and field testing are contained in a technical specification for the following test parameters, the following shall be the acceptable checkout requirements. Should these requirements conflict with the Supplier's recommendations or in any way be less stringent than the Supplier's requirements, they shall be superseded by the Supplier's requirements for checkout and testing.

B. Measurement of wearing ring clearances for all pumps requiring assembly, so equipped:

1. Take a minimum of two readings taken opposed to each other by 90".

2. All measured clearances shall be within Supplier's specifications for new installations. Replace and recheck rings found to be out of round or out of specified tolerance.

C. Measurement of Impeller Bore for all pumps requiring assembly:

1. Take a minimum of two readings opposed to each other by 90".

2. All measured clearances shall be within Supplier's specifications for new installations. Replace and recheck impellers found to be out of round or out of specified tolerance.

D. Measurement of shaft run out for all rotating equipment requiring assembly:

1. Remove bearings from the shaft. Support shaft on pedestal rollers or in a lathe.

2. Check each shoulder on the shaft.

3. Take a minimum of two readings for each shoulder, opposed to each other by 90".

4. All measured clearances shall be within Supplier's specifications for new installations. Replace and recheck shafts found to be out of round or out of specified tolerance.

E. Vibration Measurement:

1. Conduct a torsional and vibration analysis of equipment in accordance with the requirements of Section 11000 and of the individual equipment specifications.

F. Coupling/Shaft Alignment:

1. Perform all final alignments and checks with a dial indicator or a laser device. Feeler gauges and straight edges are not acceptable.

2. Eliminate soft foot conditions prior to aligning.

3. When checking for final soft foot, any displacement in excess of 0.002" must be corrected.

4. When checking for pipe strain, any displacement in excess of 0.002" requires piping realignment.

5. Alignments will not be regarded as final until the grout is set and all piping has been attached. Demonstrate that alignment is not changed by attachment of piping.

6. Shim the driving element, never the driven element.

7. Take bracket sag corrections into account when using a dial indicator. Bracket sag shall be determined on a rigid pipe.

8. Mount a dial indicator to the driven element so that it can be rotated. Rotate both elements while aligning.

9. When aligning three coupled elements, align gear reduction elements with the driven element first, then align the driver to the gear reduction element.

10. Check all four alignments; i.e., angular alignment in the vertical and horizontal planes, and parallel alignment in the vertical and horizontal planes.

11. The minimum acceptable alignment accuracy for flexible couplings is +0.005", or the Supplier's specifications, whichever is more stringent.

12. The dial indicator must be perpendicular to the alignment surface.

13. Number hold down nuts prior to tightening. Loosen in reverse order. Tighten in ascending order.

14. Use only clean, deburred shims. Clean the machine base and feet from rust or burrs prior to alignment.

G. Measurement of Noise (dB)

1. Eliminate noise sources generated by adjacent construction activity prior to testing.

2. Establish a background noise level prior to testing.

3. Perform noise level testing on each installed device as required by the technical specifications.

H. Hydrostatic Testing:

1. AWWA C600 standards latest edition are the minimum acceptable standards for all hydrostatic testing.

2. Visually inspect all welds prior to testing, for cracks, undercut on surface greater than 1 /32"deep, lack of fusion on surface, reinforcement greater than Table 127.4.2 located in ANSI B3 1.1 Power Piping, and incomplete penetration (when accessible). Repair or rework as directed by the OWNER'S REPRESENTATIVE.

3. At no time during hydrostatic testing shall any part of the piping system be subjected to a stress greater than 90% of its yield strength at test temperature.

4. After at least 10 minutes of full hydrostatic test pressures, make an examination for leakage of all joints, connections, and all regions of high stress, such as around openings and thickness transition sections.

5. Unless otherwise specified, the minimum required hydrostatic test pressure shall be 1.5 times the design pressure as specified and as indicated.

6. Unless otherwise specified, the minimum pressure holding time shall be 10 minutes plus the time required to inspect for leakage.

7. Maximum pressure shall not exceed the maximum rated pressure for any component in the system being tested.

I. Electrical Equipment

1. The testing standards for electrical components are those contained in the pertinent technical specification(s) and in Appendix A of this Section.

2. Functional and field testing shall follow the Physical Checkout and are contained in the pertinent technical specification(s) and in Appendix A of this Section.

1.6 WITNESSING OF TESTS

A. Unless otherwise noted, provide a minimum of 45 days written notice to the OWNER'S REPRESENTATIVE so that the OWNER'S REPRESENTATIVE, the OWNER, or its representatives may witness the Shop, Field, and Functional tests. The OWNER'S REPRESENTATIVE and the OWNER may witness the performance of any or all tests, at their option. The OWNER'S REPRESENTATIVE'S or OWNER'S witnessing of tests does not relieve the CONTRACTOR of its obligation to comply with the requirements of the Contract Documents.

1.7 SHOP TESTING

A. When required by the Technical Specifications, perform shop testing prior to delivery of the equipment or material. Unless otherwise noted, provide 45 days written notice indicating the time and place of testing. Submit the following for approval thirty days prior to this notice:

1. Description of the test, specifically outlining how tests will conform to the requirements in the Technical Specifications.

2. Testing devices that will be used in the tests. Description must state what portion of the tests that the devices will perform or measure, and device accuracy. Submit sample measurement results and catalog cuts.

3. Personnel used to perform the tests. Resumes, qualifications, and experience shall be submitted.

4. Schedule for testing. Schedule shall include frequency of measurements, personnel present and contingency plans for equipment and/or test failure.

5. Test forms. Submit all forms used to record and report on Shop Test data, for approval prior to the test. Forms shall include description of test, equipment used, personnel present, equipment specification numbers, and measurements made. Forms shall have a place for signature by the chief testing person, and an officer of the company that the tests performed are true, accurate, have met the required criteria, and that the equipment will operate as indicated and as specified.

B. Shop test procedures will be reviewed and returned by the OWNER'S REPRESENTATIVE within 30 days of receipt. Incorporate minor comments on the procedures, equipment, or personnel prior to testing. Major comments by the OWNER'S REPRESENTATIVE will require a resubmittal of the shop test procedure and proposed test date. The CONTRACTOR will be notified, in writing by the OWNER'S REPRESENTATIVE, if a formal resubmittal is required with the transmittal of the review comments.

C. Submit the following within one week after completion of the tests for approval:

1. Completed test forms, for each device tested, on forms as approved prior to the test.

2. Completed certification, the content of which was approved prior to the tests.

3. A written summary of testing, reporting on the results and summarizing the entire procedure.

4. A schedule for retesting, if necessary. Perform any retesting required to fulfill the intent of the Technical Specification test requirements at no additional cost to the OWNER. Additional travel required by the OWNER'S REPRESENTATIVE and the OWNER personnel to witness retesting shall be paid by the CONTRACTOR, at no additional cost to the OWNER. Reimbursement for travel expenses required for retesting will be applied as a debit against the CONTRACTOR's subsequent Application for Payment.

1.8 FIELD TESTING OF EQUIPMENT

A The CONTRACTOR shall provide the services of an experienced and authorized representative of the manufacturer of each item of equipment indicated in the equipment schedules (excluding manually-operated valves smaller than 24-inches in size, injectors, tanks, batch-type disc meters, and rotometers, and any other minor items of equipment specifically exempted in writing by the OWNER'S REPRESENTATIVE), who shall visit the site of the WORK and inspect, check, adjust if necessary, and approve the equipment installation. In each case, the CONTRACTOR shall arrange to have the manufacturer's representative revisit the job site as often as necessary until any and all trouble is corrected and the equipment installation and operation are satisfactory to the OWNER'S REPRESENTATIVE.

B. The CONTRACTOR shall require that each manufacturer's representative furnish to the OWNER'S REPRESENTATIVE a written report addressed to the OWNER certifying that the equipment has been properly installed and lubricated, is in accurate alignment, is free from any undue stress imposed by connecting piping or anchor bolts and has been operated satisfactorily under full-load conditions. The manufacturer's representative shall also provide written authorization that the equipment can be operated.

C. The CONTRACTOR shall be responsible for scheduling all operating testing. The CONTRACTOR is advised that the OWNER'S REPRESENTATIVE and the OWNER's operating personnel will witness operations testing and that the manufacturer's representative shall be required to instruct the OWNER's operating personnel in correct operation and maintenance procedures. Such instruction shall be scheduled at a time arranged with the OWNER at least 2 weeks in advance and shall be provided while the respective manufacturer's equipment is fully operational. On-site instruction shall be given by qualified persons who have been made familiar in advance with the equipment and systems in the plant. Prior to scheduling any operations testing, the CONTRACTOR shall have previously furnished the OWNER's Manuals required under Section 01300.

D. Prior to field-testing of the equipment, the CONTRACTOR shall make all supporting systems operational.

E. The CONTRACTOR shall furnish all personnel, power, water, chemicals, fuel, oil, grease, and all other necessary equipment, facilities, and services required for conducting the tests.

F. Field testing shall be in addition to, and not in lieu of, shop testing. Perform field testing as a part of the overall physical and functional testing process defined herein and in accordance with the approved Checkout Plan. However, the following specific instructions shall also apply. The CONTRACTOR shall provide ninety days written notice indicating the date and time for testing each piece of equipment, or a series of equipment pieces. The CONTRACTOR shall submit with this notice, the following for approval by the OWNER'S REPRESENTATIVE:

1. Description of the tests, specifically outlining how the test will conform to the requirements in the Technical Specifications.

2. Testing devices that will be used in the tests. Description shall state what portion of the tests that the devices will perform or measure, and device accuracy. Submit sample measurement results and catalog cuts.

3. Personnel used to perform the tests. Submit resumes, qualifications, and experience.

4. Schedule of Testing. Schedule shall include frequency of measurements, personnel present and contingency plans for equipment and /or test failure.

5. Test forms. Review and comment on all forms provided by the OWNER'S REPRESENTATIVE for recording and reporting on the Field Test data, prior to the test.

6. Material and equipment required for the test. This material and equipment shall be supplied at no additional cost to the OWNER.

7. Water and Power requirements. Water and power requirements shall be identified in the plan by the CONTRACTOR and will be supplied by the CONTRACTOR for field testing purposes only. The CONTRACTOR shall provide all temporary piping and wiring required for field testing; and equipment and labor for the reuse of the test water.

8. Operational requirements. Include valve positions, set-ups, and gate positions, including temporary arrangements that are required to run the tests so that the OWNER'S REPRESENTATIVE can anticipate and plan for the testing situation.

G. Field test procedures will be reviewed and returned by the OWNER'S REPRESENTATIVE within 30 days of receipt. Incorporate minor comments on the procedures, equipment, or personnel prior to testing. Major comments by the OWNER'S REPRESENTATIVE will require a resubmission of the field test procedure and proposed test date. The CONTRACTOR will be notified, in writing, by the OWNER'S REPRESENTATIVE if a formal resubmission is required with the transmittal of the review comments.

H. Provide seven days written notice to the OWNER'S REPRESENTATIVE prior to the actual start of any testing. This will include a statement by the CONTRACTOR that the equipment and facilities to be tested have been thoroughly inspected and cleaned of construction debris or other extraneous materials and all lubrication, materials, and preparations are completed.

I. Submit within one week after completion of the tests, the following to the OWNER'S REPRESENTATIVE for approval:

1. Completed test forms, for each device tested, on forms provided prior to the tests.

2. Completed certification documentation, the content of which was approved prior to the tests.

3. A written summary of testing, reporting on the results and summarizing t he entire procedure.

4. A schedule for retesting, if necessary. Perform any retesting required to fulfill the intent of the technical specification test requirements at no additional cost to the OWNER.

1.9 PHYSICAL CHECKOUT AND INSPECTIONS

A. Physical Checkout and inspections provide verification of conformance to the requirements of the Technical Specifications and Contract Drawings for physical presence; dimensions; and location, for proper materials, parts, and items; and for integrity of materials, equipment and systems to determine their condition and readiness for field and for functional testing. Inspection includes the following elements, as applicable

1. Exterior areas for backfill, grading, surfacing, drainage, landscaping, roadways, fencing, gates, and signage.

2. Building structural integrity, masonry, architectural, mechanical systems, electrical/lighting, communications, and HVAC systems.

3. Concrete structures for structural integrity, finish, tolerance, durability, appearance, embedded and inserted items, painting and surface applications.

4. Steel structures for member alignment, connection bolts torque, connection welds integrity, painting, fire proofing and surface applications.

5. Mechanical systems and items for installation, alignment and securing, adjustments of packing and seals, lubrication, drive connection and alignment, motor rotation, belt/chain tension, painting or surface applications, and tagging for identification.

6. Piping systems for material, size, components, direction, alignment of joints and bolting/welding, valves, packing and seals, screens, filters and strainers, painting, identification labeling and color coding, hangers, anchors, supports, and expansion provisions.

7. Electrical and control/instrumentation systems for conduit and tray installation, wire/cable material and size, circuit identification, terminal installation and identification, major switches, circuit breakers and components, and labeling for system identification.

8. Communication systems including telephone, fire/smoke alarm, security, page/party, and closed circuit TV; similar to electrical above.

9. Computer systems by station, function, and network interface.

B. Inspection will verify that tanks, pipes, conduits, vessels, equipment, systems, buildings, areas and other items provided under the Contract are clean and free from debris or materials which will interfere with subsequent testing requirements or routine operations. Correct unsatisfactory conditions prior to testing or acceptance.

C. Upon completion of the inspection, submit to the OWNER'S REPRESENTATIVE six copies of each completed inspection form, signed by an authorized representative of the CONTRACTOR who participated in the inspection. The OWNER'S REPRESENTATIVE will review and approve the contents of the forms. Should a re-inspection be required, it shall be performed at no additional cost to the OWNER.

1.10 FUNCTIONAL TESTING

A. Specific functional tests shall be performed in addition to the requirement for shop, field, and other tests called for in the Technical Specifications.

B. Provide 30 days written notice indicating the date and time during which the specific functional test is proposed. Submit with this notice, the following to the OWNER'S REPRESENTATIVE for approval:

1. Changes to the test procedures (if any) outlined in Appendix A to this Section.

2. Testing devices that will be used in the tests: Description must state what portion of the tests that the devices will perform or measure, and device accuracy. Submit sample measurement results and catalog cuts.

3. Personnel used to perform the tests: Submit resumes, and qualifications.

4. Schedule for Testing: Schedule shall include frequency of measurements, personnel present, and contingency plan s for equipment and or system test failure.

5. Test forms: Provide test forms for recording and reporting on the test data.

6. Provide material and equipment required for the test.

7. Water and Power requirements: Water and power will be supplied by the CONTRACTOR for functional testing purposes.

8. Operational requirements: Include valve positions, set-ups, and gate positions that are required to run the tests in the written request so that the CM can anticipate and plan for the testing. Provide all temporary piping, connections or other temporary requirements related to performance of the functional tests.

C. The OWNER'S REPRESENTATIVE and the OWNER may witness the performance of these tests, at their option.

D. Approval of the functional test package by the OWNER'S REPRESENTATIVE will be made within two weeks of the test date. Incorporate minor comments on the procedures, equipment, and personnel prior to testing. Major comments by the OWNER'S REPRESENTATIVE will require a resubmission of the functional test package and test date.

E. Provide seven (7) days written notice to the OWNER'S REPRESENTATIVE prior to the actual start of any testing. This will include a statement by the CONTRACTOR that the equipment and facilities to be tested have been thoroughly inspected and cleaned of construction debris or other extraneous materials and all lubrication, materials, and preparations are completed.

F. Submit within one week after completion of the tests, the following to the OWNER'S REPRESENTATIVE for approval:

1. Completed test form, for each device, or system tested, on forms approved prior to the test.

2. Completed certification, the content of which was approved prior to the tests.

3. A written summary of testing, reporting on the results and summarizing the entire procedure.

4. A schedule for retesting, if necessary, including changes to procedures, testing devices, or personnel. Any retesting required to fulfill the intent of the test requirements outlined in Appendix A of this Section, due to negligence, poor workmanship, or Products that fail to meet the Contract requirements, shall be at no additional cost to the OWNER.

5. Provide operational and pump efficiency test prior to final pump station acceptance. The CONTRACTOR shall subcontract with Pump Check or other qualified vendor for this service. Submit system head curves following the pump test.

1.11 CORRECTIONS TO THE WORK

A. Correct any items of work failing to meet the specified requirements, at no additional cost to the OWNER. Correct the nonconforming items by re-work, modification, or replacement, to the option of the OWNER'S REPRESENTATIVE. This includes the provision of all required labor, materials, and requirements for retesting as specified herein, to verify that the items conform with Contract Documents.

*** END OF SECTION ***

SECTION 01680 - APPENDIX A

FUNCTIONAL TESTING

Functional testing shall be conducted on the following systems:

1. To be completed by the CONTRACTOR and report submitted for approval by the Owner as part of the CONSTRUCTION DOCUMENTS. At a minimum, the functional testing plan shall cover all components of the pump station and demonstrated satisfactory operation over the full operating range of all systems.

SECTION 01700

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall coordinate and meet procedural requirements for contract closeout including the following activities:

1. Preliminary Substantial Completion Procedures.

2. Preliminary Substantial Completion Inspection.

3. Substantial Completion Inspection.

4. Re-inspection Procedures.

5. Partial Utilization.

6. Final Acceptance.

7. Final Cleaning.

B. Specific project closeout requirements, identified in the appropriate Sections of Division 1 through Division 16 in the CONTRACT DOCUMENTS, shall also be satisfied for project closeout.

1.2 RELATED SECTIONS

A. The work of the following Sections applies to the Work of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 01660 - Systems Start-Up and Testing

2. Spare Parts and Maintenance Materials

1.3 PRELIMINARY SUBSTANTIAL COMPLETION PROCEDURES

A. Before requesting inspection for certification of Substantial Completion, complete the following:

1. Submit an Application for Payment that coincides with, or first follows, date Substantial Completion is claimed, show 100 percent completion for portion of Work claimed as substantially complete.

a. Include supporting documentation for completion as indicated in Contract Documents.

b. If 100 percent completion cannot be shown, include a list of incomplete items, value of incomplete construction, and reasons Work is not complete.

2. Advise the OWNER of pending insurance changeover requirements.

3. Submit Affidavit of Disposal, warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.

4. Obtain and submit releases enabling OWNER unrestricted use of Work and access to services and utilities. Including occupancy permits, operating certificates, and similar releases.

5. Submit Record Documents, O&M Information, final project photographs, damage or settlement surveys, property surveys, and similar final record information.

6. Deliver tools, spare parts, extra stock, and similar items as directed by the RESIDENT ENGINEER.

7. Make final changeover of permanent locks and transmit keys to RESIDENT ENGINEER. Advise OWNER's personnel of changeover in security provisions.

8. Complete operational systems testing.

9. Complete Final Cleaning.

10. Touch up paint and otherwise repair and restore marred, exposed finishes.

11. Complete equipment and systems operational training.

1.4 PRELIMINARY SUBSTANTIAL COMPLETION INSPECTION

A. Participate in a Preliminary Substantial Completion inspection with the RESIDENT ENGINEER.

B. The purpose of the preliminary substantial completion inspection is to jointly develop a list of Incomplete Work Items that would preclude issuing a substantial completion certificate.

1.5 SUBSTANTIAL COMPLETION INSPECTION

A. After requesting issuance of a Substantial Completion Certificate or certification of Substantial Completion for Partial Utilization, participate in a Substantial Completion Inspection.

B. The purpose of the Substantial Completion Inspections is to review the list of Incomplete Work Items and develop the final Punch list.

1.6 REINSPECTION PROCEDURES

A. The RESIDENT ENGINEER will re-inspect the Work to verify that the items identified on the Incomplete Work list and Punch list have been completed.

B. Re-inspections will be scheduled upon receipt of notice that Work from the respective inspection lists has been completed.

C. The CONTRACTOR shall pay all costs associated with repetitive re-inspections (more than 2 re-inspections) of the same inspection list items.

1.7 PARTIAL UTILIZATION

A. Partial utilization of systems and/or equipment may be required when incremental acceptance of portions of the Work is required due to construction sequencing issues.

B. Partial utilization shall include:

1. All aspects of that portion of the Work as defined by the OWNER.

2. The requirements of this Section.

C. Partial Utilization shall be as approved by the OWNER.

1.8 FINAL ACCEPTANCE

A. Complete the following for Final Acceptance:

1. Participate in a Final Acceptance Inspection to verify that all final Punch list items have been completed.

2. Submit final payment request with releases and supporting documentation not previously submitted and accepted. Include insurance certificates for products and completed operations where required.

3. Submit a certified copy of the Final Inspection Punch list. The certified copy shall state that each item has been completed or otherwise resolved for acceptance and shall be endorsed and dated by the RESIDENT ENGINEER.

4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when OWNER took possession of and assumed responsibility for corresponding elements of Work.

5. Submit a final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Provide final cleaning of equipment, facilities, and all Work prior to requesting Preliminary Substantial Completion Inspection. Comply with manufacturers instructions for cleaning of equipment and systems.

B. Employ experienced workers or professional cleaners for final cleaning. Final cleaning shall be all inclusive the following is a representative list of cleaning activities:

1. Clean markings from interior and exterior of equipment, MCCs, panels, and other components.

2. Vacuum interiors of electrical and control panels, terminal boxes, MCCs, and other components.

3. Remove non-permanent labels, tapes, and adhesives.

4. Wipe surfaces of piping, mechanical and electrical equipment. Remove excess lubrication and other substances.

5. Clean light fixtures and lamps.

6. Clean the site of rubbish, litter, and other foreign substances.

7. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted to a smooth, even-textured surface.

8. Remove construction related tools, equipment, and supplies from the area.

9. Supervise workers when cleaning on or around electrical equipment using hoses or other high-pressure cleaning equipment.

C. Remove temporary protection installed for protection of Work during construction.

D. Remove temporary installations installed to facilitate Work during construction.

E. Comply with regulations of authorities having jurisdiction and safety standards for cleaning.

1. Do not burn waste materials.

2. Do not bury debris or excess materials on Owner's property.

3. Do not discharge volatile, harmful, or dangerous materials into drainage systems.

4. Remove waste materials from site and dispose of lawfully.

F. Where extra materials of value remain after completion of associated Work, they become OWNER's property. Relocate these materials to an on-site location as directed by OWNER.

G. Maintain cleaning until final acceptance.

*** END OF SECTION ***

SECTION 01730

OPERATION AND MAINTENANCE INFORMATION

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. CONTRACTOR shall provide operation and maintenance data and information in the form of instructional material for use by the OWNER's personnel for:

1. All equipment and systems
2. All valves, gates and related accessories
3. All instruments and control devices
4. All electrical gear

B. Training or start-up on any system or piece of equipment shall not be allowed until the CONTRACTOR's submittal of Operation and Maintenance Information has been incorporated into project O & M Manuals, the CONTRACTOR's Lesson Training Plans are approved by the RESIDENT ENGINEER, and the approved Operation and Maintenance Manuals have been turned over to the OWNER.

C. Definitions:

1. Operation and Maintenance Information:

a. The term "operation and maintenance information" includes all product-related information and documents which are required for preparation of the pump station operation and maintenance manual. It also includes all data which shall accompany said manual as directed by current regulations of any participating government agency.

b. Required operation and maintenance data include, but are not limited to, the following:

(1) Equipment Summary. The CONTRACTOR completes an Equipment Record Form provided by the RESIDENT ENGINEER (see Attachment 1) for each item of mechanical, electrical and instrumentation equipment installed at the facility.

(2) Mechanical Operational Procedures. The CONTRACTOR describes mechanical operational procedures for all installed equipment, as appropriate, including installation instructions, adjustment, startup, operation, load changes, calibration, shutdown, troubleshooting, disassembly, reassembly, realignment and testing.

(3) Preventive Maintenance Procedures and Schedules. The CONTRACTOR provides preventive maintenance procedures and schedules for all installed equipment, including periodic inspection, lubrication and calibration. Such procedures and schedules detail maintenance that can be performed on installed equipment, including its removal and replacement, and repairs that can be performed with the equipment in place.

Equipment Record Form

Project Name		Page _____ of _____
Equipment Description	Date Installed	Date Started
Equipment Location Tag No.	Cost	Estimated life
	Shop Drawing Transmittal No.	Specification Section
Equip. Manufacturer	Old Equip. No.	
Manufacturer Address		Phone
Local Vendor		Phone
Vendor Address		Phone

Break-In Maintenance Requirements (initial oil change, etc.)	D	W	M	Q	S	A	Hr

Preventive Maintenance Requirements	D	W	M	Q	S	A	Hr

Recommended Spare Parts

Part No.	Part Name	Quantity

Equipment Record Form *(continued)*

Lubrication Summary					
Description		Tag No.		Page _____ of _____	
Lubrication Point					
	Manufacturer	Product	AGMAS	SAE	ISO
TYPE 1					
TYPE 2					
TYPE 3					
TYPE 4					
TYPE 5					
Lubrication Point					
	Manufacturer	Product	AGMAS	SAE	ISO
TYPE 1					
TYPE 2					
TYPE 3					
TYPE 4					
TYPE 5					
Lubrication Point					
	Manufacturer	Product	AGMAS	SAE	ISO
TYPE 1					
TYPE 2					
TYPE 3					
TYPE 4					
TYPE 5					
Safety Hazards					
Special instructions or warnings associated with this equipment:					

Form No. _____

Page 2 of 2

(4) Parts List. The CONTRACTOR provides a complete parts list for all installed equipment, including a list of recommended spare parts for two years of continuous operation, a generic description and identification number for each part, addresses and telephone numbers of vendors from whom parts can be purchased, and cross-sectional or assembly-type drawings. Any instructions, parts lists or other items packed with or attached to the equipment when delivered are also provided.

(5) Wiring Diagrams. The CONTRACTOR provides complete internal and connection wiring diagrams for each installed component, if applicable.

(6) Machine Shop Fabrication Drawings. The CONTRACTOR provides approved machine shop fabrication drawings, complete with dimensions, for all installed component.

(7) Safety. The CONTRACTOR provides safety instructions and precautions to be taken when working on all installed equipment items.

(8) Documentation. The CONTRACTOR *provides all warranties, affidavits and certifications required for all installed equipment items.*

D. Submittals:

1. General: Submit operations and maintenance information to the RESIDENT ENGINEER within ninety (90) days after approval of Shop Drawings, unless noted otherwise.

2. Number of Copies: ten (10) of each item.

3. Letter of Transmittal: Provide a letter of transmittal with each submittal and include the following in the letter:

   a. Date of submittal

   b. Contract title and number

   c. CONTRACTOR's name and address

   d. A list of the attachments and the Specification Sections to which they relate

   e. Reference to or explanation of related submittals already made or to be made at a future date

4. Format Requirements:

   a. Use 8-1/2-inch by 11-inch paper of high rag content and quality. Larger drawings or illustrations are acceptable if neatly folded to the specified size in a manner which will permit easy unfolding without removal from the binder. Provide reinforced punched binder tab. Or provide fly-leaf for each product.

   b. All text must be legible, typewritten or machine printed originals or high quality copies of same.

c. Each page shall have a binding margin of approximately 1-1/2 inches and be punched for placement into a three-ring, loose-leaf binder. Provide binders. Identify each binder with the following:

(1) Title "OPERATING AND MAINTENANCE INSTRUCTIONS"

(2) Title of Project.

(3) Identity of building or structure as applicable.

(4) Identity *of general subject matter covered.*

d. Use dividers and indexed tabs between major categories of information such as operating instructions, preventive maintenance instructions, or other. When necessary, place each major category in a separate binder.

e. Provide a table of contents for each binder.

f. Identify products by their functional names in the table of contents and at least once in each chapter or Section. Thereafter, abbreviations and acronyms may be used if their meaning is explained in a table in the back of each binder. Use of model or catalog numbers or letters for identification is not acceptable.

g. Indicate all components of the equipment on catalog pages by highlighting or some other clearly definable medium for ease of identification.

1.2 RELATED SECTIONS

A. The Work of the following Sections apply to the Work of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 01300 Submittals

2. Section 01700 Contract Closeout

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

*** END OF SECTION ***

SECTION 01750

SPARE PARTS AND MAINTENANCE MATERIALS

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. Ninety (90) days after approval of the Shop Drawings of the equipment specified in the individual Sections, the CONTRACTOR shall furnish spare parts data and maintenance material for equipment. The data shall include a complete list of parts and supplies, with current unit prices and source or sources of supply.

B. Spare parts and materials required to be supplied in the Contract Documents shall be furnished in manufacturer's unopened cartons, boxes, crates or other protective covering suitable for preventing corrosion or deterioration for the maximum length of storage which may be normally anticipated. They shall be clearly marked and identified as to the name of manufacturer or supplier, applicable equipment, part number, description and location in the equipment. All parts shall be protected and packaged for a shelf life of at least ten (10) years.

C. During construction, store spare parts in buildings or trailers with floor, roof and closed sides and in accordance with manufacturer's recommendations. Protect from weather, condensation and humidity.

D. Parts and materials shall be delivered to the OWNER upon Substantial Completion of the Work or before start-up. CONTRACTOR shall then place them in permanent storage rooms or areas approved by the OWNER. The turnover procedures shall be developed by the RESIDENT ENGINEER.

E. Provide a letter of transmittal and spare parts receiver form including the following:

1. Date of letter and transfer of parts and material.

2. Contract title and number.

3. CONTRACTOR's name and address.

4. Transmittal should lists applicable specification sections for each set of spare parts supplied.

5. Spare Parts Receiver Form.

F. CONTRACTOR shall be fully responsible for loss or damage to parts and materials until they are transmitted to the OWNER.

1.2 RELATED SECTIONS

A. The work of the following Sections applies to the Work of this Section. Work of other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 01300 Submittals
2. Section 01700 Contract Closeout

PART 2 - PRODUCTS (Not Used)

PART 3 -EXECUTION (Not Used)

Spare Part Receiver
Project: Tierrasanta Pump Station
Specification Section 01750

Manufacturer: _____

Item Description: _____

Cost: _____

Manufacturer Part Number: _____

Supplier: _____

Cross Reference Number: _____

Vendor Information: _____

Vendor Order Part Number: _____

Part to be used on what equipment: _____

_____

Equipment Number: _____

Specification Section: _____

CITY PERSONNEL FILL IN:

Bin Number: _____

Aims Number: _____

Location in Stores: _____

Received By: _____

*** END OF SECTION ***

SECTION 02050

DEMOLITION

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall furnish all materials, equipment and labor necessary to perform and complete demolition of the existing Temporary Tierrasanta Pump Station as shown on Sheet C-01 and described below.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 01700 .Contract Closeout
2. Section 02200 Earthwork

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. The WORK of this Section shall comply with the current edition of the Uniform Building Code as adopted by the City of San Diego.

B. Except as otherwise indicated in this Section, the CONTRACTOR shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC), together with the latest adopted edition of the Regional and City of San Diego Supplement Amendments.

1.4 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall submit a demolition schedule in compliance with Section 01300 - Submittals. The demolition schedule shall provide a complete coordination schedule for demolition work including shut-off and continuation of utility services before the start of the demolition. The schedule shall indicate proposed methods and operations of facility demolition, and provide a detailed sequence of demolition and removal work to ensure uninterrupted operation of occupied areas.

B. Before completion of the Work, the CONTRACTOR shall submit an Affidavit of Legal Disposal attesting to the lawful disposal of all demolished materials.

PART 2 -- PRODUCTS (Not Used)

PART 3 -- EXECUTION

3.1 GENERAL

A. Demolition of the Temporary Tierrasanta Pump Station and Modification of the existing Via Dominique Pump Station shall be sequenced to be performed after the new dual zone pumping station is placed in service. All interconnections to existing zone piping and other operations shall be performed in a manner to maintain water service to the extent possible, and to minimize downtime, with the precise time window to be coordinated with the City, which could require night work. Only City Forces shall operate system valves and existing pumping stations.

B. Structures shall be demolished and removed in compliance with SSPWC subsection 306-5 and the requirements indicated herein.

3.2 POLLUTION CONTROL

B. Water sprinkling, temporary enclosures, chutes, and other suitable methods shall be used for dust suppression in compliance with SSPWC Section 7.

C. Water shall not be used when it creates hazardous or objectionable conditions such as flooding, erosion, sedimentation, or pollution.

3.3 PROTECTION

A. Safe passage of persons around the area of demolition shall be provided. Operations shall be conducted to prevent injury to people and damage to adjacent buildings, structures, and other facilities in compliance with SSPWC Section 7.

B. Interior and exterior shoring, bracing, or supports shall be provided to prevent movement, settlement or collapse of structures to be demolished.

C. Existing landscaping materials, structures, and appurtenances which are not to be demolished shall be protected and maintained as necessary and in accordance with SSPWC Section 7.

D. Unless otherwise indicated, the CONTRACTOR shall protect and maintain all utilities in the proximity of the facilities to be demolished.

E. The CONTRACTOR shall protect nearby existing equipment from dust caused by demolition activities by covering, drop-curtains and other similar methods.

3.4 REMOVAL AND/OR ABANDONMENT OF EXISTING WATER FACILITIES

A. Any existing gate valve to be removed shall be removed entirely, together with the valve box and cover. Any gate valve to be abandoned shall be abandoned in place by removing the box cover, filling the valve box with sand, and patching the pavement.

B. In general, existing water mains shall be removed if the alignment of the existing main is within the trench excavation of the new water main or is not more than 1 foot outside of the

trench for the new main. Where portions of the old water main and/or services are abandoned and left in place, the exposed ends of the abandoned main and services shall be tightly plugged with concrete.

C. All salvaged material from abandoned water mains and appurtenances, except fire hydrant bodies, shall become the property.of the CONTRACTOR upon removal from the trench unless otherwise shown on the Drawings. Such material shall not be allowed to accumulate along the line of the Work, but shall be removed from the area at the earliest practical time. Fire hydrant bodies shall be left at the job site and will be picked up by the OWNER.

D. Payment for removing and/or abandonment of existing water facilities shall be included in the Bid amount and no separate payment will be allowed.

3.5 STRUCTURE DEMOLITION

A. Building structures and appurtenances shall be demolished, as shown and required to complete work, in compliance with governing regulations.

B. Small structures may be removed intact when approved by the utility or authorities having jurisdiction.

C. Demolition shall proceed in a systematic manner, from top of structure to ground.

D. Concrete and masonry shall be demolished into small sections. The CONTRACTOR shall use bracing and shoring to prevent collapse of structures.

E. Demolition equipment shall be dispersed throughout structure and demolished materials removed to prevent excessive loads on supporting walls, floors or framing.

3.6 BELOW-GRADE DEMOLITION

A. Demolition of below grade areas shall be done as noted in the Contract Drawings.

B. Below-grade areas and voids resulting from demolition of structures shall be completely filled to a minimum compaction of 95%.

C. All fill and compaction shall be in accordance with Section 02200 - Earthwork.

D. After fill and compaction, surfaces shall be graded to meet adjacent contours and to provide flow to surface drainage structures, or as indicated.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Demolition and removal of debris shall be conducted to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities which shall not be closed or obstructed without permission from the OWNER. Alternate routes shall be provided around closed or obstructed traffic ways.

B. Site debris, rubbish, and other materials resulting from demolition operations shall be removed and disposed of in compliance with all laws and regulations. Burning of removed materials from demolished structures will not be permitted.

3.8 PATCHING AND REPAIRING

A. The CONTRACTOR shall provide patching, replacing, repairing, and refinishing of damaged areas involved in demolition as necessary to match the existing adjacent surfaces.

B. The CONTRACTOR shall repair all damages caused to adjacent facilities by demolition at no additional cost to the OWNER.

C. After patching and repairing has been completed, the CONTRACTOR shall carefully remove splatterings of mortar from adjoining work (plumbing fixtures, trim, tile, and finished metal surfaces) and repair any damage caused by such cleaning operations.

3.9 CLEANING

A. During and upon completion of Work, the CONTRACTOR shall promptly remove unused tools and equipment, surplus materials, rubbish, debris, and dust and shall leave areas affected by the Work in a clean condition in accordance with Section 01700 - Contract Closeout.

*** END OF SECTION ***

SECTION 02100

SITE PREPARATION

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall furnish all materials, equipment, and labor necessary to prepare the site including clearing, grubbing and stripping.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 02050 Demolition
2. Section 02200 Earthwork

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated in this Section, the CONTRACTOR shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC) together with the latest adopted editions of the Regional and City of San Diego Supplement Amendments.

1.4 DEFINITIONS

A. The following definitions apply to the Work of this Section:

1. Clearing is defined as cutting trees, removing fences and posts, removing curbs and other improvements to prepare the site for grubbing and stripping.

2. Grubbing is defined as the below grade part of clearing to remove roots, small piping, irrigation systems, etc., to prepare the site for stripping.

3. Stripping is defined as removing a surface layer of soil and organic material, sod, top-soil, and other unsuitable material as defined in Section 02200 - Earthwork, to a depth that earthwork can proceed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL

A. Existing Conditions: The site shall be examined and the RESIDENT ENGINEER notified of any conditions which affect the Work of this Section.

B. Utility Interference: Where existing utilities interfere with the Work of this Section, the RESIDENT ENGINEER shall be notified of interferences, and notifications to the relevant departments and utilities shall be provided in accordance with SSPWC Section 7.

3.2 CLEARING, GRUBBING AND STRIPPING

A. Clearing, grubbing and stripping shall comply with the requirements of SSPWC Subsection 300-1 and the following:

1. All construction areas shall be cleared of grass and weeds to at least a depth of 6 inches and cleared of structures, concrete or masonry debris, trees, logs, upturned stumps, loose boulders, and any other objectionable material of any kind which would interfere with the performance or completion of the Work, create a hazard to safety, or impair the Work's subsequent usefulness or obstruct its operation. Loose boulders within 10 feet of the top of cut lines shall be incorporated in landscaping or removed from the site. Trees and other natural vegetation outside the actual lines of construction shall be protected from damage during construction, as directed by the RESIDENT ENGINEER.

2. Within the limits of clearing, the areas below the natural ground surface shall be grubbed to a depth necessary to remove all stumps, roots, buried logs, and all other objectionable material. Septic tanks, drain fields, and connection lines and any other underground structures, debris or waste shall be totally removed if they are found on the site.

3. The entire area to be affected by construction shall be stripped of top soil to a depth to be determined by the RESIDENT ENGINEER during construction as successive 6-inch layers are removed to expose the underlying material. If the exposed material contains organic or other material not suitable for use as part of the earthwork in accordance with Section 02200 - Earthwork, additional layers of material shall be removed, down to as much as 2.5 feet below the existing ground contours, until all the topsoil is removed. The stripped materials shall be stockpiled and incorporated into landscaped areas or other nonstructural embankments.

4. Unless otherwise indicated, native trees larger than 3 inches in diameter at the base shall not be removed without the RESIDENT ENGINEER's approval. The removal of any trees, shrubs, fences, or other improvements outside of rights-of-way as deemed necessary, shall be arranged with the property owner and be removed and replaced at no increased cost to the OWNER.

5. Except in areas to be excavated, stump holes and other holes resulting from the Work shall be backfilled with suitable material in accordance with Section 02200 - Earthwork.

6. Removal and disposal of all waste materials shall be as indicated in SSPWC Subsection 300-1.3. Unless otherwise indicated, all merchantable timber shall become the property of the CONTRACTOR.

7. Low hanging branches and unsound or unsightly branches on trees or shrubs designated to remain, shall be removed as directed, but only after the RESIDENT ENGINEER has visited the site and provided written instructions.

8. Project site maintenance shall conform to SSPWC Subsection 7-8.

*** END OF SECTION ***

SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals required to perform all excavating, backfilling, compaction, filling and grading, and disposing of earth materials for construction of structures, , vaults, conduits, pipelines, paved areas, and other facilities required to complete the work in every aspect.

2. All necessary preparation of subgrade for slabs, footings, foundations and pavements is included.

3. All temporary means needed to prevent discharge of sediment to water courses from dewatering systems or erosion are included.

4. No classification of excavated materials is made. Excavation shall include all materials regardless of type, character, composition, moisture, or condition thereof.

5. CONTRACTOR shall provide all labor, materials, equipment, incidentals, and temporary power necessary to dewater all excavations, including trenches, augered holes, pits, etc. during excavation, construction, and backfilling operations.

B. Coordination:

1. Review installation procedures under other Sections of these specifications and coordinate the installation of items that must be installed with the excavation and backfill.

2. The CONTRACTOR, subcontractors, suppliers, and/or manufacturers furnishing and/or installing equipment, labor, materials, services and/or specialties required under this Division shall be required to review and satisfy all relevant requirements of other sections of the Contract Documents and the requirements of the Contract Drawings. The CONTRACTOR, manufacturer, supplier, fabricator and/or subcontractors furnishing and/or installing equipment, services and/or specialties associated with this Section shall fully coordinate their efforts to avoid potential claims that are based on failure to review relevant Contract Documents, including the Contract Drawings.

C. Related Sections Specified Elsewhere (To be developed and/or modified by CONTRACTOR):

1. Section 01300, Submittals.
2. Section 01400, Quality Control.
3. Section 02050, Demolitions.
4. Division 15, Mechanical.
5. Division 16, Electrical.

1.2 QUALITY ASSURANCE

A. Tests:

1. The OWNER will provide the services of a qualified testing laboratory to perform tests and determine acceptability of the fill or material as listed below. Laboratory shall be acceptable to and approved by ENGINEER.

2. Required Tests:

a. Select Fill Samples: Gradation, ASTM D 422.
b. Compacted Select Fill, Backfill and Fill: Compaction, ASTM D 1556, ASTM D 1557, ASTM D 2922 and ASTM 3017.
c. UBC Standard No. 29-2, Expansion Index Test.

3. The CONTRACTOR shall cooperate with laboratory personnel and provide access to the work as necessary to perform the testing work.

B. Permits and Regulations:

1. Obtain all necessary permits for work in roads, rights-of-way, railroads, etc. Also obtain permits as required by local, state and federal agencies for discharging water from excavations.

2. Perform all excavation in compliance with State of California Code Regulations Title 8, Industrial Relations Construction Safety Orders, Cal OSHA Article 6, Sections 1539 thru 1547, Appendix A thru F and Labor Code of the State of California, Section 6705 and Article I, Section 1503 of Cal OSHA.

3. CONTRACTOR is required to conform to all legal requirements as outlined in Cal OSHA California Trenching and Shoring Manual@ and Cal OSHA DOHS Construction Safety Orders.

4. CONTRACTOR is required to obtain and keep current an annual Trench/Excavation Permit from the State of California, Department of Industrial Relations, Division of Occupational Safety and Health. This annual permit issued is subject to the requirement that the CONTRACTOR submit Job Notification Form Cal OSHA S-691 describing the new project preferably at least one week in advance of start-up work. CONTRACTOR shall post the annual Trench/Excavation Permit on Site.

5. CONTRACTOR shall notify DOSH with form Cal OSHA S-691 at the commencement of any new trenching/excavation project.

C. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified.

1. ASTM A 36, Specification for Structural Steel.

2. ASTM A 328, Specification for Steel Sheet Piling.

3. ASTM C 136, Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates.

4. ASTM D 422, Method for Particle-Size Analysis of Soils.

5. ASTM D 1556, Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

6. ASTM D 1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft 16/cu ft) (2,700 KN-m/cum).

7. ASTM D 2922, Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

8. ASTM D 3017, Test Method for Water Contact of Soil and Rock in place by nuclear methods (shallow depth).

9. AISC Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings.

10. OSHA Standard, Title 29, Code of Federal Regulations, Part 1926, Section 650 (Subpart P - Excavations).

11. Standard Specification for Public Works Construction (SSPWC) (2000 edition, including the latest Regional Supplement Amendments, the latest City of San Diego Supplement Amendments and any subsequent approved revision/amendment thereto).

12. ASTM D 431B, Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

13. Uniform Building Code Standard No. 29-2, Expansion Index Test.

14. State of California, Department of Transportation, Standard Plans and Standard Specifications, dated July 2002.

15. City of San Diego Standard Drawings, 2006 Edition, Document No. AEC1231063 and any approved revision/amendment thereof.

16. Standard Specifications for Public Works Construction (SSPWC), 2006 Edition, Document Co. AEC1231061 and the City of San Diego Supplements thereto, Document No. AEC1231062.

D. Soils Report: All work herein shall also conform to the following documents incorporated into this specification herein by reference.

1. Any additional geotechnical investigations deemed necessary by the CONTRACTOR prior to bid, or in the preparation of shop drawings for interim grading conditions, sheeting, shoring, bracing, and underpinning, shall be performed by the CONTRACTOR at his/her own expense.

2. A soil report has been prepared for this project, titled "Report of Geotechnical Investigation Tierrasanta Pump Station City of San Diego AGE Project No. 54D108" dated 8/09/2013.

1.3 SUBMITTALS

A. Excavation Plan: Prior to start of trenching/excavation operations, submit written plan prepared by and stamped by a California Registered Professional Engineer to demonstrate compliance with California Code Regulations Title 8, Industrial Relations, Construction Safety Orders, Cal OSHA, Article 6 Sections 1539 thru 1547. This excavation plan shall conform to the Cal OSHA California Trenching and Shoring Manual. As a minimum, excavation plan shall include:

1. Name and training experience of competent person.

2. Excavation method(s) or protective system(s) to be used.

3. Copy of the trenching/excavation permit issued by the California Department of Industrial Safety including notification form Cal OSHA S-691.

4. Plan identifying areas to be used for stockpiling excavated material, haul route, ingress/egress from excavations.

5. Plan identifying proposed compaction equipment and procedures.

B. Test Reports - Borrow, Backfill, and Grading:

1. Testing laboratory shall submit copies of the following reports directly to ENGINEER, with copy to CONTRACTOR:

a. Tests on borrow material. Required tests per Specification Section 02200, Paragraph 1.2.A.2.

b. Tests on footing subgrade. Required tests per Specification Section 02200, Paragraph 1.2.A.2.

c. Field density tests. Required tests per Specification Section 02200, Paragraph 1.2.A.2.

d. Optimum moisture - maximum density curve for each soil used for backfill. Required tests per Specification Section 02200, Paragraph 1.2.A. 2.

e. Tests of actual unconfined compressive strength or bearing tests of each strata.

C. Samples of all select backfill, backfill, filter material, gabions, sand, crushed stone, granular embedment and topsoil shall be submitted by the CONTRACTOR to the ENGINEER and the testing service. Samples of the proposed material shall be submitted at least fourteen (14) days in advance of its anticipated use.

D. CONTRACTOR shall prepare drawings for the following items: Sheeting and bracing for excavations over twenty (20) feet deep, or other protective system(s) in compliance with the provisions for Shoring and Bracing Drawings @ in Section 6705 of the California Labor Code. Drawings and calculations shall be prepared by a Registered Civil Engineer licensed in the State of California. Drawings shall be submitted to OWNER for record purposes only. Calculations shall be submitted. CONTRACTOR shall be solely responsible for designing, installing, operating and maintaining whatever system is submitted and/or is necessary to satisfactorily accomplish all necessary sheeting, bracing, protection, underpinning and dewatering. The OWNER reserves the right to review all sheeting, shoring and bracing designs.

E. The CONTRACTOR shall prepare grading plans for all interim grading conditions and shall submit such plans to the OWNER for review prior to commencing any grading operations. The interim grading plans shall specify all interim conditions for stockpiling and staging, and shall identify all erosion and sediment control measures required by the Water Pollution Control Program (WPCP). Such control measures may include straw bale dikes, sandbag dikes, silt fences, drainage swales, pipe drains, sediment traps, protective sheets, jute matting, hydro-seeding, and appropriate surface contouring. The CONTRACTOR shall not commence any clearing, grubbing, or grading operations until the WPCP has been submitted, reviewed, and approved by the OWNER.

F. Submit for approval the following: Dewatering system drawings and calculations prepared by and stamped with the seal of a Registered Professional Engineer in the State of California.

G. Excavation plan shall be coordinated with the dewatering plan. The excavation plan and dewatering plan shall be submitted at the same time.

H. The need for and the design of sheeting, bracing and shoring systems required to perform the excavation work within the site constraints shall be the sole responsibility of the CONTRACTOR. The CONTRACTOR shall provide all sheeting, bracing, and shoring systems necessary to protect the excavation and all other structures, pipelines and utilities, and new footings and walls, at no additional cost to the OWNER.

1.4 JOB CONDITIONS

A. Existing Utilities: Locate existing underground utilities in the areas of work. If utilities are to remain in place, provide adequate means of protection during all operations.

1. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult piping or utility owner and the ENGINEER immediately for directions as to procedure. Cooperate with OWNER and utility

owner in keeping services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

2. In general, service lines to individual houses and buildings are not shown; however, CONTRACTOR shall assume that a service exists for each utility to each house or building.

3. Do not interrupt existing utilities serving facilities occupied and used by OWNER or others, except when permitted in writing by ENGINEER and then only after acceptable temporary utility services have been provided.

4. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active.

5. Keep as-built records of all underground utilities encountered during construction.

6. Utilities that must be relocated to accommodate the excavation area proposed by the CONTRACTOR shall be relocated at the CONTRACTOR's expense after approval in writing by the ENGINEER.

7. Rock excavation will be required during grading operations at no cost to the owner. Follow requirements of Geotechnical Report to be performed by CONTRACTOR.

B. NOT USED.

C. Protection of Persons and Property: Barricade open excavations occurring as part of the work and post with warning lights. Operate warning lights during hours from dusk to dawn each day and as otherwise required.

1. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork and trenching operations.

D. Dust Control: Conduct all operations and maintain areas of activity, including sweeping and sprinkling of roadways, to minimize creation and dispersion of dust. Calcium chloride may be used to control serious or prolonged dust problems, subject to approval of ENGINEER.

PART 2 - PRODUCTS

2.1 EARTHWORK MATERIALS

A. Select Fill:

1. All imported soils shall consist of select fill material and shall be placed where shown for grading of the site or as specified below, around structures, pipelines, roads, backfills and other work.

2. Use granular material free from organic matter that has a UBC expansion index of 30 or less when tested in accordance with UBC Standard 29-2, a liquid limit of 30 or less, a plasticity index of 15 or less and a R-valve of 30 or greater.

3. Select fill shall contain no rocks or hard lumps greater than 6 inches in maximum dimension, and shall contain at least 40% by weight of material smaller than 1/4-inch in size. Material of a perishable, spongy, or otherwise improper nature shall not be used in fills. Select fill for pavement subgrade shall not contain rocks greater than 3 inches per SSPWC Section 301-1.2.

4. Previously excavated materials meeting these requirements may be used for select fill.

5. Samples of materials to be used for fill shall be tested in the laboratory in order to evaluate the maximum density, optimum moisture content, classification of the soil, and expansion index, as required.

6. During earthwork operations, soil types other than those analyzed in the report of the geotechnical study may be encountered by the CONTRACTOR. The ENGINEER shall be consulted to determine the suitability of these soils for use as backfill.

7. The select backfill mixture shall contain no clay lumps or organic matter. The select backfill shall be deposited in uniform layers not exceeding 8-inches in uncompacted thickness. The backfill shall be compacted by a suitable vibratory roller or platform vibrator as specified in Section 3.9.F.

8. No material for select backfill shall be placed without the ENGINEER'S approval.

9. The term select fill shall also mean backfill, fill, select backfill and pavement subgrade course.

B. Structure Subgrade: Shallow structures shall be placed on engineered fill or undisturbed Stadium Conglomerate underlying the existing undocumented fill. Existing fill soils are not suitable for support of foundations and slabs.

C. Roadway/Parking Area Subgrade:

1. Roadway/Parking Area subgrade is defined as the top 12 inches of soil excluding untreated base material in areas to be paved with asphalt concrete or portland cement concrete, and extends from centerline of roadway to the outside limits of shoulders.

2. Materials for roadway subgrade shall be select fill.

3. Excavated materials meeting the requirements for pavement subgrade course in Specification Section 02200, Paragraph 2.1.A.3 may be used for roadway subgrade

D. Trench Subgrade: Subgrades for trench bottoms shall be firm, dense, free of rocks greater than 3 inches, free from mud, muck, and other soft or unsuitable materials; and be thoroughly compacted and consolidated; and shall remain firm and intact under all construction operations. Subgrades which are otherwise solid, but which become soft or mucky on top as a result of construction operations, shall be reinforced with crushed stone or select fill material. Subgrades which are soft or mucky shall be scarified to a depth of twelve (12) inches and recompacted to 95% relative compaction. The finished elevation of stabilized subgrades shall not be above subgrade elevation shown on the drawings.

E. Trench Backfill:

1. Trench backfill materials above pipe zone shall be select fill.

2. As an alternative, Controlled Low Strength Material (CLSM) may be used to backfill trenches. The use of CLSM shall be approved prior to placement by the ENGINEER.

F. Structure Backfill: Structure backfill materials shall be select fill.

G. Roadway Backfill: Roadway backfill shall be select fill.

2.2 HYDROSEED MATERIALS

A. Hydroseed Mix. See Section 3.16.B.

2.3 EROSION CONTROL MATERIALS

A. Silt Fencing: Silt fencing shall be composed of an entrenched filter fabric,. Silt fencing shall be similar to the detail shown on Best Management Practices (BMP) No. ESC 50 of the Construction Activity - California Storm Water Best Management Practice Handbook.

1. Product and Manufacturer: Provide silt fencing as manufactured by one of the following:

a. Belton Geotextiles - Beltech Silt Fence
b. Or equal

B. Straw Mat: The straw mat shall be composed of a single photodegradable top net over a fiber layer of 100 percent California straw fiber and held in place with a biodegradable corn-based polymer stake. The weight of the straw mat shall be plus or minus 0.5 lbs./sq. yd.

1. Product and Manufacturer: Provide straw matting as manufactured by one of the following:

a. Greenfix America - WS05.
b. North American Green - 575.
c. Or equal.

C. Straw Rolls: Straw rolls shall be composed of naturally weed free California rice straw in photodegradable netting forming a 9-inch diameter roll and held in place by wooden stakes.

1. Product and Manufacturer: Provide straw rolls as manufactured by one of the following:

a. Earth Saver Rice Straw Wattle.
b. Pacific Soil Stabilization - Fiber Rolls
c. Or equal

D. Jute Mat: Jute matting shall be a cloth of uniform weave of jute yarn, 48-inches in width and weighing an average of 1.2 pounds per linear yard. The yarn shall be of a loosely twisted construction and shall not vary in thickness by more than its normal diameter. The mat shall be anchored by No. 11 gauge wire staples or heavier, having a length of from six to ten inches.

1. Product and Manufacturer: Provide jute matting as manufactured by one of the following:

a. Belton Industries, Inc. - Geocoir/DeKoWe 700.
b. Or equal.

PART 3 -EXECUTION

3.1 INSPECTION

A. Provide OWNER with sufficient notice and with means to examine the areas and conditions under which excavating, filling, and grading are to be performed. ENGINEER will notify CONTRACTOR if conditions are found that may be detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

3.2 SITE PREPARATION

A. Clear all areas to be occupied by permanent construction or embankments of all trees, brush, roots, stumps, logs, wood and other materials and debris. Clean and strip subgrades for fills and embankments of vegetation, sod, topsoil and organic matter. All waste materials shall be removed from site and properly disposed of by CONTRACTOR. CONTRACTOR shall bear all costs associated with clearing included, but not limited to, demolition, stockpiling, sorting, loading and unloading, transportation and disposal fees. Burning will not be permitted.

3.3 TEST PITS

A. Where shown or ordered by ENGINEER, excavate and backfill test pits, in advance of construction, to determine conditions or location of existing facilities. Perform all work required in connection with excavating, stockpiling, maintaining, sheeting, shoring, backfilling and replacing pavement for the test pits. CONTRACTOR shall compact backfill to a minimum of 90% relative compaction.

B. All test pits shall be backfilled with select backfill in 8-inch layers and compacted to 95% relative compaction unless otherwise ordered by the ENGINEER.

C. No separate payment will be made for test pits.

3.4 EXCAVATION

A. Perform all excavation required to complete the work as shown, specified and required. Excavations are unclassified and shall include earth, sand, clay, gravel, hardpan, boulders, rock, granite, pavements, rubbish and all other materials within the excavation limits.

B. Excavations for structures and pipelines shall be open excavations. Provide excavation protection system(s) required by ordinances, codes, law and regulations to prevent injury to workmen and to prevent damage to new and existing structures or pipelines. Unless shown or specified otherwise, protection system(s) shall be utilized under the following conditions.

1. Excavation Less Than 5 Feet Deep: Excavations in stable rock or in soil conditions where there is no potential for a cave-in may be made with vertical sides. Under all other conditions, excavations shall be sloped and benched, shielded, or shored and braced in accordance with CAL/OSHA requirements.

2. Excavations More Than 5 Feet Deep: Under all conditions, excavations shall be sloped and benched, shielded or shored and braced.

3. Excavation Protection System(s) shall be installed and maintained in accordance with drawings submitted under Part 1.3, above.

C. Where the structure or pipeline is to be placed below the ground water table, well points, cofferdams or other acceptable methods shall be used to permit construction of said structure or pipeline under dry conditions. Dry conditions shall be maintained until concrete has reached sufficient strength to withstand earth and hydrostatic loads and until the pipelines are properly jointed, tested and backfilled. In addition, protect excavation from flooding until all walls and floor framing up to and including grade level floors are in place and backfilling has begun. Water level shall be maintained a minimum of two (2) feet below the subgrade level at all times. Dewatering plans and calculations shall be submitted to the ENGINEER for approval in accordance with Part 1.3 above.

D. Pumping of water from excavations shall be done in such a manner to prevent the carrying away of unsolidified concrete materials, and to prevent damage to the existing subgrade.

E. The elevation of the bottom of footings shown shall be considered as approximate only and ENGINEER may order such changes in dimensions and elevations as may be required to secure a satisfactory footing. All structure excavations shall be hand-trimmed to permit the placing of full widths, and lengths of footings on horizontal beds. Rounded and undercut edges will not be permitted.

F. When excavations are made below the required grades without the written order of ENGINEER, they shall be backfilled with compacted gravel or concrete, as directed by ENGINEER, at the expense of CONTRACTOR.

G. Excavations shall be extended sufficiently on each side of structures, footings, etc., to permit setting of forms, installation of shoring or bracing or the safe sloping of banks.

H. Subgrades for roadways, structures and trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud, muck, and other soft or unsuitable materials; and shall remain firm and intact under all construction operations. Subgrades which are otherwise solid, but which become soft or mucky on top due to construction operations, shall be reinforced with crushed stone. The finished elevation of stabilized subgrades shall not be above subgrade elevations shown.

I. Pipe Trench Excavation:

1. Trench width shall be minimized to the greatest extent practical and shall conform to the following:

   a. Sufficient to provide room for installing, jointing and inspecting piping, but in no case wider at top of pipe than pipe barrel outside diameter plus 2-feet.
   b. Enlargements at pipe joints may be made if required and approved by ENGINEER.
   c. Sufficient for shoring and bracing, or shielding and dewatering.
   d. Sufficient to allow thorough compaction of backfill adjacent to bottom half of pipe.
   e. Do not use excavating equipment which requires the trench to be excavated to excessive width.

2. Depth of trench shall be as shown. If required and approved by ENGINEER, depths may be revised.

3. Except where otherwise shown, pipe trenches shall be excavated below the underside of the pipe to the depth shown on Drawings to provide for the installation of pipe bedding material.

J. Material Storage: Stockpile satisfactory excavated materials in approved areas, until required for backfill or fill. Place grade and shape stockpiles for proper drainage.

1. Locate and retain soil materials away from edge of excavations behind a projected 1:1 plane extending from the bottom of the excavation.

2. Dispose of excess soil material and waste materials as specified hereinafter.

K. Where ENGINEER considers the existing material beneath the bedding material unsuitable, CONTRACTOR shall remove same and replace it with select backfill or compact crushed stone at no additional cost to the OWNER. Where the existing material in the trench bottom is unsuitable, CONTRACTOR shall remove unsuitable material 6 inches beyond its limits and replace with select backfill material compacted to 95% relative compaction or crushed stone at no additional cost to the OWNER.

3.5 UNAUTHORIZED EXCAVATION

A. All excavation outside the lines and grades shown, and which is not approved by ENGINEER, together with the removal and disposal of the associated material shall be at CONTRACTOR's expense. Unauthorized excavations shall be filled and compacted with select backfill by CONTRACTOR at his expense.

3.6 DRAINAGE AND DEWATERING

A. General:

1. Prevent surface and subsurface water from flowing into excavations and from flooding adjacent areas.

2. Remove water from excavation as fast as it collects.

3. Maintain the ground water level a minimum of two (2) feet below the bottom of the excavation to provide a stable surface for construction operations, a stable subgrade for the permanent work, and to prevent damage to the work during all stages of construction.

4. Provide and maintain pumps, sumps, suction and discharge lines and other dewatering system components necessary to convey water away from excavations.

5. Obtain ENGINEER'S approval before shutting down dewatering system for any reason.

B. Standby Requirements for Dewatering: Provide standby equipment to insure continuity of dewatering operations.

C. Disposal of Water Removed by Dewatering System:

1. Dispose of all water removed from the excavation in such a manner as not to endanger public health, property, or any portion of the work under construction or completed.

2. Dispose of water in such a manner as to cause no inconvenience to OWNER, ENGINEER, or others involved in work about the site.

3. Convey water from the construction site in a closed conduit. Do not use trench excavations as temporary drainage ditches.

4. CONTRACTOR shall be responsible for obtaining any permits required to operate the dewatering system. The CONTRACTOR shall also be responsible for any fees for discharging dewatering effluent into the City's sanitary sewage system.

5. Disposal of water into Lake Miramar is strictly prohibited.

3.7 SHEETING, SHORING AND BRACING

A. General:

1. Used material shall be in good condition, not damaged or excessively pitted. All steel or wood sheeting designated to remain in place shall be new. New or used sheeting may be used for temporary work.

2. All timber used for breast boards (lagging) shall be new or used, meeting the requirements for Douglas Fir Dense Construction grade with a bending strength not less than 1500 psi or Southern Pine No. 2 Dense.

3. All steel work for sheeting, shoring, bracing, cofferdams etc., shall be designed in accordance with the provisions of the "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings", of the AISC except that field welding will be permitted.

4. Steel sheet piling shall be manufactured from steel conforming to ASTM A 328. Steel for soldier piles, vales and braces shall be new or used and shall conform to ASTM A 992.

5. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

6. Unless otherwise shown, specified, or ordered, all materials used for temporary construction shall be removed when work is completed. Such removal shall be made in a manner not injurious to the structure or its appearance or to adjacent work.

7. Provide permanent steel sheet piling or pressure creosoted timber sheet piling wherever subsequent removal of sheet piling might permit lateral movement of soil under adjacent structures. Cut off tops a minimum of six feet below grade or more as required.

8. The clearances and types of the temporary structures, insofar as they affect the character of the finished work, and the design of sheeting to be left in place, will be subject to the approval of ENGINEER; but the CONTRACTOR shall be responsible for the adequacy of all sheeting, shoring, bracing, coffer-damming, etc.

9. Safe and satisfactory sheeting, shoring and bracing shall be the entire responsibility of CONTRACTOR.

B. Sheeting Left in Place:

1. Any steel sheet piling that is shown to be left in place shall consist of rolled sections of the continuous interlocking type unless otherwise approved. The type and design of the sheeting and bracing shall conform to the above specifications for all steel work for sheeting and bracing. Steel sheeting designated to be left in place shall be new.

2. Steel sheet piling to be left in place shall be driven straight to the lines and grades as shown or directed. The piles shall penetrate into firm materials with secure interlocking throughout the entire length of the pile. Damaged piling having faulty alignment shall be pulled and replaced by new piling.

3. The type of guide structure used and method of driving for steel sheet piling to be left in place shall be subject to the approval of ENGINEER. Jetting will not be permitted.

4. Cut off piling left in place to the grades shown or ordered by ENGINEER and remove the cut offs from the site.

5. Clean vales, braces and all other items to be embedded in the permanent structure, and ensure that the concrete surrounding the embedded element is sound and free from air pockets or harmful inclusions. Provisions shall include the cutting of holes in the webs and flanges of wale and bracing members, and the welding of steel diaphragm waterstops perpendicular to the centerline of brace ends which are to be embedded.

6. Subsequent to removal of the inside face forms, and when removal of bracing is permitted, cut back steel at least 2 inches inside the wall face and patch opening with cement mortar. Concrete shall be thoroughly worked beneath vales and braces, around stiffeners and in any other place where voids may be formed.

7. Portions of sheeting or soldier piles and breast boards which are in contact with the foundation concrete shall be left in place, together with vales and bracing members which are cast into foundation or superstructure concrete.

C. Removal of Sheeting and Bracing:

1. Remove all sheeting and bracing from excavations unless otherwise indicated per paragraph 3.7.A.7. Removal shall be done so as to not cause injury to the work. Removal shall be equal on both sides of excavation to ensure no unequal loads on pipe or structure.

2. Defer removal of sheeting and bracing, where removal may cause soil to come into contact with concrete, until the following conditions are satisfied:

a. Concrete has cured a minimum of 7 days.
b. Wall and floor framing up to and including grade level floors are in place.

3.8 TRENCH SHIELDS

A. Excavation of earth material below the bottom of a shield shall not exceed the limits established by ordinances, codes, laws and regulations.

B. When using a shield for pipe installation: Top of trench shield shall project a minimum 18 inches above the vertical portion of the trench excavation per Cal OSHA Section 1541.1.

C. When using a shield for the installation of structures, the bottom of the shield shall not extend below the top of the bedding for the structures.

D. When a shield is removed or moved ahead, extreme care shall be taken to prevent the movement of pipe or structures or the disturbance of the bedding for pipe or structures. Pipe or structures that are disturbed shall be removed and reinstalled as specified.

3.9 PLACEMENT FOR BACKFILL, FILL AND COMPACTION

A. General:

1. All select backfill and backfill required for structures and trenches and required to provide the finished grades shown and as described herein shall be furnished, placed and compacted by the CONTRACTOR.

2. Backfill excavations as promptly as work permits, but not until completion of the following:

a. Acceptance by the ENGINEER of construction below finish grade.

b. Inspection, testing, approval, and recording of locations of underground piping and ductwork.

c. Removal of concrete formwork.

d. Removal of shoring and bracing, and backfilling of voids with satisfactory materials.

e. Removal of trash and debris.

f. Testing of structure for water tightness.

3. Fill containing organic materials or other unacceptable material shall be removed and replaced with approved fill material as specified.

B. Placement of Select Backfill:

1. Select backfill shall be placed to the grades shown on the Drawings. The lift thickness and compaction moisture content range given herein are approximate. These values shall be finally determined from the laboratory test results on the fill materials.

2. All select backfill shall be placed in horizontal loose lifts, not exceeding 8-inches in thickness, and shall be mixed and spread in a manner assuring uniform lift thickness after placing. Each lift shall be compacted by not less than two complete coverages of the specified compactor. Select backfill shall be placed to the underside of all concrete slabs. The fill material shall extend a minimum of

two feet outside the face of each structure and be 12-inches below finished grade. The maximum slope of select backfill to the subgrade shall be one vertical to one horizontal.

3. Backfill and fill around and outside of structures shall be select backfill and shall be deposited in layers not to exceed 8- inches in uncompacted thickness and mechanically compacted, using platform type tampers. Compaction of structures backfilled by rolling will be permitted provided the desired compaction is obtained and damage to the structure is prevented. Compaction of select backfill and/or backfill by inundation with water will not be permitted. All materials shall be deposited as specified herein and as shown on the Drawings.

4. The material shall be placed at a moisture content and density as specified under Paragraphs 3.9.F to 3.9.G. The CONTRACTOR shall provide equipment capable of adding measured amounts of water to the backfill and/or select backfill material to bring it to a condition within the range of the required moisture content. The CONTRACTOR shall provide equipment capable of discing, aerating, and mixing the soil to ensure reasonable uniformity of moisture content throughout the fill material and to reduce the moisture content of the borrow material by air drying, if necessary. If the subgrade or lift of earth material must be moisture conditioned before compaction, the fill material shall be sufficiently mixed or worked on the subgrade to ensure an uniform moisture content throughout the lift of material to be compacted. Materials at moisture content in excess of the specified limit shall be dried by aeration or stockpiled for drying.

5. No backfill or fill material shall be placed when free water is standing on the surface of the area where the fill is to be placed. No compaction of fill will be permitted with free water on any portion of the fill to be compacted. No fill shall be placed or compacted in a frozen condition or on top of frozen material. Any fill containing organic materials or other unacceptable material previously described shall be removed and replaced with approved fill material prior to compaction.

6. Compaction shall be performed with equipment suitable for the type of fill material being placed. The CONTRACTOR shall select equipment which is capable of providing the minimum density required by these Specifications. Equipment shall be provided that is capable of compacting in restricted areas next to structures and around piping. The effectiveness of the equipment selected by the CONTRACTOR shall be tested at the commencement of compacted fill work by construction of a small section of fill within the area where fill is to be placed. If tests on this section of fill show that the specified compaction is not obtained, the CONTRACTOR shall increase the amount of coverages, decrease the lift thicknesses and/or obtain a different type of compactor.

7. Levels of backfill against concrete walls shall not differ by more than 2 feet on either side of walls, unless walls are adequately braced or all floor framing is in place up to and including grade level slabs. Particular care shall be taken to compact structure backfill which will be beneath pipes, roads, or other surface construction or structures. In addition, wherever a trench passes through structure backfill, the structure backfill shall be placed and compacted to an

elevation 12-inch above the top of the pipe before the trench is excavated. Compacted areas, in each case, shall be adequate to support the item to be constructed or placed thereon.

8. The compaction requirements specified are predicated on the use of normal materials and compaction equipment. In order to establish criteria for the placement of a controlled fill so that it will have compressibility and strength characteristics compatible with the proposed structural loadings, a series of laboratory compaction and/or compressive strength tests shall be performed on the samples of materials submitted by the CONTRACTOR. From the results of the laboratory tests, the final values of the required percent compaction, the acceptable compaction moisture content range, and the maximum permissible lift thickness will be established for the fill material and construction equipment proposed.

C. Backfill in Pipe Trenches:

1. Pipeline trenches may be backfilled prior to pressure testing, but no structure shall be constructed over any pipeline until it has been tested.

2. All pipes, except plastic pipe, shall be placed on a minimum 6-inch thick pipe bedding layer of 3/4-inch crushed stone.. PVC pipe shall be placed on a minimum 6-inch thick pipe bedding layer of sand. This 6-inch layer is noted as the pipe bedding material on the Typical Pipe Trench detail on the Plans.

3. Pipe zone materials both around and above the top of the pipe, classes of materials to be used, and placement and compaction of materials shall conform to the following requirements:

a. The pipe zone is the area around the pipe that extends from the bottom of the pipe to 12-inches above the top of the pipe across the entire width of the trench. Material placed within the pipe zone shall consist of controlled low strength materials (CLSM), sand, granular select backfill material or crushed rock that does not contain clay or organic material, has 90 to 100 percent passing the No. 4 sieve, and does not have more than five percent passing the No. 200 sieve as noted below. The top 12-inches of sand backfill should be compacted to at least 90 percent relative compaction. See Specification Section 02230 for material definitions.

1) Pipe zone material shall be to the dimensions shown on the Typical Pipe Trench Detail on the Plans as follows:

- PVC pipe – sand
- Ductile Iron pipe - granular select backfill material
- RCP and Steel pipe - controlled low strength materials (CLSM) to the mid diameter of the pipe and granular select backfill material to one foot above the pipe.

b. Materials shall be spread and the surface graded and compacted with a vibratory compactor to provide a uniform and continuous support beneath the pipe at all points between bell holes or pipe joints. It will be permissible to slightly disturb the finished subgrade surface by withdrawal of pipe slings or other lifting tackle. After each pipe has been graded, aligned, placed in final position on the bedding material, sufficient pipe zone backfill material shall be deposited and compacted under and around each side of the pipe, the bell holes, and back of the bell or end thereof to hold the pipe in proper position and to maintain alignment during subsequent pipe jointing and backfilling operations. Materials shall be deposited and compacted uniformly and simultaneously on each side of the pipe to prevent lateral displacement.

c. The method of compaction and the equipment used shall be appropriate for the material to be compacted and shall not transmit damaging shocks to the pipe.

d. The degree of compaction required for pipe zone materials is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557.

4. Backfill above the pipe zone:

a. Select fill shall be placed above the pipe zone; the material may be obtained from excavations or imported. The material should be placed in lifts eight inches or less in loose thickness, moisture-conditioned to within two percentage points of optimum moisture content, and compacted to at least 90 percent relative compaction.

b. Compacted backfill shall be required for the full depth of the trench above the pipe zone material. If the trench for one pipe passes beneath the trench for another pipe or electrical ductbank, the lower trench shall be compacted to the mid level or middle diameter of the upper trench.

c. Each layer of backfill material shall be compacted by at least two complete coverages of all portions of the surface of each lift using approved compaction equipment. One coverage is defined as the conditions reached when all portions of the fill lift have been subjected to the direct contact of the compacting surface of the compactor.

D. Backfill in Electrical Ductbank Trenches:

1. Compacted backfill shall be required for the full depth of the trench above the electrical concrete-encased ductbank. If the trench for one ductbank passes beneath the trench for another pipe or ductbank select backfill shall be placed to the mid level or middle diameter of the upper trench.

2. Placement and compaction of backfill in electrical ductbank trenches shall conform to the requirements of Paragraph 3.9.B.

E. Compaction Density Requirements:

1. The degree of compaction required for all types of fills shall be as listed below. Material shall be moistened or aerated as necessary to provide the moisture content that will facilitate obtaining the specified compaction.

Material Thick.(in)	Required Minimum Density-Percent Compaction (ASTM D 1557)	Maximum Uncompacted Lift (inches)
Subgrade Soil: Cut Condition		
Below slabs on grade (expansive native soils) Upper 18"	95 (max)	-
Below slabs on grade (non-expansive native soils) Upper 12"	95	-
Below base of footings or mats, structural slabs and tank floors	95	-
Below asphalt paving	95	-
Subgrade Soil Fill Condition:		
Below concrete pedestrian slabs - upper 12"	95	8
Below base of footings or mats structural slabs and tank floors - upper 18" - 36"	95	8
Below asphalt concrete paving - upper 24"	95	8
*Structural Backfill (Lean Concrete):	95	
Untreated Base Materials:		
Below concrete slabs or mats	95	8
Below asphalt paving	95	8
Trench Backfill above pipe zone	90	12
Crushed Stone (Pipe Bedding and Pipe Zone)	90	6
Sand (Pipe Bedding and Pipe Zone)	90	6
Trench subgrade below pipe zone	95	6

**Structural backfill shall not be used for support of facilities which are susceptible to damage from differential settlement of the fill section relative to walls.*

a. All fill must be wetted and thoroughly mixed to achieve optimum moisture content, at 2 percent, with the following exception:

1) Expansive soils shall be compacted at 2 to 4 percent above optimum moisture content.

2) Native undisturbed soils or compacted soil subsequently disturbed or removed by construction operations shall be replaced with materials compacted as specified above.

2. The OWNER'S testing service shall perform tests necessary to provide data for selection of fill material and control of placement water content.

3. Field density tests, to ensure that the specified density is being obtained, shall be performed by the OWNER'S testing service during each day of compaction work.

4. If the tests indicate unsatisfactory compaction, the CONTRACTOR shall provide the additional compaction necessary to obtain the specified degree of compaction. All additional compaction work shall be performed by the CONTRACTOR, at no additional cost to the OWNER, until the specified compaction is obtained. This work shall include complete removal of unacceptable (as determined by the ENGINEER) fill areas and replacement and recompaction until acceptable fill is provided.

F. Replacement of Unacceptable Excavated Materials: In cases where over-excavation for the replacement of unacceptable soil materials is required, the excavation shall be backfilled to the required subgrade with select backfill material or crushed stone and thoroughly compacted as specified in Paragraph 3.9.E. Sides of the excavation shall be sloped in accordance to the maximum inclinations specified for each structure location.

3.10 GRADING

A. General: Uniformly grade areas within limits of grading under this Section, including adjacent transition areas. Smooth subgrade surfaces within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes, and as follows:

1. Turfed Areas or Areas Covered with Gravel, Stone, Wood Chips, or Other Special Cover: Finish areas to receive topsoil or special cover to within not more than 1/2-inch above or below the required subgrade elevations.

2. Pavements: Shape surface of areas under pavement to line, grade and cross-section elevation. Subgrade tolerances for pavement, sidewalk, curb and gutter, driveways or other roadway structures shall be per SSPWC 301-1.4.

C. Grading Surface of Subgrade Under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 2-inch when tested with a 10 foot straightedge.

D. Compaction:

1. After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

3.11 ROADWAY SUBGRADE COURSE

A. General: Cut or fill subgrade material as shown on Contract Drawings and typical roadway sections. Subgrade materials shall be as specified in Specification Section 02200, Paragraphs 2.1.C.1 through 2.1.C.3 and the following requirements:

1. Upper 24 inches of subgrade below pavement and sidewalk areas shall be compacted to at least 95% relative compaction.

2. Expansive soils and rocks greater than 3 inches shall not be placed in the upper 24 inches of subgrade.

B. Grade Control: During construction, maintain lines and grades including crown and cross-slope of subgrade per SSPWC 301-1.4.

C. Shoulders: Place shoulders along edges of subgrade course prior to CTB/asphalt placement to prevent lateral movement. Construct shoulders of select fill materials, placed in such quantity to compact to thickness equal to roadway section layer. Compact and roll at least a 24-inch width of shoulder simultaneously with compacting and rolling of each layer of the roadway section.

D. Placing: Place subgrade select fill material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting subbase material during placement operations.

1. When a compacted subgrade course is shown to be 6-inches thick or less, place material in a single layer. When shown to be more than 6-inches thick, place material in equal layers, except no single layer more than 6-inches or less than 3-inches in thickness when compacted.

3.12 DISPOSAL OF EXCAVATED MATERIALS

A. Material removed from the excavations which does not conform to the requirements for fill or is in excess of that required for backfill shall be hauled away from the project site by the CONTRACTOR and disposed of in compliance with ordinances, codes, laws and regulations, at no additional cost to the OWNER.

3.13 RESTORING AND RESURFACING EXISTING ROADWAYS AND FACILITIES

A. Place 1-1/2-inches of temporary bituminous pavement immediately after backfilling trenches in paved roadways which are to be retained for permanent use. Maintain the surface of the paved area over the trench in good and safe condition during progress of the entire work, and promptly fill all depressions over and adjacent to the trench caused by settlement of backfilling. The permanent replacement pavement shall be Type B Trench Resurfacing per San Diego City Standard Drawing No. G-24 or Type D Trench Resurfacing per San Diego City Standard Drawing No. G-25 as specified by the ENGINEER.

B. Pavement, gutters, curbs, sidewalks or roadways disturbed or damaged by the CONTRACTOR's operations, except areas designated "New Pavement" or "Proposed Pavement", shall be restored by him at his own expense to as good condition as they were previous to the commencement of the work and in accordance with applicable local and state highway specifications.

3.14 TEMPORARY FENCING

A. Furnish and install a temporary fence surrounding excavations and work area. Fence shall have openings only at vehicular, equipment and worker access points.

B. The fence shall be a snowfence type enclosure, 48-inches high. Fence shall be constructed of vertical hardwood slats measuring 1-1/2 by 1/4-inch interwoven with strands of horizontal wire, or shall be of equivalent plastic construction. Posts shall be of steel, either U, Y, T or channel section, and shall have corrugations, knobs, notches or studs placed and constructed to engage a substantial number of fence line wire in the proper position. Posts shall have tapered anchors weighing 0.67 pounds or more, each firmly attached by means of welding, riveting or clamping. Posts shall have a nominal weight of 1/3 pound per linear foot exclusive of the anchor. Each post shall be furnished with a sufficient number of galvanized wire fasteners or clamps, of not less than 0.120-inch in diameter for attaching fence wire to the post.

3.15 FIELD QUALITY CONTROL

A. Field density tests shall be performed by the CONTRACTOR on all compacted fill to provide a basis for determining whether the fill material has been compacted to the minimum relative compaction specified. Tests must show that all compacted or recompacted areas indicate a relative compaction as specified. Density tests shall be made in the compacted material below any disturbed surface.

B. The frequency of field density tests shall follow the minimum requirements listed below. The actual frequency of tests shall be based on the more stringent condition.

1. Mass Grading Fill:

   1 test every 500 cubic yards
   1 test every 2 feet vertical
   1 test every 6,000 square feet

2. Trench and Wall Backfill

   1 test every 500 cubic yards
   1 test every 2 feet vertical
   1 test every 100 feet horizontal

3. Subgrades and Bases

   1 test every 100 cubic yards
   1 test every 2,500 square feet

C. If the specified densities are not obtained because of improper control of placement or compaction procedures, or because of inadequate or improperly functioning compaction equipment, the CONTRACTOR shall perform whatever work is required to provide the required densities. This work shall include complete removal of unacceptable fill areas, and replacement and recompaction until acceptable fill is provided.

D. During construction, the CONTRACTOR shall properly grade all excavated surfaces to provide positive drainage and prevent ponding of water. When earthwork operations are interrupted, the CONTRACTOR shall reestablish specified compaction to the depth necessary before placing new fill. The CONTRACTOR shall control surface water to avoid damage to adjoining properties or to finished work on the site. The CONTRACTOR shall take remedial measures to prevent erosion of freshly graded areas

and until such time as permanent drainage and erosion control features have been installed.

3.16 EROSION CONTROL

A. Temporary Erosion Control During Construction:

1. During all phases of construction, the CONTRACTOR shall perform the work in a manner which will minimize soil erosion and water and air pollution.

2. The CONTRACTOR shall minimize erosion, turbidity and siltation on the work site by proper scheduling of work and careful construction practices; by trapping sedimentation in temporary debris basins where sediment is caused by construction operations; and by employing erosion control measures and temporary site drainage structures where significant erosion would occur during the winter periods.

   a. Prior to mobilization and move-in onto the staging area, the CONTRACTOR shall install the erosion control measures shown on the plans.

      1) Install the Silt Fencing at the top and toe of the existing slope around the staging area per said BMP No. ESC 50 and the manufacturer's recommendations.

      2) Place the Straw Mat on the existing slope around the staging area per BMP No. ESC 20 and the manufacturer's recommendations.

   b. The CONTRACTOR shall prohibit any silt, debris or sedimentation material from being carried onto Lake Miramar by any construction activity or rainfall event.

3. The CONTRACTOR shall maintain existing erosion protection until grading and paving work is complete. Existing erosion protection shall remain in place in areas accepting runoff from unpaved areas.

4. The CONTRACTOR shall immediately restore all erosion control devices to working order after each rainfall event.

5. All existing removable erosion control devices shall be in place at the end of each working day when the five (5) day rain probability forecast exceeds forty percent (40%). Silt and other debris shall be removed after each rainfall event.

B. Permanent Erosion Control Work:

1. Hydroseeding: After the final cleanup and grading of the work site to the lines and grades shown on the plans, the area to be hydroseeded, as shown on the plans, shall be hydroseeded as follows:

a. The hydroseeding mixture, in the proportion indicated, shall be applied with hydroseeding equipment in one application within 30 minutes after the seed has been added to the mixture.

Material	**Pounds per Acre (slope Measurement)**
Fiber	1,500 lbs. Per acre
Seed	25 lbs. Per acre
Stabilizing Emulsion (solids)	50 lbs. Per acre
Commercial Fertilizer (16-20-0)	150 lbs Per acre

b. When premixed seed from containers is added to the hydroseeding equipment, the entire contents of the containers shall be used in preparing hydroseeding mixture. Partial use of a container of premixed seed will not be permitted in a hydroseeding mixture.

c. The ratio of total water to total stabilizing emulsion in the mixture shall be as recommended by the manufacturer of the emulsion, but shall not exceed 12 gallons of water per pound of stabilizing emulsion solids specified.

d. Erosion control materials shall not be applied in an area where an irrigation system is to be installed until the irrigation system in that area has been completed, nor in a planting area until the planting in that area has been completed.

e. Once erosion control work is started in an area, all applications shall be completed in that area on the same working day.

f. Clean-up: As project progresses, CONTRACTOR shall maintain all areas in a neat manner and remove unsightly debris as necessary. After completion of project, CONTRACTOR shall remove all debris used in accomplishing work. CONTRACTOR shall remove all debris used in accomplishing work. CONTRACTOR shall sweep and clean all sidewalks and concrete areas adjacent to plantings.

2. Erosion Control: After the final cleanup and grading of the staging area to the lines and grades shown on the plans, the following erosion control measures shall be installed.

a. The jute matting shall be installed on all the slopes surrounding the newly graded staging area before the installation of the hydroseeding.

1) The jute matting shall be loosely laid on the raked slope from the top of the slope down per the manufacturer's recommendation.

b. Straw rolls shall be installed on the tops of all the slopes surrounding the newly graded staging area and at the toe of the slopes facing Lake Murray before the installation of the hydroseeding.

1) The straw rolls shall be partly laid in trenches per the manufacturer's recommendations.

3.17 ADJUSTMENT OF MANHOLE FRAME AND COVER SETS, STORM DRAIN CLEANOUT FRAME AND COVER SETS, PULL BOXES, VALVE BOXES, VAULTS AND HANDHOLES

A. The utility adjustments shall include, but are not limited to all utility manholes, storm drain and sewer manholes, valve boxes, handholes and vaults installed under this Contract and shall be subject to the following requirements:

1. All utility manholes, storm drain and sewer manholes in unpaved areas shall be adjusted to a grade 18 inches above finish grade. The general grade around these structures shall drain away from the structure.

2. All valve boxes in unpaved areas shall be set 6 inches above finish grade and a concrete pad 6 inches thick and measuring two feet wider, then the valve box on each side shall be cast-in-place around each valve box. Concrete shall be SSPWC SS201.1.1.2 560-C-3250. The general grade around these structures shall drain away from the structure.

3. All utility vaults, handholes in unpaved areas shall be set 6 inches above finish grade. The general grade around these structures shall drain away from the structure.

B. The utility adjustments shall include, but are not limited to all utility manholes, storm drain and sewer manholes, valve boxes, handholes and vaults that exist at the time of bid and shall be subject to the following requirements:

1. All structures mentioned above that were previously installed under other contracts but are in the areas to be re-graded and/or paved shall be raised or lowered so that paving can be performed. After paving is complete these utilities will be adjusted to grade.

2. All structures mentioned above that were previously installed under other contracts and were raised or lowered so that paving could be performed, shall be set to final grades within a tolerance of 1/8-inch when tested with a 10-foot straight edge along each axis.

*** END OF SECTION ***

SECTION 02620

SUBDRAINAGE

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide materials for the construction of the bioretention basin in accordance with the Contract Documents.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 02100 Site Preparation
2. Section 02200 Earthwork
3. Section 02644 PVC Nonpressure Pipe

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated in this Section, the CONTRACTOR shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC) together with the latest adopted editions of the Regional and City of San Diego Supplement Amendments.

1.4 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall submit, in writing, materials testing reports, job-mix formulas, and other pertinent information satisfactory to the RESIDENT ENGINEER, demonstrating that materials and methods CONTRACTOR proposes to use will comply with the provisions of this Section. Submittals shall be in accordance with the requirements of Section 01300 - Submittals.

B. Suitability Tests of Proposed Materials: For materials not produced by a supplier currently authorized by the City Materials and Testing Lab, tests for conformance with the Specifications shall be performed before start of the Work. The samples shall be identified to show the name of the material, aggregate source, name of the supplier, contract number, and the segment of the Work where the material represented by the sample is to be used. Results of all tests shall be submitted to the RESIDENT ENGINEER for approval. Materials to be tested shall include filtration material, and liner. Tests shall also include saturated hydraulic conductivity and grain size analysis.

C. The CONTRACTOR shall submit certification and test records of all proposed materials showing that they meet the applicable requirements.

PART 2 - PRODUCTS

2.1 BIORETENTION BASIN FILTRATION MATERIAL

A. Typically, on-site soils will not be suitable due to clay content. Material shall not contain >5% fines (silt and clay) content.

B. Filtration material shall be loamy sand that maintains a minimum percolation rate of 5" per hour and no more than 10 inches per hour throughout the life of the facility, and it must be suitable for maintaining plant life.

C. Filtration material shall consist of 50 to 60% sand, 10 to 20% fine sand, 20 to 25% organics, by volume.

D. Sand for Filtration Material shall:

1. Be free of wood, waste, coating such as clay, stone dust, carbonate, etc., or any other deleterious material. All aggregate passing the No. 200 sieve size shall be non-plastic.

2. Shall be analyzed by an accredited lab using #200, #100, #40, #30, #16. #8, #4, and 3/8 inch sieves (ASTM D 422 or as approved by City of San Diego), and meet the following gradation:

a. Sieve Size Percent Passing (by weight):

Filtration Material	Percentage passing
3/8"	100-100
No. 4	90-100
No. 8	70-100
No. 16	40-95
No. 30	15-70
No. 40	5-55
No. 100	0-15
No. 200	0-5

Note: All sands complying with ASTM C33 for fine aggregate comply with the above gradation requirements

E. Filtration material shall be supplied from one single approved production batch. If additional batches are required, provide new testing results that demonstrate the Filter Media Mix meets specifications.

F. Initially delivered batch from approved Soil Filter Mix stockpile shall be tested using ASTM D2434 to confirm that the percolation rate meets specifications prior to installation. Testing labs approved for construction material testing by the City of San Diego can be found at www.sandiego.gov/developmentservices/industry/pdf/testlabs.pdf.

G. Each delivered batch of Filtration Material for Bioretention Basins shall be:

1. Mixed upon arrival on site to ensure that the material is well-graded and contains no gaps in the particle size range.
2. Accompanied by a certification letter from the supplier verifying that the material meets specifications and is supplied from the approved Soil Filter Mix stockpile

2.2 GRAVEL BASE

A. Drainage Rock shall be AASHTO or CalTrans equivalent (Class 2 Permeable Material) with no fines.

B. Gravel Base Material:

1. Shall be free of wood, waste, coating such as clay, stone dust, carbonate, etc., or any other deleterious material. All aggregate passing the No. 200 sieve size shall be non-plastic.

2. Shall meet the following gradation:

a. Sieve Size Percent Passing (by weight)

Filtration Material	Percentage passing
1"	100
3/4"	90-100
3/8"	40–100
No. 4	25–40
No. 8	18–33
No. 30	5–15
No. 50	0–7
No. 200	0–3

C. Do not use filter fabric or an impermeable liner to separate the Filtration Material from the Gravel Base drainage layer or the gravel drainage layer from the native soil. A transition layer may be used of course sand (nominal size – 1 to 2 mm).

2.3 IMPERMEABLE BASIN LINER

A. Liner material shall be Polyvinyl Chloride (PVC) or High-Density Polyethylene (HDPE) or Linear Low Density Polyethylene (LLDPE). Liner materials should consist of new first quality raw materials. Recycling of manufactured PVC, HDPE or LLDPE products and/or materials shall not occur. Additives may be used provided they do not interfere with the intended use of the product and are used according to the manufacturer's recommendation.

B. Liner material should be produced as single, homogenous sheets free of holes, blisters, roughness, striations, and contamination by foreign matter, undispersed raw materials, or any other defect which may cause the liner to deviate from the minimum material requirements. If such conditions are found to exist, the engineer has the option to reject the roll, or ask the material supplier to repair the defective area. Where excessive damage or a repeating pattern of damage to the liner has occurred, the engineer shall reject the roll.

C. Liner material shall be supplied in rolls. Labels on each roll shall identify the thickness of the material, the length and width of the roll, lot and roll numbers, and name of manufacturer.

D. Liner material stored on site should be protected to keep PVC sheeting clean and dry. Storage should minimize exposure to excessive heat or sunlight. The manufacturer should provide specific information regarding allowable exposure conditions.

E. Prior to delivery of the synthetic liner to the job site, manufacturer certified test results, showing that liner made from each new batch of raw material meets all specification requirements, should be supplied to the engineer. Additional random samples should be taken from liner rolls shipped to the site according to the following rate:

1. These samples should be tested by an independent testing laboratory for thickness, elongation, and tensile properties. Test results shall be reported to the engineer and contractor. Testing labs approved for construction material testing by the City of San Diego: www.sandiego.gov/developmentservices/industry/pdf/testlabs.pdf

2. Certified test results from the manufacturer should show that all material properties are in conformance with the specifications.

3. Shall meet the following minimum requirements from ASTM Standard D7176 [Geomembranes used in Buried Applications]:

Certified Properties	Test Method	Requirement
Thickness (mils)	D5199	30 ± 1.5
Tensile Properties (minimum)		
Strength at Break	D882	73 lb/in
Elongation		380 %
Modulus at 100%		30 lb/in
Tear Strength (min)	D1004	8 lb
Dimensional Stability (max change)	D1204	3%
Low Temperature Impact	D1790	-20°F
Specific Gravity (min)	D792	1.2
Water Extraction (max loss)	D1239	0.15%
Volatile Loss (max loss)	D1203	0.70%

Certified Properties	Test Method	Requirement
Soil Burial (max change)	G160	
Break Strength		5%
Elongation		20%
Modulus at 100%		20%
Hydrostatic Resistance (min)	D751	100 psi
Minimum Average Molecular Weight	D2124	400

4. Factory seams shall meet the following minimum requirements from ASTM Standard D7408 [Geomembranes Seam Strength]:

Property	Test Method	Value
Bonded Seam Strength (factory seam, breaking factor, ppi width)	ASTM D3083	55.2
Peel Adhesion (lbs/in. minimum)	ASTM D413	10
Resistance to Soil Burial (max % Change in original value)	ASTM D3083	
1. Peel adhesion		-20
2. Bonded Seam Strength		-20

PART 3 - EXECUTION

3.1 IMPEREABLE BASIN LINER

A. Installation

1. Substrates must be clean, dry, smooth, and free of sharp edges, fins, loose or foreign materials, oil, grease, and other materials that may damage the liner.

2. All roughened surfaces that can damage the basin liner shall be repaired as specified to offer a smooth substrate. This includes concrete structures.

3. Liner rolls should be applied according to plans supplied by the manufacturer, and no deviation will be allowed except with approval of the engineer. Only those panels that can be seamed that day will be deployed.

4. Liner panels shall be overlapping according to manufacturers' recommendation. Overlap distance must be sufficient so that all seam tests can be performed as stated in the various test procedures. Typical overlaps are three to six inches. There shall be no loose flap on the top side of the completed seam, resulting from the overlap, to avoid catching during covering.

5. At no time during liner placement shall any vehicle be allowed directly on the exposed liner.

6. All workers, inspectors, and supervisors must wear soft-soled shoes.

B. Seaming:

1. All seaming of PVC panels should be made according to the manufacturer's recommendations. Ambient temperatures for seaming should be in the range of 50 to 95°F. Seaming should not occur on wet or damp PVC bonding areas. In addition, interfaces should be cleaned of all dust and dirt. Any method is acceptable as long as it can consistently produce a seam that passes all seam tests. Liner materials stored over winter or for long periods of time may be difficult to bond. Consult the manufacturer for potential seaming difficulties.

2. The type of adhesive and method of application should be according to the manufacturer's recommendation. Paint rollers shall not be used as they cannot reach the "v" area formed by the last seamed area.

3. Following adhesive application, seams shall be closed immediately to prevent excessive solvent evaporation. A dull or cloudy adhesive film appearance, prior to closing the seam, may indicate a high rate of evaporation.

4. All solvent or cleaning agents should be stored away from PVC material to prevent degradation of the materials from spills. Any spills of solvent or cleaning agents on the liner should be wiped up immediately.

5. The final product seam should be capable of producing a continuous homogenous bond at every location, meeting seam strength requirements

6. Fish mouths are not allowed. A fish mouth is defined as an area in the seam where one liner panel is first folded over on itself and a second liner panel is placed and welded over this fold. Where fish mouths occur, the liner must be cut, overlapped and covered with a patch.

3.2 INSTALLATION AND TESTING

A. Infiltration basins shall not be constructed until all of the contributing drainage area has been completely stabilized, thereby reducing high sediment loads associated with construction. Upstream construction shall be completed and stabilized before connection to a downstream infiltration facility

B. In-situ Percolation Testing Filtration Material:

1. Conduct an in-situ percolation rate test within bioretention basins for a test area of at least 2' by 2'. Methodology shall include soil saturation following by a percolations test. For saturation, continuously add water to the test area to saturate the formation (minimum saturation period of 2 hours). To complete percolation test, add water to the test area while keeping the water height constant (minimum test 4 hours). Record the volume of the added water and time during the testing. Percolation rate is linearly proportional to the volume of the added water. In-situ percolation shall be a minimum rate of 5 inches per hour and a maximum rate of 10 inches per hour.

2. The minimum geotechnical testing is one test hole per 5000 sf, with a minimum of two borings per facility (taken within the proposed limits of the facility).

C. Failure of Percolation Test:

1. Report in writing to the Engineer all areas not passing these tests, and all soil conditions that the Contractor considers detrimental to drainage/percolation.

2. The Contractor is to use recommendations as provided by the Engineer and make a proposal that states condition, and cost estimate for correcting the unsatisfactory conditions.

3. Obtain the Engineer's instructions prior to proceeding with the work.

4. Re-test after corrections have been made under the direction of the Engineer.

5. Failure to perform drainage tests, and/or to notify the Engineer in writing of the conditions specified above, renders the Contractor responsible for all bioretention basin/drainage failure that occurs, as determined by the Engineer.

*** END OF SECTION ***

SECTION 02644

PVC NONPRESSURE PIPE

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide underground PVC nonpressure pipe and all appurtenant work, complete in place.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 02200 Earthwork
2. Section 03300 Cast in Place Concrete

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated in this Section, the CONTRACTOR shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC) together with the latest adopted editions of the Regional and City of San Diego Supplement Amendments.

B. Except as otherwise indicated, the current editions of the following apply to the Work of this Section:

1.	ASTM D 2321	Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
2.	ASTM D 3033	Type PSP Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
3.	ASTM D 3034	Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
4.	ASTM F679	Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings

1.4 HANDLING

B. Handling of the PVC pipe shall be done in accordance with manufacturer's instructions to ensure that the pipe is not damaged in any manner during storage, transit, loading, unloading, and installation.

PART 2 - PRODUCTS

2.1 GENERAL

B. PVC pipe, fittings, couplings and appurtenances shall comply with SSPWC Subsection 207-17, and shall conform to the requirements of ASTM D3034.

C. In addition to the identification marks specified in SSPWC 207-17.2.1, the CONTRACTOR shall also require the manufacturer to mark the date of extrusion on the pipe. This dating shall be done in conjunction with records to be held by the manufacturer for 2 years, covering quality control tests, raw material batch number, and other information deemed necessary by the manufacturer.

D. All PVC pipe shall be suitable for joining by compression joints unless otherwise shown or indicated.

2.2 BEDDING MATERIAL AND BACKFILL

A. Unless otherwise indicated, all material used for pipe bedding shall conform to the requirements of SSPWC Subsection 306-1.2.13 and Section 02200 Earthwork, and trench backfill material shall comply with the requirements in Section 02200 - Earthwork.

PART 3 - EXECUTION

3.1 GENERAL

A. All laying, jointing, testing for defects and for leakage shall be performed in the presence of the RESIDENT ENGINEER, and shall be subject to his approval before acceptance.

B. Installation shall conform to the recommendations of pipe manufacturer, the requirements of ASTM D 2321, SSPWC Subsection 306-1.2.13, and as indicated herein.

C. Traffic: The CONTRACTOR's operations shall comply in all respects with SSPWC Section 7.

D. Utility Relocation: The CONTRACTOR's operations shall comply in all respects with SSPWC Section 5.

3.2 TRENCHING AND BACKFILL

A. Trench excavation and backfill shall conform to the requirements of Sections 02200 - Earthwork and SSPWC Subsection 306-1.3.

B. The minimum depth of cover over the top of the pipe shall be 36 inches unless otherwise shown. Trench widths shall be as shown on the Drawings.

3.3 LAYING PIPE

A. Immediately before placing each section of pipe in final position for jointings, the bedding for the pipe shall be checked for firmness and uniformity of surface.

B. Proper implements, tools, and facilities as recommended by the pipe manufacturer's standard printed installation instructions shall be provided and used by the CONTRACTOR for safe and efficient execution of the Work. All pipe, fittings, valves, and accessories shall be carefully lowered into the trench by means of derrick, ropes, or other suitable equipment in such a manner as to prevent damage to pipe and fittings. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.

C. Cutting and machining of the pipe shall be accomplished in accordance with the pipe manufacturer's standard procedures for this operation. Pipe shall not be cut with a cold chisel, standard iron pipe cutter, or any other method that may fracture the pipe or will produce ragged, uneven edges.

D. The pipe and accessories shall be inspected for defects prior to lowering into the trench. Any defective, damaged or unsound pipe shall be repaired or replaced. All foreign matter or dirt shall be removed from the interior of the pipe before lowering into position in the trench. Pipe shall be kept clean during and after laying. All openings in the pipe line shall be closed with water tight expandable type sewer plugs or PVC test plugs at the end of each day's operation or whenever the pipe openings are left unattended. The use of burlap, wood, or other similar temporary plugs will not be permitted.

E. Where indicated that the grade or alignment of the pipe is obstructed by existing utility structures such as conduits, ducts, pipes, branch connections to main sewers, or main drains, the obstruction shall be permanently supported, relocated, removed, or reconstructed by the CONTRACTOR in cooperation with owners of such utility structures. Unless otherwise indicated, this Work shall be performed at the CONTRACTOR's expense.

3.4 FIELD JOINTING

A. Pipe shall be jointed in compliance with manufacturer's printed instructions.

B. When pipe laying is not in progress, the open ends of the pipe shall be closed to prevent trench water from entering pipe. Adequate backfill shall be deposited on pipe to prevent floating of pipe. Any pipe which has floated shall be removed from the trench, cleaned, and re-laid in an acceptable manner. No pipe shall be laid when, in the opinion of the RESIDENT ENGINEER, the trench conditions or weather are unsuitable for such work.

3.5 INSTALLATION OF BENDS, TEES, AND REDUCERS

A. Fittings shall be installed using standard installation procedures. Fittings shall be lowered into the trench by means of rope, cable, chain, or other acceptable means without damage to the fittings. Cable, rope, or other devices used for lowering fittings into trench shall be attached around the exterior of fitting for handling. Under no circumstances shall the cable, rope or other device be attached through the fitting's interior for handling. Fittings shall be carefully connected to the pipe or other facility, and joints shall be checked to ensure a sound and proper joint.

3.6 COMPACTION OF PIPE BEDDING AND BACKFILL

A. Compaction of pipe bedding and trench backfill material shall conform to the requirements of Section 02200 - Earthwork.

*** END OF SECTION ***

SECTION 02645

PVC PRESSURE PIPE (4 IN. AND SMALLER)

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The Work of this Section includes providing solvent-welded, polyvinyl chloride (PVC) piping as indicated, including fittings and accessories as required for a complete and operable piping system, up to and including 4-inch diameter pipe.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 02200 Earthwork
2. Section 09800 Protective Coating
3. Section 15000 Piping Components
4. Section 15020 Pipe Supports
5. Section 15030 Piping Identification Systems

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated in this Section, the CONTRACTOR shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction together with the latest adopted editions of the Regional and City of San Diego Supplement Amendments.

B. The Work of this Section shall comply with the current edition of the Uniform Plumbing Code as adopted by the City of San Diego.

C. Except as otherwise indicated, the current editions of the following apply to the Work of this Section:

1.	ASTM D 1599	Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing and Fittings.
2.	ASTM D 1785	Specification for Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.
3.	ASTM D 2467	Specification for Socket-Type Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80.

1.4 CONTRACTOR SUBMITTALS

A. The following shall be submitted in compliance with Section 01300 - Submittals:

1. Manufacturer's product data.

2. Shop drawings showing dimensions and details of pipe joints, fittings, fitting specials, valves and appurtenances.

1.5 NOT USED

1.6 PROJECT RECORD DRAWINGS

A. For concealed field-routed piping, the CONTRACTOR shall provide Record Drawings in compliance with City of San Diego Standard Specifications For Public Works Construction Section 2-5.4. The Record Drawings shall be complete layout drawings indicating the location of the pipeline as installed, with dimensions, the length and depth of all pipe runs, offsets from structures and other facilities, and the locations of bends, fittings, specials, and appurtenances.

1.7 NOT USED

1.8 FIELD TESTING

A. Piping shall be pressure tested at a pressure of 1-1/2 times the maximum working pressure for not less than one hour with no leakage.

B. Leakage may be determined by loss of pressure, soap solution, chemical indicator, or other positive and accurate method. All fixtures, devices, or other accessories connected to the line which would be damaged by the test pressure shall be disconnected. Ends of branch lines disconnect points shall be plugged or capped as appropriate during the test procedure.

C. Leaks shall be repaired to the satisfaction of the RESIDENT ENGINEER and the piping shall be re-tested until no leaks are found.

1.9 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials: Piping materials shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer.

B. Storage: Piping materials shall be carefully stored in a manner that will prevent damage and in an area that is protected from sunlight and other harmful elements.

PART 2 - PRODUCTS

2.1 GENERAL

A. General: Pipe and fittings for welded joints shall comply with the requirements of Subsection 212-2.1.3 of SSPWC and as indicated herein.

2.2 PIPE

A. PVC pipe shall conform to ASTM D 1785 - Schedule 80, suitable for solvent weld joints unless indicated otherwise.

2.3 FITTINGS

A. Fittings shall be socket fittings conforming to ASTM D 2467 - Schedule 80 unless indicated otherwise.

2.4 PIPE SUPPORTS

A. Pipe supports shall conform to the requirements of Section 15020 - Pipe Supports and shall also be in compliance with the manufacturer's recommendations.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING

A. General: PVC pipe shall be installed in accordance with Subsection 308-5.2.3 of SSPWC and the manufacturer's instructions for solvent weld joints.

B. For exposed piping, pipe supports shall be provided in compliance with Section 15020 - Pipe Supports and as recommended by the pipe manufacturer.

C. For buried piping, trenching configuration pipe zone material, backfill and compaction shall be performed in accordance with the manufacturer's instructions, and in compliance with Section 02200 - Earthwork.

3.2 PROTECTIVE COATING OF EXPOSED PVC PIPING

A. Unless otherwise indicated, PVC piping exposed to sunlight shall be painted as specified in Section 09800 - Protective Coating.

3.3 PIPE IDENTIFICATION

A. Piping identification shall be in compliance with Section 15030 - Pipe Identification Systems.

B. Continuous plastic marking tape and metallic locator tape shall be installed in accordance with the requirements of Section 02200 - Earthwork along the pipeline at the depth and location shown on the Drawings.

*** END OF SECTION ***

SECTION 02650

STEEL PIPE, LINED AND COATED

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section is to provide steel pipe, lined and coated as specified herein, within the pump station facility and its property limits, above and below grade, complete, in accordance with the CONTRACT DOCUMENTS.

B. Work shall be performed as shown on the plans and as specified in the Standard Specifications for Public Works Construction ("Greenbook"), City Supplements ("Whitebook"), and the Supplementary Special Provisions provided in the CONTRACT DOCUMENTS

C. Payment for work within the pump station facility and property limits shall be in accordance to Section 01025.

D. Payment for work within the public rights-of-way shall be in accordance with the Greenbook (current edition), the Whitebook (current edition), as modified by the Supplementary Special Provisions.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated, the current editions of the following commercial standards apply to the Work of this Section:

1. ANSI/AWWA C210 Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines

1.3 DESIGN (OPERATING) PRESSURE AND TEST PRESSURE

A. Design (operating) pressure and test pressure shall be as identified on the pipe schedule in the drawings.

PART 2 – PRODUCTS

2.1 GENERAL

A. Products shall be per paragraph 02650-1.1B except as indicated otherwise. Minimum pipe thickness for buried piping shall be 0.25 inches, or per AWWA M-11, whichever is greater.

2.2 EXTERIOR COATING OF PIPE

A. Exterior Coating of Exposed Piping: Exposed steel pipe shall be epoxy coated with a final color coat as specified in Section 09800 - Protective Coating. Unless otherwise specified, pipe and fittings shall be coated with a liquid epoxy as specified in AWWA C210 with the following exceptions:

1. No coal tar products shall be incorporated in the liquid epoxy.

2. The curing agent may be an amidoamine as well as the other curing agents listed in AWWA C210.

B. The coating shall be applied to a minimum thickness of 16 mils in not less than two coats.

C. Coating of Buried Piping: Buried steel pipe shall be tape wrapped and provided with cement-mortar armor per SSPWC 207-10.4.7.

D. Coating of Encased Piping: Steel pipe encased in concrete shall be tape wrapped as specified for buried piping except that the cement-mortar armor coating shall be deleted.

PART 3 – EXECUTION (Per paragraph 1.1B)

*** END OF SECTION ***

SECTION 02831

CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section is to provide chain link fencing, gates and appurtenances, complete and operable, in accordance with the CONTRACT DOCUMENTS.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. The Work of this Section shall comply with the current edition of the Uniform Building Code as adopted by the City of San Diego.

B. Except as otherwise indicated in this Section, the CONTRACTOR shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC) together with the latest adopted editions of the Regional and City of San Diego Supplement Amendments.

C. Except as otherwise indicated, the current editions of the following apply to the Work of this Section:

1.	ASTM A 90	Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles
2.	ASTM A 392	Specification for Zinc-Coated Steel Chain-Link Fence Fabric
3.	ASTM F 668	Specification for PVC Coated Steel Chain-Link Fence Fabric

PART 2 - PRODUCTS

2.1 GENERAL

A. General: Materials for chain link fencing, gates and appurtenances shall conform to the requirements of SSPWC Subsection 206-6 and as indicated herein.

2.2 POSTS, RAILS AND BRACES

A. Materials for posts, rails and braces shall be Class 1 PVC coated complying with SSPWC Subsection 206-6.1 and 206-6.2. Posts and rails shall be minimum of 2 inches I.D.

2.3 WIRE FABRIC

A. Chain link fabric shall be PVC coated, Class 2 conforming to SSPWC Subsection 206-6.3.1 and 206-6.3.2. Fabric wire shall be 9 gauge before coating. Wire fabric shall be factory tested for weight of zinc coating in accordance with method specified in ASTM A 90.

2.4 FOOTINGS

A. Concrete for post footings shall conform to SSPWC Subsection 201-1, Class 520-C-2500 concrete.

2.5 COATING

A. PVC coated fabric shall conform to ASTM F668. Color shall black or as selected by the CONTRACTOR and approved by the OWNER.

2.6 FITTINGS & BARBED WIRE

A. Extension arms for barbed wire shall be of a type that can be attached to the tops of the posts and carry three wires at approximately 5 inches centers in plane approximately 45 degrees from the vertical.

B. Chain link fence shall have three strands of vinyl-coated barbed wire .Barbed wire shall be four point pattern, composed of three strands of 12-1/2 gage galvanized steel wire with barbs spaced 5 inches apart and shall conform to ASTM A 121.

*** END OF SECTION ***

SECTION 03100

CONCRETE FORMWORK

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide concrete formwork, bracing, shoring, supports, and false work, in accordance with the Contract Documents.

B. Work Included in this Section. Principal items are:

1. Furnishing, erection, and removal of forms.

2. Shoring and bracing of formwork.

3. Setting of embedded items and pipe sleeves for mechanical and electrical work under direction of respective trade.

1.2 RELATED SECTIONS

A. The Work of the following Sections apply to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of the Work.

1. Section 03200 Reinforcement Steel
2. Section 03290 Joints in Concrete Structures
3. Section 03300 Cast-in-Place Concrete
4. Section 03315 Grout

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC), together with the latest adopted editions of the Regional and City of San Diego Supplement Amendments.

B. The current edition of the California Building Code (CBC) as adopted by the City of San Diego Municipal Code.

C. Except as otherwise indicated, the current editions of the following apply to the Work of this Section:

1.	APA PS 1	U.S. Product Standard for Concrete Forms, Class I
2.	ALSC PS 20	American Softwood Lumber Standard

3.	ACI 117	Standard Specifications for Tolerances for Concrete Construction and Materials
4.	ACI 347	Guide to Formwork for Concrete

1.4 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall, in accordance with the requirements in Section 01300 - Submittals, submit the following.

1. Form ties and all related accessories, including taper tie plugs, if taper ties are used.
2. Form gaskets.

B. The CONTRACTOR shall provide concrete construction joints and expansion joints of the types and locations indicated on the Drawings. The CONTRACTOR shall submit shop drawings showing the proposed location and type of required construction for any joints not shown on the Drawings, and the sequence of forming and concrete placing operations.

C. Forms and false work to support the roof and floor slabs shall be designed for the total dead load, plus a live load of 50 psf (minimum). The minimum design load for combined dead and live loads shall be 100 psf.

1.5 QUALITY ASSURANCE

A. The CONTRACTOR shall comply with the requirements of California Division of Occupational Health and Safety Construction Safety Orders Section 1717 and OSHA Part 1926, Section 1926.701 that apply to the Work of this Section. The CONTRACTOR shall prepare and maintain at least one copy of the required drawings at the site. Design of the structures shown on the Drawings does not include any allowance or consideration for imposed construction loads. Shoring and falsework design drawings and calculations shall be stamped and signed by a professional engineer registered in the State of California. The CONTRACTOR shall provide forms, shoring and falsework adequate for imposed live and dead loads, including equipment, height of concrete drop, concrete and foundation pressures, stresses, lateral stability, and other safety factors during construction.

B. Tolerances: The CONTRACTOR shall employ formwork complying with ACI 347 Guide to Formwork for Concrete, except as exceeded by the requirements of regulatory agencies, or as otherwise indicated or specified. The CONTRACTOR shall design and construct formwork to produce finished concrete conforming to tolerances given in ACI 117.

PART 2 - PRODUCTS

2.1 GENERAL

A. Except as otherwise expressly accepted by the RESIDENT ENGINEER, all lumber brought on the job site for use as forms, shoring, or bracing shall be new material. All forms shall be smooth surface forms and shall be of the following materials:

Walls	-	Steel or plywood panel
Columns	-	Steel, plywood or fiber glass
Roof and floor	-	Plywood
All other work	-	Steel panels, plywood or tongue and groove lumber

B. Form materials which may remain or leave residues on or in the concrete shall be classified as acceptable for potable water use by the Environmental Protection Agency within 30 days of application or use.

2.2 FORM AND FALSE WORK MATERIALS

A. Materials for concrete forms, formwork, and false work shall conform to the following requirements:

1. Lumber shall be Douglas Fir or Southern Yellow Pine, construction grade or better, in conformance with U.S. Product Standard PS 20.

2. Plywood for concrete formwork shall be new, waterproof, synthetic resin bonded, exterior type Douglas Fir or Southern Yellow Pine plywood manufactured especially for concrete formwork and shall conform to the requirements of PS 1 for Concrete Forms, Class I, and shall be edge sealed.

3. Form materials shall be metal, wood, plywood, or other approved material that will not adversely affect the concrete and will facilitate placement of concrete to the shape, form, line, and grade shown. Metal forms shall be an approved type that will accomplish such results. Wood forms for surfaces to be painted shall be Medium Density Overlaid plywood, MDO Ext. Grade.

2.3 FORM TIES

A. Form ties with integral water stops shall be provided with a plastic cone or other suitable means for forming a conical hole to insure that the form tie may be broken off back of the face of the concrete. The maximum diameter of removable cones for rod ties, or of other removable form-tie fasteners having a circular cross-section, shall not exceed 1-1/2 inches; and all such fasteners shall be such as to leave holes of regular shape for reaming. Form ties shall be Standard Snap Tie by Dayton Superior; Masco Snapties by the Masons Supply Company; or approved alternate.

B. Form ties for water-retaining structures shall have integral water stops. Removable taper ties may be used when approved by the RESIDENT ENGINEER. A preformed neoprene or polyurethane tapered plug sized to seat at the center of the wall shall be inserted in the hole left by the removal of the taper tie. Use Taper Ties by Dayton Superior; Masco Taper Tie by the Masons Supply Company; or approved alternate.

2.4 FORM COATING

A. Non-grainraising and nonstaining resin or polymer type that will not leave residual matter on surface of concrete or adversely effect bonding to concrete of paint, plaster, mortar, protective coatings, waterproofing or other applied materials. Coatings containing mineral oils, paraffins, waxes or other nondrying ingredients, are not permitted. For concrete surfaces contacting portable stored water, use only coatings and form-release agents that are completely nontoxic.

2.5 FORM JOINT SEALERS

A. For joints between form panels, use resilient foam rubber strips, non-hardening plastic-type caulking compound free of oil, or waterproof pressure-sensitive plastic tape of minimum 8 mil thickness and 2 inches width. For form tie holes, use rubber plugs, plastic caulking compound, or equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Forms to confine the concrete and shape it to the required lines shall be used wherever necessary. The CONTRACTOR shall assume full responsibility for the adequate design of all forms, and any forms which are unsafe or inadequate in any respect shall promptly be removed from the Work and replaced at no increased cost to the OWNER. The CONTRACTOR shall provide worker protection from protruding reinforcement bars in accordance with applicable safety codes. A sufficient number of forms of each kind shall be provided to permit the required rate of progress to be maintained. The design and inspection of concrete forms, false work, and shoring shall comply with applicable local, state and Federal regulations. Plumb and string lines shall be installed before concrete placement and shall be maintained during placement. Such lines shall be used by CONTRACTOR's personnel and by the RESIDENT ENGINEER and shall be in sufficient number and properly installed. During concrete placement, the CONTRACTOR shall continually monitor plumb and string line form positions and immediately correct deficiencies.

B. Concrete forms shall conform to the shape, lines, and dimensions of members as called for on the Drawings, and shall be substantial, free from surface defects, and sufficiently tight to prevent leakage. Forms shall be properly braced or tied together to maintain their position and shape under a load of freshly placed concrete. If adequate foundation for shores cannot be secured, trussed supports shall be provided.

C. Unless otherwise indicated, exterior corners in concrete members shall be provided with 3/4-inch chamfers. Re-entrant corners in concrete members shall not have fillets unless otherwise indicated.

3.2 FORM DESIGN

A. All forms shall be true in every respect to the required shape and size, shall conform to the established alignment and grade, and shall be of sufficient strength and rigidity to maintain their position and shape under the loads and operations incident to placing and vibrating the concrete. Suitable and effective means shall be provided on all forms for holding adjacent edges and ends of panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets, or similar surface defects in the finished concrete. Plywood, 5/8-inch and greater in thickness, may be fastened directly to studding if the studs are spaced close enough to prevent visible deflection marks in the concrete. The forms shall be tight so as to prevent the loss of water, cement and fines during placing and vibrating of the concrete. Specifically, the bottom of wall forms that rest on concrete footings or slabs shall be provided with a gasket to prevent loss of fines and paste during placement and vibration of concrete. Such gasket may be a 1- to 1-1/2-inch diameter polyethylene rod held in position to the underside of the wall form. Adequate clean-out holes shall be provided at the bottom of each lift of forms. The size, number, and location of such clean-outs shall be as acceptable to the RESIDENT ENGINEER. Whenever concrete cannot be placed from the top of a wall form in a manner that meets the requirements of the Contract Documents, form windows shall be provided in the size and spacing needed to allow placement of concrete to the requirements of Section 03300 - Cast-in-Place Concrete. The size, number, and location of such form windows shall be as acceptable to the RESIDENT ENGINEER.

3.3 CONSTRUCTION

A. Vertical Surfaces: All vertical surfaces of concrete members shall be formed, except where placement of the concrete against the ground is shown. Not less than 1 inch of concrete shall be added to the thickness of the concrete member as shown where concrete is permitted to be placed against trimmed ground in lieu of forms. Such permission will be granted only for members of comparatively limited height and where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing until the concrete has been placed.

B. Construction Joints: Concrete construction joints will not be permitted at locations other than those shown or specified, except as may be acceptable to the RESIDENT ENGINEER. When a second lift is placed on hardened concrete, special precautions shall be taken in the way of the number, location, and tightening of ties at the top of the old lift and the bottom of the new to prevent any unsatisfactory effect whatsoever on the concrete. Pipe stubs and anchor bolts shall be set in the forms where required.

C. Form Ties:

1. Embedded Ties: Holes left by the removal of form tie cones shall be reamed with suitable toothed reamers so as to leave the surface of the holes clean and rough before being filled with mortar as specified for "Finish of Concrete Surfaces" in Section 03300 - Cast-in-Place Concrete. Wire ties for holding forms will not be permitted. No form-tying device or part thereof, other than metal, shall be left embedded in the concrete. Ties shall not be removed in such manner as to leave a hole extending through the interior of the concrete members. The use of snap-ties which cause spalling of the concrete upon form stripping or tie removal will not be permitted. If steel panel forms are used, rubber grommets

shall be provided where the ties pass through the form in order to prevent loss of cement paste. Where metal rods extending through the concrete are used to support or to strengthen forms, the rods shall remain embedded and shall terminate not less than 1 inch back from the formed face or faces of the concrete.

2. Removable Ties: Where taper ties are approved for use, the larger end of the taper tie shall be on the wet side of walls in water retaining structures. After the taper tie is removed, the hole shall be thoroughly cleaned and roughened for bond. A precast neoprene or polyurethane tapered plug shall be located at the wall centerline. The hole shall be completely filled with non-shrink grout for water bearing and below-grade walls. The hole shall be completely filled with non-shrink or regular cement grout for above-grade walls which are dry on both sides. Exposed faces of walls shall have the outer 2 inches of the exposed face filled with a cement grout which shall match the color and texture of the surrounding wall surface.

D. Embedded Items: Before the placement of concrete within the forms, each trade having embedded items, including water stops within the forms and affected by the pour, shall certify that all items are properly located and braced. This certification shall be provided by the CONTRACTOR to the RESIDENT ENGINEER at least 24 hours in advance of placement.

3.4 EMBEDDED PIPING AND ROUGH HARDWARE

A. The CONTRACTOR shall consult with all trades which require openings for the passage of pipes, conduits and other inserts, and properly and accurately install the necessary pipe sleeves, anchors, or other required inserts, and properly size the equipment pads. The CONTRACTOR shall reinforce openings as indicated and required. The CONTRACTOR shall locate conduits or pipes so as not to reduce the strength of the construction, and in no case, place pipes, other than conduits, in a slab 4-1/2 inches or less in thickness. The CONTRACTOR shall not embed conduit having an outside diameter greater than 1/3 of the thickness of the slab in a concrete slab, nor place conduit below bottom reinforcing steel or over top reinforcing steel. Conduits may be embedded in walls, provided they are not larger in outside diameter than 1/3 the thickness of the wall, are not spaced closer than three diameters on center, and do not impair the strength of the structure. The CONTRACTOR shall support embedded pipes and conduits independently from reinforcing steel in a manner to prevent metallic contact, and thereby, prevent electrolytic deterioration. The CONTRACTOR shall place embedded pipes and conduits as nearly as possible to the center line of the concrete section. The CONTRACTOR shall submit all conduit, piping and other wall penetrations, reinforcements and anchor bolt sizing and locations for review and approval.

3.5 REMOVAL OF FORMS

A. Careful procedures for the removal of forms shall be strictly followed, and this Work shall be done with care so as to avoid injury to the concrete. No heavy loading on green concrete will be permitted. In the case of roof slabs and above-ground floor slabs, forms for supported slab, but not shoring, shall remain in place until test cylinders for the roof concrete attain a minimum compressive strength of 75 percent of the 28-day strength specified in Section 03300 - Cast-in-Place Concrete; provided, that no forms shall be disturbed or removed under an individual panel or unit before the concrete in the adjacent

panel or unit has attained 75 percent of the specified 28-day strength and has been in place for a minimum of 7 days. The time required to establish said strength shall be as determined by the RESIDENT ENGINEER who will make several test cylinders for this purpose from concrete used in the first group of roof panels placed. If the time so determined is more than the 7-day minimum, then that time shall be used as the minimum length of time. Forms for all vertical walls and columns shall remain in place at least 2 days after the concrete has been placed. Forms for all parts of the Work not specifically mentioned herein shall remain in place for periods of time as determined by the RESIDENT ENGINEER.

3.6 REUSE OF FORMS

A. Forms may be reused only if in good condition and only if acceptable to the RESIDENT ENGINEER. Light sanding between uses will be required wherever necessary to obtain uniform surface texture on all exposed concrete surfaces. Exposed concrete surfaces are defined as surfaces which are permanently exposed to view. In the case of forms for the inside wall surfaces of hydraulic/water retaining structures, unused tie rod holes in forms shall be covered with metal caps or shall be filled by other methods acceptable to the RESIDENT ENGINEER.

3.7 MAINTENANCE OF FORMS

A. Forms shall be maintained at all times in good condition, particularly as to size, shape, strength, rigidity, tightness, and smoothness of surface. Forms, when in place, shall conform to the established alignment and grades. Before concrete is placed, the forms shall be thoroughly cleaned. The form surfaces shall be treated with a non-staining mineral oil or other lubricant acceptable to the RESIDENT ENGINEER. Any excess lubricant shall be satisfactorily removed before placing the concrete. Care shall be exercised to keep oil off the surfaces of steel reinforcement and other metal items to be embedded in concrete.

3.8 FALSE WORK

A. The CONTRACTOR shall be responsible for the design, engineering, construction, maintenance, and safety of all false work, including staging, walkways, forms, ladders, and similar appurtenances, which shall equal or exceed the applicable requirements of the provisions of the OSHA Safety and Health Standards for Construction, and the requirements of the California Division of Industrial Safety.

3.9 REMOVAL OF SHORING AND FALSE WORK

A. The CONTRACTOR shall not remove shoring and false work until 21 days after concrete placement, or concrete has attained at least 90 percent of the 28 day design compressive strength as demonstrated by control test cylinders, but not sooner than 14 days.

3.10 LOAD RESTRICTION

A. The CONTRACTOR shall not impose construction, equipment or permanent loads on columns, supported slabs, or supported beams until concrete has attained the 28 day design compressive strength.

*** END OF SECTION ***

SECTION 03200

REINFORCEMENT STEEL

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide concrete reinforcement steel, welded wire fabric, couplers, concrete inserts, wires, clips, supports, chairs, spacers, and other accessories, complete, all in accordance with the Contract Documents.

B. Work Included in this Section. Principal items are:

1. Furnishing and placing bar and mesh reinforcing for cast-in-place concrete.
2. Furnishing reinforcing steel bars for masonry, including delivery to the site.
3. Submittals.

1.2 RELATED SECTIONS

A. The Work of the following Sections apply to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 03100 Concrete Formwork
2. Section 03290 Joints in Concrete Structures
3. Section 03300 Cast-in-Place Concrete
4. Section 03315 Grout
5. Section 04232 Reinforced Concrete Block Masonry

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the latest adopted edition of the Standard specifications for Public Works Construction (SSPWC), together with the latest adopted editions of the Regional and City of San Diego Supplement Amendments.

B. The current edition of the California Building Code (CBC) as adopted by the City of San Diego Municipal Code.

C. Commercial Standards (Current Edition):

1.	ACI 117	Specification for Tolerances for Concrete Construction and Materials
2.	ACI 315	Details and Detailing of Concrete Reinforcement
3.	ACI 318	Building Code Requirements for Structural Concrete
4.	CRSI MSP	Concrete Reinforcing Steel Institute Manual of Standard Practice

5.	WRI	Manual of Standard Practice for Welded Wire Fabric
6.	AWS D1.4	Structural Welding Code - Reinforcing Steel

D. ASTM Standards in Building Codes (Current Edition):

1.	ASTM A82	Steel Wire, Plain, for Concrete Reinforcement
2.	ASTM A185	Steel Welded Wire Reinforcement, Plain, for Concrete
3.	ASTM A615	Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
4.	ASTM A706	Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
5.	ASTM A775	Epoxy-Coated Reinforcing Steel Bars

1.4 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall furnish shop bending diagrams, placing lists, and drawings of all reinforcement steel before fabrication in accordance with the requirements of Section 01300 - Submittals.

B. Details of the concrete reinforcement steel and concrete inserts shall be submitted at the earliest possible date after receipt of the Notice to Proceed. Details of reinforcement steel for fabrication and erection shall conform to ACI 315, ACI 301 and the requirements indicated. The shop bending diagrams shall show the actual lengths of bars, to the nearest inch, measured to the intersection of the extensions (tangents for bars of circular cross section) of the outside surface. The shop drawings shall include bar placement diagrams which clearly indicate the dimensions of each bar splice.

1.5 QUALITY ASSURANCE

A. If requested by the CONSTRUCTION MANAGER, the CONTRACTOR shall furnish samples from each heat of reinforcement steel delivered in a quantity adequate for testing. Costs of initial tests will be paid by the OWNER. Costs of additional tests due to material failing initial tests shall be paid by the CONTRACTOR.

PART 2 - PRODUCTS

2.1 MATERIAL REQUIREMENTS

A. Materials which may remain or leave residues on or within the concrete shall be classified as acceptable for potable water use by the Environmental Protection Agency within 30 days of application or use.

2.2 REINFORCEMENT STEEL

A. Reinforcement steel for all cast-in-place reinforced concrete construction shall conform to the following requirements:

1. Bar reinforcement shall conform to the requirements of ASTM A615 for Grade 60 Billet Steel Reinforcement or as otherwise indicated.

2. All welded reinforcement, specifically detailed or otherwise indicated, shall be low-alloy grade 60 deformed bars conforming to the requirements of ASTM A706.

3. Spiral reinforcement shall be cold-drawn steel wire conforming to the requirements of ASTM A82.

4. Tie wire shall be Annealed Steel, 14 gauge minimum.

B. Accessories:

1. Accessories shall include all necessary chairs, slab bolsters, concrete blocks, tie wires, dips, supports, spacers, and other devices to position reinforcement during concrete placement. All bar supports shall meet the requirements of the CRSI Manual of Standard Practice, Chapter 3, including special requirements for supporting epoxy coated reinforcing bars. Wire bar supports shall be CRSI Class 1 for maximum protection with a 1/16-inch minimum thickness of plastic coating which extends at least 2-inch from the concrete surface. Plastic shall be gray in color.

2. Concrete blocks (dobies), used to support and position reinforcement steel, shall have the same or higher compressive strength as specified for the concrete in which it is located. Wire ties shall be embedded in concrete block bar supports.

C. Epoxy coating for reinforcing and accessories, where indicated, shall conform to ASTM A775.

2.3 MECHANICAL COUPLERS

A. Mechanical couplers shall not be used.

2.4 WELDED SPLICES

A. Welded splices shall not be used.

2.5 EPOXY GROUT

A. Epoxy for grouting reinforcing bars shall be Hilti HIT-HY 200 or as specified on the Plans.

PART 3 - EXECUTION

3.1 GENERAL

A. All reinforcement steel, welded wire fabric and other appurtenances shall be fabricated, and placed in accordance with the requirements of the California Building Code and the supplementary requirements indicated herein.

3.2 FABRICATION AND DELIVERY

A. The CONTRACTOR shall conform to CRSI MSP, Chapters 6 and 7, except as otherwise indicated or specified. The CONTRACTOR shall bundle reinforcement and tag with suitable identification to facilitate sorting and placing, and transport and store at site so as not to damage material. The CONTRACTOR shall keep a sufficient supply of tested, approved, and proper reinforcement at site to avoid delays.

B. Bending and Forming: The CONTRACTOR shall bend bars of indicated size and accurately form in accordance with the requirements of ACI 315 and ACI 318 to shapes and lengths indicated on drawings and required by methods not injurious to materials. The CONTRACTOR shall not heat reinforcement for bending. Bars with kinks or bends not scheduled will be rejected.

C. Fabricating tolerance: All fabrication of reinforcing bars shall meet the requirements of ACI 117.

D. Reinforcing Bars for Masonry: The CONTRACTOR shall detail and fabricate bars at the shop, ready for installation by masons.

3.3 PLACING

A. Reinforcement steel shall be accurately positioned and shall be supported and wired together to prevent displacement, using annealed iron wire ties or suitable clips at intersections. All reinforcement steel shall be supported by concrete, plastic or metal supports, spacers or metal hangers which are strong and rigid enough to prevent any displacement of the reinforcement steel. Where concrete is to be placed on the ground, supporting concrete blocks (or dobies) shall be used, in sufficient numbers to support the bars without settlement, but in no case shall such support be continuous. All concrete blocks used to support reinforcement steel shall be tied to the steel with wire ties which are embedded in the blocks. For concrete over formwork, the CONTRACTOR shall furnish concrete, metal, plastic, or other acceptable bar chairs and spacers.

B. Limitations on the use of bar support materials shall be as follows:

1. Concrete Dobies: Permitted at all locations except where architectural finish is required.

2. Wire Bar Supports: Permitted only at slabs over dry areas, interior dry wall surfaces, and exterior wall surfaces.

3. Plastic Bar Supports: Permitted at all locations except on grade.

C. Tie wires shall be bent away from the forms in order to provide the specified concrete coverage.

D. Bars additional to those shown which may be found necessary or desirable by the CONTRACTOR for the purpose of securing reinforcement in position shall be provided by the CONTRACTOR at no additional cost to the OWNER.

E. Unless otherwise specified, reinforcement placing tolerances shall be within the limits specified in Section 7.5 of ACI 318 except where in conflict with the requirements of the CBC.

F. Bars may be moved as necessary to avoid interference with other reinforcement steel, conduits, or embedded items. If bars are moved more than one bar diameter, or enough to exceed the above tolerances, the resulting arrangement of bars shall be subject to the approval of the CONSTRUCTION MANAGER.

G. Welded wire fabric reinforcement placed over horizontal forms shall be supported on slab bolsters. Slab bolsters shall be spaced not more than 30 inches on centers, shall extend continuously across the entire width of the reinforcement mat, and shall support the reinforcement mat in the plane indicated.

H. Welded wire fabric placed over the ground shall be supported on wired concrete blocks (dobies) spaced not more than 3 feet on centers in any direction. The construction practice of placing welded wire fabric on the ground and hooking into place in the freshly placed concrete shall not be used.

I. Epoxy coated reinforcing bars shall be stored, transported, and placed in such a manner as to avoid chipping of the epoxy coating. Non-abrasive slings made of nylon and similar materials shall be used. Specially coated bar supports shall be used. All chips or cracks in the epoxy coating shall be repaired with a compatible epoxy repair material prior to placing concrete.

J. Accessories supporting reinforcing bars shall be spaced such that there is no deflection of the accessory from the weight of the supported bars. When used to space the reinforcing bars from wall forms, the forms and bars shall be located so that there is no deflection of the accessory when the forms are tightened into position.

3.4 SPLICES

A. Splicing shall be in accordance with ACI 318, unless otherwise noted on Drawings.

B. Vertical Bars. Except as specifically detailed or otherwise indicated, splicing of vertical bars in concrete is not permitted, except at the indicated or approved horizontal construction joints or as otherwise specifically detailed.

C. Horizontal Bars. Except as specifically detailed or otherwise indicated, splicing of horizontal bars in concrete is not permitted.

3.5 ADDITIONAL REINFORCING

A. The CONTRACTOR shall provide additional reinforcing bars at sleeves and openings as indicated on Drawings.

3.6 EMBEDMENT OF DRILLED REINFORCING STEEL DOWELS

A. Hole Preparation:

1. The hole diameter shall be as recommended by the epoxy manufacturer but shall be no larger than 0.25 inch greater than the diameter of the outer surface of the reinforcing bar deformations.

2. The depth of the hole shall be as recommended by the epoxy manufacturer to fully develop the bar but shall not be less than 12 bar diameters, unless noted otherwise.

3. The hole shall be drilled by methods which do not interfere with the proper bonding of epoxy.

4. Existing reinforcing steel in the vicinity of proposed holes shall be located prior to drilling. The location of holes to be drilled shall be adjusted to avoid drilling through or nicking any existing reinforcing bars.

5. The hole shall be blown clean with clean, dry compressed air to remove all dust and loose particles.

6. Epoxy shall be injected into the hole through a tube placed to the bottom of the hole. The tube shall be withdrawn as epoxy is placed but kept immersed to prevent formation of air pockets. The hole shall be filled to a depth that insures that excess material will be expelled from the hole during dowel placement.

7. Dowels shall be twisted during insertion into the partially filled hole so as to guarantee full wetting of the bar surface with epoxy. The bar shall be inserted slowly enough to avoid developing air pockets.

*** END OF SECTION ***

SECTION 03280

JOINTS IN SITE WORK CONCRETE

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The Work of this Section includes providing expansion joints, construction joints, weakened plane control joints and contact joints in concrete pavement, sidewalk, curb and gutter.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 03100 Concrete Formwork
2. Section 03310 Cast-in-Place Sitework Concrete

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated in this Section, the CONTRACTOR shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC), together with the latest adopted editions of the Regional and City of San Diego Supplement Amendments.

B. The current edition of the California Building Code (CBC) of International Code Council (ICC) as adopted by the City of San Diego Municipal Code.

C. ASTM Standards in Building Codes (Current Edition):

1.	ASTM D1751	Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
2.	ASTM D994	Preformed Expansion Joint Filler for Concrete (Bituminous Type)

1.4 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall submit the following in compliance with Section 01300 - Submittals.

1. Placement shop drawings showing the location and type of all joints.

2. Catalog cuts and samples of the preformed expansion joint filler material, including complete product data.

1.5 OPERATION AND MAINTENANCE INFORMATION

A. The following operation and maintenance related information shall be submitted in compliance with Section 01730 - Operations and Maintenance Information:

1. Manufacturer's certification indicating that the preformed expansion joint material meets or exceeds the requirements of the Specifications.

PART 2 - PRODUCTS

2.1 PREMOLDED JOINT FILLER

A. Premolded joint filler shall be in conformance with SSPWC Subsection 201-3.2 and shall be either Preformed Expansion Joint Filler (ASTM D994) or Nonextruding and Resilient Filler (ASTM D1751) as indicated.

2.2 STEEL BARS AND DOWELS

A. Steel bars used in construction joints or contact joints shall conform to SSPWC Subsection 201-2.2.

2.3 CONCRETE CURING COMPOUND

A. Curing compound shall comply with SSPWC Subsection 201-4.

PART 3 - EXECUTION

3.1 EXPANSION JOINTS

A. Expansion joints in concrete pavement shall be constructed in accordance with SSPWC Subsection 302-6.5.3 except that the configuration of the joint shall be as indicated on the drawings.

B. Expansion joints in concrete curbs, sidewalk and gutter shall comply with SSPWC Subsection 303-5.4.2 except that the joint configuration shall be as indicated on the drawings.

3.2 CONSTRUCTION JOINTS

A. Construction joints in concrete pavement shall comply with SSPWC Subsection 302-6.5.2.

3.3 WEAKENED PLANE CONTROL JOINTS

A. Weakened plane joints in concrete pavement shall comply with SSPWC Subsection 302-6.5.4 except that the configuration of the joint shall be as indicated on the drawings.

B. Weakened plane joints in concrete curbs, sidewalks and gutters shall comply with SSPWC Subsection 303-5.4.3 except that the joint configuration shall be as indicated on the drawings.

3.4 CONTACT JOINTS

A. Contact joints in concrete pavement shall be made by placing fresh concrete against hardened concrete. A moisture barrier consisting of curing compound conforming to SSPWC Subsection 201-4 shall be applied to the face of any contact joint and allowed to dry prior to placing fresh concrete against that joint face. This provision is also applicable to existing portland cement concrete pavement not constructed as part of the Work performed under the contract. Application rate shall be as specified in SSPWC Subsection 302-6.6 for the compound used.

*** END OF SECTION ***

SECTION 03290

JOINTS IN CONCRETE STRUCTURES

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide joints in concrete at the locations indicated, complete, in accordance with the Contract Documents.

1.2 RELATED SECTIONS

A. The Work of the following Sections apply to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of the Work.

1. Section 03100 Concrete Formwork
2. Section 03200 Reinforcement Steel
3. Section 03300 Cast-in-Place Concrete
4. Section 07920 Sealants and Caulking

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated in this Section, the CONTRACTOR shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC), together with the latest adopted editions of the Regional and City of San Diego Supplement Amendments.

B. The current edition of the California Building Code (CBC) as adopted by the City of San Diego Municipal Code.

C. Federal Specifications (Current Edition):

1.	TT-S-0227E(3)	Sealing Compound, elastomeric type, Multi-component for Caulking, Sealing, and Glazing Buildings and Other Structures
2.	SS-S-210A	Sealing compound, preformed plastic, for expansion joints and pipe joints

D. U.S. Army Corps of Engineers Specifications:

1.	CRD-C572	Polyvinylchloride Waterstop

E. ASTM Standards in Building Codes (Current Edition):

1.	ASTM A775	Epoxy-Coated Steel Reinforcing Bars
2.	ASTM C920	Elastomeric Joint Sealants

3.	ASTM D412	Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
4.	ASTM D624	Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
5.	ASTM D638	Test Method for Tensile Properties of Plastics
6.	ASTM D746	Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
7.	ASTM D747	Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam
8.	ASTM D1056	Flexible Cellular Materials - Sponge or Expanded Rubber
9.	ASTM D1752	Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
10.	ASTM D2000	Classification System for Rubber Product in Automotive Applications
11.	ASTM D2240	Test Method for Rubber Property -- Durometer Hardness
12.	ASTM D2241	Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)

1.4 TYPES OF JOINTS

A. Construction Joints: When fresh concrete is placed against a hardened concrete surface, the joint between the two pours is called a construction joint. Unless otherwise indicated, all joints in water bearing members shall be provided with a waterstop and/or sealant groove of the shape indicated. The surface of the first pour may also be required to receive a coating of a bonding agent as indicated.

B. Contraction Joints: Contraction joints are similar to construction joints except that the fresh concrete shall not bond to the hardened surface of the first pour, which shall be coated with a bond breaker. The slab reinforcement shall be stopped 4-2 inches from the joint; which is provided with a sleeve-type dowel, to allow shrinkage of the concrete of the second pour. Waterstop and/or sealant groove shall also be provided unless otherwise indicated on the Drawings.

C. Expansion Joints: To allow the concrete to expand freely, a space is provided between the two pours; the joint shall be formed as indicated. This space is obtained by placing a filler joint material against the first pour, which acts as a form for the second pour. Unless otherwise indicated, all expansion joints in water bearing members shall be provided with a center-bulb type waterstop.

D. Control Joints: The function of the control joint is to provide a weaker plane in the concrete, where shrinkage cracks will probably occur. A groove, of the shape and dimensions indicated, is formed or saw-cut in the concrete. This groove is filled afterward with a joint sealant material as specified.

1.5 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall submit the following in compliance with Section 01300 - Submittals:

1. Waterstops: Before production of the required materials, qualification samples shall be submitted. Such samples shall consist of extruded or molded sections of each size or shape to be used, and shall be accomplished so that the material and workmanship represents in all respects the material to be provided under this contract. The balance of the material to be used under this contract shall not be produced until after the RESIDENT ENGINEER has reviewed the qualification samples.

2. Joint Sealant: Before ordering the sealant material, the CONTRACTOR shall submit sufficient data to show general compliance with the requirements of the Contract Documents.

3. Before the sealant is used on the job, the CONTRACTOR shall submit certified test reports from the sealant manufacturer on the actual batch of material being supplied indicating compliance with the above requirements.

4. Shipping Certification: The CONTRACTOR shall furnish written certification from the manufacturer as an integral part of the shipping form, to show that all of the material shipped to this project meets or exceeds the physical property requirements of the Contract Documents. Supplier certificates are not acceptable.

5. Joint Location: The CONTRACTOR shall submit placement shop drawings showing the location and type of all joints for each structure.

1.6 QUALITY ASSURANCE

A. Waterstop Inspection: All waterstop field joints shall be subject to rigid inspection, and no such work shall be scheduled or started without the CONTRACTOR having made prior arrangements with the RESIDENT ENGINEER to provide for the required inspections. Not less than 24 hours' notice shall be given to the RESIDENT ENGINEER for scheduling such inspections.

B. All field joints in waterstops shall be subject to rigid inspection for misalignment, bubbles, inadequate bond, porosity, cracks, offsets, and other defects which would reduce the potential resistance of the material to water pressure at any point. All defective joints shall be replaced with material which shall pass said inspection, and all faulty material shall be removed from the site and disposed of by the CONTRACTOR at no increase in cost to the OWNER.

C. The following waterstop defects represent a partial list of defects which shall be grounds for rejection:

1. Offsets at joints greater than 1/16 inch or 15 percent of material thickness, at any point, whichever is less.

2. Exterior crack at joint, due to incomplete bond, which is deeper than 1/16 inch or 15 percent of material thickness, at any point, whichever is less.

3. Any combination of offset or exterior crack which will result in a net reduction in the cross section of the waterstop in excess of 1/16-inch or 15% of material thickness at any point, whichever is less.

4. Misalignment of joint which result in misalignment of the waterstop in excess of 2 inch in 10 feet.

5. Porosity in the welded joint as evidenced by visual inspection.

6. Bubbles or inadequate bonding which can be detected with a penknife test. If, while prodding the entire joint with the point of a pen knife, the knife breaks through the outer portion of the weld into a bubble, the joint shall be considered defective.

1.7 WARRANTY

A. The CONTRACTOR shall furnish a 5-year written warranty of the entire sealant installation for all joints provided against faulty and/or incompatible materials and workmanship, along with a statement that it agrees to repair or replace, to the satisfaction of the OWNER and at no additional cost to the OWNER, any defects that appear during the warranty period.

PART 2 - PRODUCTS

2.1 GENERAL

A. All joint materials specified herein shall be classified by the Environmental Protection Agency as acceptable for potable water use.

2.2 PVC WATERSTOPS

A. General: Waterstops shall be extruded from an elastomeric polyvinyl chloride compound containing the plasticizers, resins, stabilizers, and other materials necessary to meet the requirements of these Specifications. No reclaimed or scrap material shall be used. The CONTRACTOR shall obtain from the waterstop manufacturer and submit to the RESIDENT ENGINEER current test reports and a written certification that the material to be shipped meets the physical requirements outlined in the U.S. Army Corps of Engineers Specification CRD-C572 and those listed herein.

B. Flatstrip and Center-Bulb Waterstops: At no place shall the thickness of flat strip waterstops, including the center bulb type, be less than 3/8 inch. Flatstrip and center-bulb waterstops shall be manufactured by Water Seals, Inc., Chicago, Illinois; Progress Unlimited, Inc., Lynbrook, New York; Greenstreak Plastic Products Co., St. Louis, Missouri; or approved alternate. Prefabricated factory made joint fittings shall be used at all intersections of the flatstrip and center-bulb type waterstops.

C. Other Types of Waterstops: When other types of waterstops not listed above are required and indicated, they shall be subjected to the same requirements as those listed herein.

D. Waterstop Testing Requirements: When tested in accordance with the standards, the waterstop material shall meet or exceed the following requirements:

Physical Property, Sheet Material	Value	ASTM Std.
Tensile Strength-min (psi)	1,750	D638, Type IV
Ultimate Elongation-min (%)	350	D638, Type IV
Low Temp Brittleness-max (degrees F)	-35	D746
Stiffness in Flexure-min (psi)	400	D747
Accelerated Extraction (CRD-C572)		
Tensile Strength-min (psi)	1,500	D638, Type IV
Ultimate Elongation-min (%)	300	D638, Type IV
Effect of Alkalies (CRD-C572)		
Change in Weight (%)	+0.25/-0.10	------
Change in Durometer, Shore A	+5	D2240
Finish Waterstop		
Tensile Strength-min (psi)	1,400	D638, Type IV
Ultimate Elongation-min (%)	280	D638, Type IV

2.3 JOINT SEALANT

A. Joint sealant shall be polyurethane polymer designed for bonding to concrete which is continuously submerged in water. No material will be acceptable which has an unsatisfactory history as to bond or durability when used in the joints of water retaining structures.

B. Joint sealant material shall meet the following requirements (73 degrees F and 50% relative humidity):

Work Life	45 - 180 minutes
Time to Reach 20 Shore "A" Hardness (at 77 degrees F, 200 gr quantity)	24 hours, maximum

Ultimate Hardness (ASTM D 2240)	20 - 45 Shore "A"
Tensile Strength (ASTM D 412)	200 psi, minimum
Ultimate Elongation (ASTM D 412)	400%, minimum
Tear Resistance (Die C ASTM D 624)	75 pounds per inch of thickness, minimum
Color	Light Gray

C. All polyurethane sealants for waterstop joints in concrete shall conform to the following requirements:

1. Sealant shall be two-part polyurethane with the physical properties of the cured sealant conforming to or exceeding the requirements of ASTM C920 or Federal Specification TT-S-0227 E(3) for two-part material, as applicable.

2. For vertical joints and overhead horizontal joints, only "nonsag" compounds shall be used; all such compounds shall conform to the requirements of ASTM C920 Class 25, Grade NS, or Federal Specification TT-S-0227 E(3), Type II, Class A.

3. For plane horizontal joints, the self-leveling compounds which meet the requirements of ASTM C920 Class 25, Grade P, or Federal Specification TT-S-0227 E(3), Type I shall be used. For joints subject to either pedestrian or vehicular traffic, a compound providing nontracking characteristics, and having a Shore "A" hardness range of 35 to 45, shall be used.

4. Primer materials, if recommended by the sealant manufacturer, shall conform to the printed recommendations of the sealant manufacturer.

D. All sealants, wherever shown, or required hereunder shall be PSI-275 as manufactured by Polymeric Systems Inc.; Elastothane 227R as manufactured by Pacific Polymers; Sikaflex 2C, as manufactured by Sika Corporation, or approved alternate.

E. Sealants for nonwaterstop joints in concrete shall conform to the requirements of Section 07920 - Sealants and Calking.

2.4 JOINT MATERIALS

A. Bearing Pad: Bearing pad to be neoprene conforming to ASTM D2000 BC 420, 40 durometer hardness unless otherwise indicated.

B. Neoprene Sponge: Sponge to be neoprene, closed-cell, expanded, conforming to ASTM D1056, Type 2C3-E1.

C. Joint Filler:

1. Joint filler for expansion joints in water holding structures shall be neoprene conforming to ASTM D1056, Type 2C5-E1.

2. Joint filler material in other locations shall be of the preformed nonextruding type joint filler constructed of cellular neoprene sponge rubber or polyurethane of firm texture. Bituminous fiber type will not be permitted. All nonextruding and resilient-type preformed expansion joint fillers shall conform to the requirements and tests set forth in ASTM D1752 for Type I, except as otherwise indicated.

2.5 BACKING ROD

A. Backing rod shall be an extruded closed-cell, polyethylene foam rod. The material shall be compatible with the joint sealant material used and shall have a tensile strength of not less than 40 psi and a compression deflection of approximately 25% at 8 psi. The rod shall be 1/8 inch larger in diameter than the joint width except that a 1 inch diameter rod shall be used for a 3/4 inch wide joint.

2.6 BOND BREAKER

A. Bond breaker shall be Silcoseal Select as manufactured by Nox-Crete, Omaha, Nebraska; Easy-Lift E as manufactured by Atlas, San Diego, California; Select Cure CRB as manufactured by Select Products Co., Upland, California, or approved alternate. It shall contain a fugitive dye so that areas of application will be readily distinguishable.

2.7 SLIP DOWELS

A. Slip dowels in joints shall be A36 smooth epoxy-coated bars, as indicated on the Drawings, and epoxy coated conforming to ASTM A775.

2.8 PVC TUBING

A. PVC tubing in joints shall be Sch. SDR 13.5, conforming to ASTM D2241.

PART 3 - EXECUTION

3.1 GENERAL

A. Waterstops of the type indicated shall be embedded in the concrete across joints as indicated. All waterstops shall be fully continuous for the extent of the joint. Splices necessary to provide such continuity shall be accomplished in conformance to printed instructions of manufacturer of the waterstops. The CONTRACTOR shall take suitable precautions and means to support and protect the waterstops during the progress of the Work and repair or replace at its own expense any waterstops damaged during the progress of the Work. All waterstops shall be stored so as to permit free circulation of air around the waterstop material.

B. When any waterstop is installed in the concrete on one side of a joint, while the other half or portion of the waterstop remains exposed to the atmosphere for more than 2 days, suitable precautions shall be taken to shade and protect the exposed waterstop from direct rays of the sun during the entire exposure and until the exposed portion of the waterstop is embedded in concrete.

3.2 SPLICES IN WATERSTOPS

A. Splices in waterstops shall be performed by heat sealing the adjacent waterstop sections in accordance with the manufacturer's printed recommendations. It is essential that:

1. The material not be damaged by heat sealing.

2. The splices have a tensile strength of not less than 60% of the unspliced materials tensile strength.

3. The continuity of the waterstop ribs and of its tubular center axis be maintained.

B. Butt joints of the ends of two identical waterstop sections may be made while the material is in the forms.

C. All joints with waterstops involving more than two ends to be jointed together, and all joints which involve an angle cut, alignment change, or the joining of two dissimilar waterstop sections shall be prefabricated before placement in the forms, allowing not less than 24-inch long strips of waterstop material beyond the joint. Upon being inspected and approved, such prefabricated waterstop joint assemblies shall be installed in the forms and the ends of the 24-inch strips shall be butt welded to the straight run portions of waterstop in place in the forms.

D. Where a centerbulb waterstop intersects and is jointed with a noncenterbulb waterstop, care shall be taken to seal the end of the centerbulb, using additional PVC material if needed.

3.3 JOINT CONSTRUCTION

A. Setting Waterstops: To eliminate faulty installation that may result in joint leakage, particular care shall be taken of the correct positioning of the waterstops during installation. Adequate provisions shall be made to support and anchor the waterstops during the progress of the Work and to ensure the proper embedment in the concrete. The symmetrical halves of the waterstops shall be equally divided between the concrete pours at the joints. The center axis of the waterstops shall be coincident with the joint openings. Maximum density and imperviousness of the concrete shall be ensured by thoroughly working it in the vicinity of all joints.

B. In placing flat-strip waterstops in the forms, a means shall be provided to prevent them from being folded over by the concrete as it is placed. Unless otherwise indicated, all waterstops shall be held in place with light wire ties on 12-inch centers which shall be passed through the edge of the waterstop and tied to the curtain of reinforcing steel. Horizontal waterstops, with their flat face in a vertical plane, shall be held in place with continuous supports to which the top edge of the waterstop shall be tacked. In placing concrete around horizontal waterstops, with their flat face in a horizontal plane, concrete shall be worked under the waterstops by hand so as to avoid the formation of air and rock pockets.

C. In placing center-bulb waterstops in expansion joints, the center-bulb shall be centered on the joint filler material.

D. Waterstop in vertical wall joints shall stop 6 inches from the top of the wall where such waterstop does not connect with any other waterstop and is not to be connected to for a future concrete placement.

E. Joint Location: Construction joints, and other types of joints, shall be provided where indicated. When not indicated, construction joints shall be provided at 25-foot maximum spacing for all concrete construction, unless noted otherwise. The location of all joints, of any type, shall be submitted for acceptance by the RESIDENT ENGINEER.

F. Joint Preparation: Special care shall be used in preparing concrete surfaces at joints where bonding between two sections of concrete is required. Unless otherwise indicated, such bonding will be required at all horizontal joints in walls. Surfaces shall be prepared in accordance with the requirements of Section 03300 - Cast-in-Place Concrete.

G. Premolded expansion joint material shall be installed with the edge at the indicated distance below or back from finished concrete surface, and shall have a slightly tapered, dressed, and oiled wood strip secured to or placed at the edge thereof during concrete placement, which shall later be removed to form space for sealing material.

H. The space so formed shall be filled with a joint sealant material as specified. In order to keep the two wall or slab elements in line the joint shall also be provided with a sleeve-type dowel, unless otherwise indicated on Drawings.

I. Construction Joint Sealant: Construction joints in water-bearing floor slabs, and elsewhere as indicated, shall be provided with grooves, which shall be filled with a construction joint sealant. The material used for forming the grooves shall be left in the grooves until just before the grooves are cleaned and filled with joint sealant. After removing the forms from the grooves, all laitance and fins shall be removed, and the grooves shall be sand-blasted. The grooves shall be allowed to become thoroughly dry, after which they shall be blown out; immediately thereafter, they shall be primed, bond breaker tape placed in the bottom of the groove, and filled with the joint sealant. The primer used shall be supplied by the same manufacturer supplying the sealant. No sealant will be permitted to be used without a primer. Care shall be used to completely fill the sealant grooves. Areas designated to receive a sealant fillet shall be thoroughly cleaned, as outlined for the grooves, before application of the sealant.

J. The primer and sealant shall be placed strictly in accordance with the printed recommendations of the manufacturer, taking special care to properly mix the sealant before application. The sides of the sealant groove shall not be coated with bond breaker, curing compound, or any other substance which would interfere with proper bonding of the sealant. All sealant shall achieve final cure at least 7 days before the structure is filled with water.

K. All sealant shall be installed by a competent waterproofing specialty CONTRACTOR who has a successful record of performance in similar installations. Before Work is commenced, the crew doing the Work shall be instructed as to the proper method of application by a representative of the sealant manufacturer.

L. Thorough, uniform mixing of two-part, catalyst-cured materials is essential; special care shall be taken to properly mix the sealer before its application. Before any sealer is placed, arrange to have the crew doing the Work carefully instructed as to the proper method of mixing and application by a representative of the sealant manufacturer.

M. Any joint sealant which, after the manufacturer's recommended curing time for the job conditions of the Work hereunder, fails to fully and properly cure shall be completely removed; the groove shall be thoroughly sandblasted to remove all traces of the uncured or partially cured sealant and primer, and shall be resealed with the indicated joint sealant. All costs of such removal, joint treatment, resealing, and appurtenant work shall be at no additional cost to the OWNER.

N. Bentonite Waterstop: Bentonite waterstop is not permitted.

*** END OF SECTION ***

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide finished structural concrete, complete, in accordance with the Contract Documents.

B. The following types of concrete are covered in this Section:

1. Structural Concrete: Concrete to be used in all cases except where noted otherwise in the Contract Documents.

2. Lean Concrete: Concrete to be used for thrust blocks, anchor blocks, pipe trench cut-off blocks and cradles, where the preceding items are detailed on the Drawings as unreinforced. Concrete to be used as protective cover for dowels intended for future connection.

C. The term "hydraulic structure" used in these Specifications refers to environmental engineering concrete structures for the containment, treatment, or transmission of water, or other fluids.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 03100 Concrete Formwork
2. Section 03200 Reinforcement Steel
3. Section 03280 Joints in Site Work Concrete
3. Section 03290 Joints in Concrete Structures
5. Section 03315 Grout

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated in this Section, the CONTRACTOR shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC), together with the latest adopted editions of the Regional and City of San Diego Supplement Amendments.

B. The current edition of the California Building Code (CBC) as adopted by the City of San Diego Municipal Code.

C. Except as otherwise indicated, the current editions of the following standards apply to the work of this Section:

1. Federal Specifications

UU-B-790A (1) (2)	Building Paper, Vegetable Fiber (Kraft, Water-proofed, Water Repellant and Fire Resistant)

2. Commercial Standards:

ACI 117	Tolerances for Concrete Construction and Materials
ACI 214R	Guide to Evaluation of Strength Test Results of Concrete
ACI 301	Specifications for Structural Concrete
ACI 304.2R	Placing Concrete by Pumping Methods
ACI 305R	Guide to Hot Weather Concreting
ACI 309R	Guide for Consolidation of Concrete
ACI 315	Details and Detailing of Concrete Reinforcement
ACI 318	Building Code Requirements for Structural Concrete
ACI 350	Code Requirements for Environmental Engineering Concrete Structures

3. ASTM Standards in Building Codes:

ASTM C31	Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33	Concrete Aggregates
ASTM C39	Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C40	Test Method for Organic Impurities in Fine Aggregates for Concrete
ASTM C42	Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C88	Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C94	Ready Mixed Concrete

ASTM C136	Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C138	Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C143	Test Method for Slump of Hydraulic Cement Concrete
ASTM C150	Portland Cement
ASTM C156	Test Method for Water Loss [from Mortar Specimen] Through Liquid Membrane Forming Curing Compounds for Concrete
ASTM C157	Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete
ASTM C192	Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C231	Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260	Air-Entraining Admixtures for Concrete
ASTM C289	Test Method for Potential Alkali Silica Reactivity of Aggregates (Chemical Method)
ASTM C309	Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494	Chemical Admixtures for Concrete
ASTM C1077	Practice for Agencies Testing Concrete and Concrete Aggregates for use in Construction and Criteria for Testing Agency Evaluation
ASTM D1751	Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D2419	Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM E119	Test Methods for Fire Tests of Building Construction and Materials

1.4 CONTRACTOR SUBMITTALS

A. Mix Designs:

1. Within 14 days of starting the work, the CONTRACTOR shall submit to the RESIDENT ENGINEER, for review, preliminary concrete mix designs which shall show the proportions and gradations of all materials proposed and 28-day compression test reports for each class and type of concrete specified herein in accordance with Section 01300 - Submittals.

2. The mix designs shall be checked and certified to conform to these specifications by an independent testing laboratory acceptable to the RESIDENT ENGINEER to be in conformance with these Specifications. All costs related to such checking and testing shall be borne by the CONTRACTOR at no increased cost to the OWNER.

B. Delivery Tickets: Where ready-mix concrete is used, the CONTRACTOR shall furnish delivery tickets at the time of delivery of each load of concrete. Each ticket shall show the state certified equipment used for measuring and the total quantities, by weight, of cement, sand, each class of aggregate, admixtures, and the amounts of water in the aggregate added at the batching plant, and the amount allowed to be added at the site for the specific design mix. In addition, each ticket shall state the mix number, total yield in cubic yards, and the time of day, to the nearest minute, corresponding to the times when the batch was dispatched, when it left the plant, when it arrived at the site, when unloading began, and when unloading was finished.

C. The CONTRACTOR shall provide the following submittals in accordance with ACI 301:

1. Mill tests for cement.
2. Admixture certification. Chloride ion content must be included.
3. Aggregate gradation and certification.
4. Materials and methods for curing.

D. The CONTRACTOR shall provide catalog cuts and other manufacturer's technical data demonstrating compliance with the requirements indicated and specified herein for all admixtures used in the concrete mix design.

1.5 QUALITY ASSURANCE

A. General:

1. Tests on component materials and for compressive strength of concrete will be performed as specified herein. Test for determining slump will be in accordance with the requirements of ASTM C143.

2. The cost of all laboratory tests requested by the RESIDENT ENGINEER on cement, aggregates, and concrete, will be borne by the OWNER. However, the CONTRACTOR will be charged for the cost of any additional tests and investigation on work performed which does not meet the Specifications. The laboratory must meet or exceed the requirements of ASTM C1077.

3. Concrete for testing shall be supplied by the CONTRACTOR at no cost to the OWNER, and the CONTRACTOR shall provide assistance to the RESIDENT ENGINEER in obtaining samples, and disposal and cleanup of excess material.

B. Field Compression Tests:

1. Compression test specimens will be taken during construction from the first placement of each class of concrete specified herein and at intervals thereafter as selected by the RESIDENT ENGINEER to ensure continued compliance with these Specifications. Each set of test specimens will be a minimum of five cylinders.

2. Compression test specimens for concrete shall be made in accordance with section 9.2 of ASTM C31. Specimens shall be 6-inch diameter by 12-inch high cylinders.

3. Compression tests shall be performed in accordance with ASTM C39. One test cylinder will be tested at 7 days and two at 28 days. The remaining cylinders will be held to verify test results, if needed.

C. Evaluation and Acceptance of Concrete:

1. Evaluation and acceptance of the compressive strength of concrete shall be according to the requirements of ACI 318, Chapter 5 "Concrete Quality, Mixing, and Placing," and as specified herein.

2. A statistical analysis of compression test results will be performed according to the requirements of ACI 214. The standard deviation of the test results shall not exceed 640 psi, when ordered at equivalent water content as estimated by slump.

3. If any concrete fails to meet these requirements, immediate corrective action shall be taken to increase the compressive strength for all subsequent batches of the type of concrete affected.

4. When the standard deviation of the test results exceeds 640 psi, the average strength for which the mix is designed shall be increased by an amount necessary to satisfy the statistical requirement that the probability of any test being more than 500 psi below or the average of any three consecutive tests being below the specified compressive strength is 1 in 100. The required average strength shall be calculated by Criterion No. 3 of ACI 214 using the actual standard of deviation.

5. All concrete which fails to meet the ACI requirements and these Specifications, is subject to removal and replacement at no increase in cost to the OWNER.

D. Construction Tolerances: Set and maintain concrete forms and perform finishing operations so as to ensure that the completed Work is within the tolerances specified herein. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances. Tolerance is the specified permissible variation from lines, grades, or dimensions shown. Where tolerances are not stated in the Specifications, permissible deviations will be in accordance with ACI 117.

1. The following construction tolerances are hereby established and apply to finished walls and slab unless otherwise shown:

Item	Tolerance
Variation of the constructed linear outline from the established position in plan.	In 10 feet: 3-inch; In 20 feet or more: 2-inch
Variation from the level or from the grades shown.	In 10 feet: 3-inch; In 20 feet or more: 2-inch
Variation from the plumb	In 10 feet: 3-inch; In 20 feet or more: 2-inch
Variation in the thickness of slabs and walls.	Minus 3-inch; Plus 2-inch
Variation in the locations and sizes of slabs and wall openings	Plus or minus 3-inch

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. General:

1. All materials specified herein shall be classified by the Environmental Protection Agency as acceptable for potable water use within 30 days of application.

2. Materials shall be delivered, stored, and handled so as to prevent damage by water or breakage. Only one brand of cement shall be used. Cement reclaimed from cleaning bags or leaking containers shall not be used. All cement shall be used in the sequence of receipt of shipments.

B. All materials furnished for the Work shall comply with the requirements of Sections 201, 203, and 204 of ACI 301, as applicable.

C. Storage of materials shall conform to the requirements of Section 2.5 of ACI 301 or the SSPWC.

D. Materials for concrete shall conform to the following requirements:

1. Cement shall be standard brand Portland cement conforming to ASTM C150 for Type II/V, including Table 2 optional requirements. A minimum of 85 percent of cement by weight shall pass a 325 screen. A single brand of cement shall be used throughout the Work, and before its use, the brand shall be acceptable to the RESIDENT ENGINEER. The cement shall be suitably protected from exposure to moisture until used. Cement that has become lumpy shall not be used. Sacked cement shall be stored in such a manner so as to permit access for inspection and

sampling. Certified mill test reports, including fineness, for each shipment of cement to be used shall be submitted to the RESIDENT ENGINEER if requested regarding compliance with these Specifications.

2. Water for mixing and curing shall be potable, clean, and free from objectionable quantities of silty organic matter, alkali, salts and other impurities. Agricultural water with high total dissolved solids concentration (over 1,000 mg/l) shall not be used.

3. Aggregates shall be obtained from pits acceptable to the RESIDENT ENGINEER, shall be nonreactive, and shall conform to ASTM C33. Maximum size of coarse aggregate shall be as specified herein. Lightweight sand for fine aggregate will not be permitted.

   a. Coarse aggregates shall consist of clean, hard, durable gravel, crushed gravel, crushed rock or a combination thereof. The coarse aggregates shall be prepared and handled in two or more size groups for combined aggregates with a maximum size greater than 1 inch. When the aggregates are proportioned for each batch of concrete the two size groups shall be combined. See the Paragraph in Part 2 entitled "Trial Batch and Laboratory Tests" for the use of the size groups.

   b. Fine aggregates shall be natural sand or a combination of natural and manufactured sand that are hard and durable. When tested in accordance with ASTM D2419, the sand equivalency shall not be less than 75 percent for an average of three samples, nor less than 70 percent for an individual test. Gradation of fine aggregate shall conform to ASTM C33, with 15 to 30 percent passing the number 50 screen and 5 to 10 percent passing the number 100 screen. The fineness modulus of sand used shall not be over 3.00.

   c. Combined aggregates shall be well graded from coarse to fine sizes, and shall be uniformly graded between screen sizes to produce a concrete that has optimum workability and consolidation characteristics. Where a trial batch is required for a mix design, the final combined aggregate gradations will be established during the trial batch process.

   d. When tested in accordance with ASTM C33, the ratio of silica released to reduction in alkalinity shall not exceed 1.0.

   e. When tested in accordance with ASTM C33, the fine aggregate shall produce a color in the supernatant liquid no darker than the reference standard color solution.

   f. When tested in accordance with ASTM C33, the coarse aggregate shall show a loss not exceeding 42 percent after 500 revolutions, or 10.5 percent after 100 revolutions.

   g. When tested in accordance with ASTM C33, the loss resulting after five cycles shall not exceed 10 percent for fine or coarse aggregate when using sodium sulfate.

4. Ready-mix concrete shall conform to the requirements of ASTM C94.

5. Admixtures: All admixtures shall be compatible and by a single manufacturer capable of providing qualified field service representation. Admixtures shall be used in accordance with manufacturer's recommendations. If the use of an admixture is producing an inferior end result, discontinue use of the admixture. Admixtures shall not contain thiocyanates nor more than 0.05 percent chloride ion, and shall be nontoxic after 30 days.

   a. Air-entraining agent meeting the requirements of ASTM C260, shall be used. Sufficient air-entraining agent shall be used to provide a total air content of 3 to 5 percent. The OWNER reserves the right, at any time, to sample and test the air-entraining agent received on the job. The air-entraining agent shall be added to the batch in a portion of the mixing water. The solution shall be batched by means of a mechanical batcher capable of accurate measurement. Air content shall be tested at the point of placement. Air entraining agent shall be Micro-Air by BASF Admixture Systems; Daravair by Grace Construction Products; Sika AEA-15 by Sika Corporation; or approved alternate.

   b. Set controlling and water reducing admixtures: Admixtures may be added at the CONTRACTOR's option to control the set, effect water reduction, and increase workability. The addition of an admixture shall be at no increase in cost to the OWNER. The use of an admixture shall be subject to acceptance by the RESIDENT ENGINEER. Concrete containing an admixture shall be first placed at a location determined by the RESIDENT ENGINEER. Admixtures specified herein shall conform to the requirements of ASTM C494. The required quantity of cement shall be used in the mix regardless of whether or not an admixture is used.

      (1) Concrete shall not contain more than one water reducing admixture. Concrete containing an admixture shall be first placed at a location determined by the RESIDENT ENGINEER.

      (2) Set controlling admixture shall be either with or without water-reducing properties. Where the air temperature at the time of placement is expected to be consistently over 80 degrees F, a set retarding admixture such as Plastocrete by Sika Corporation; Pozzolith 300R by BASF Admixture Systems; Daratard by Grace Construction Products; or approved alternate shall be used. Where the air temperature at the time of placement is expected to be consistently under 40 degrees F, a noncorrosive set accelerating admixture such as Plastocrete 161FL by Sika Corporation; Pozzutec 20 by BASF Admixture Systems; Daraset by Grace Construction Products; or approved alternate shall be used.

      (3) Normal range water reducer shall conform to ASTM C494, Type A. WRDA 79 by Grace Construction Products; Pozzolith

322-N by BASF Admixture Systems; Plastocrete 161 by Sika Corporation; or approved alternate. The quantity of admixture used and the method of mixing shall be in accordance with the Manufacturer's instructions and recommendations.

(4) High range water reducer shall conform to ASTM C494, Type F or G. Daracem 100 or WDRA 19 by Grace Construction Products; Sikament FF or Sikament 86 by Sika Corporation; Rheobuild 1000 or Rheobuild 716 by BASF Admixture Systems; or approved alternate. High range water reducer shall be added to the concrete after all other ingredients have been mixed and initial slump has been verified. No more than 14 ounces of water reducer per sack of cement shall be used. Water reducer shall be considered as part of the mixing water when calculating water cement ratio.

(5) If the high range water reducer is added to the concrete at the job site, it may be used in conjunction with the same water reducer added at the batch plant. Concrete shall have a slump of 3 inches ± 2 inch before adding the high range water reducing admixture at the job site. The high range water reducing admixture shall be accurately measured and pressure injected into the mixer as a single dose by an experienced technician. A standby system shall be provided and tested before each day's operation of the job site system.

(6) Concrete shall be mixed at mixing speed for a minimum of 30 mixer revolutions after the addition of the high range water reducer.

(7) Flyash: Flyash shall conform to the requirements of ASTM C618, Class F and Loss of Ignition shall not exceed 4 percent. Flyash, as a percentage by weight of total cementitious materials, shall not exceed 15 percent.

2.2 CURING MATERIALS

A. Materials for curing concrete as specified herein shall conform to the following requirements and ASTM C309:

1. All curing compounds shall be white pigmented and resin based. Sodium silicate compounds shall not be allowed. Concrete curing compound shall be Spartan Cote Cure-Seal Hardener by Dayton Superior; Super Rez Seal by Euclid Chemical Company; MB-429 as manufactured by BASF Building Systems; or approved alternate. Water based resin curing compounds shall be used only where local air quality regulations prohibit the use of a solvent based compound. Water based curing compounds shall be Aqua Resincure by Dayton Superior; Aqua-Cure VOX by Euclid Chemical Company; Masterkure-W by BASF Building Systems; or approved alternate.

2. Polyethylene sheet for use as concrete curing blanket shall be white, and shall have a nominal thickness of 6 mils. The loss of moisture when determined in accordance with the requirements of ASTM C156 shall not exceed 0.055 grams per square centimeter of surface.

3. Polyethylene-coated waterproof paper sheeting for use as concrete curing blanket shall consist of white polyethylene sheeting free of visible defects, uniform in appearance, having a nominal thickness of 2 mils and permanently bonded to waterproof paper conforming to the requirements of Federal Specification UU-B-790A (1) (2). The loss of moisture, when determined in accordance with the requirements of ASTM C156, shall not exceed 0.055 gram per square centimeter of surface.

4. Polyethylene-coated burlap for use as concrete curing blanket shall be 4 mils thick, white opaque polyethylene film impregnated or extruded into one side of the burlap. Burlap shall weigh not less than 9 ounces per square yard. The loss of moisture, when determined in accordance with the requirements of ASTM C156, shall not exceed 0.055 gram per square centimeter of surface.

5 Curing mats for use in Curing Method 6 as specified herein, shall be heavy shag rugs or carpets or cotton mats quilted at 4 inches on center. Curing mats shall weigh a minimum of 12 ounces per square yard when dry.

6 Evaporation retardant shall be a material such as Confilm as manufactured by BASF Building Systems; Eucobar as manufactured by Euclid Chemical Company; or approved alternate.

2.3 NONWATERSTOP JOINT MATERIALS

A. Materials for nonwaterstop joints in concrete shall conform to the following requirements:

1 Preformed joint filler shall be a nonextruding, resilient, bituminous type conforming to the requirements of ASTM 1751.

2. Elastomeric joint sealer shall conform to the requirements of Section 07920 - Sealants and Caulking.

3. Mastic joint sealer shall be a material that does not contain evaporating solvents; that will tenaciously adhere to concrete surfaces; that will remain permanently resilient and pliable; that will not be affected by continuous presence of water and will not in any way contaminate potable water; and that will effectively seal the joints against moisture infiltration even when the joints are subject to movement due to expansion and contraction. The sealer shall be composed of special asphalts or similar materials blended with lubricating and plasticizing agents to form a tough, durable mastic substance containing no volatile oils or lubricants and shall be capable of meeting the test requirements set forth hereinafter, if testing is required by the RESIDENT ENGINEER.

2.4 MISCELLANEOUS MATERIALS

A. Dampproofing agent shall be an asphalt emulsion, such as Hydrocide 600 by BASF Building Systems; Damp-proofing Asphalt Coating by Euclid Chemical Company; Sealmastic by W. R. Meadows Inc., or approved alternate.

B Bonding agents shall be epoxy adhesives conforming to the following products for the applications specified:

1. For bonding freshly-mixed, plastic concrete to hardened concrete, Sikadur 32 Hi-Mod Epoxy Adhesive, as manufactured by Sika Corporation; Concresive Liquid (LPL), as manufactured by BASF Building Systems; BurkEpoxy MV as manufactured by Dayton Superior; or approved alternate.

2. For bonding hardened concrete or masonry to steel, Sikadur 31 Hi-Mod Gel as manufactured by Sika Corporation; BurkEpoxy NS as manufactured by Dayton Superior; Concresive Paste (LPL) as manufactured by BASF Building Systems; or approved alternate.

2.5 CONCRETE DESIGN REQUIREMENTS

A. Mix Design.

1. General:

a. Concrete shall be composed of cement, admixtures, aggregates and water. These materials shall be of the qualities specified. The exact proportions in which these materials are to be used for different parts of the Work will be determined during the trial batch.

b. In general, the mix shall be designed to produce a concrete capable of being deposited so as to obtain maximum density and minimum shrinkage and, where deposited in forms, to have good consolidation properties and maximum smoothness of surface. In mix designs, the percentage of sand of the total weight of fine and coarse aggregate shall not exceed 41 for hydraulic structures or 50 for all other structures, unless noted otherwise. The aggregate gradations shall be formulated to provide fresh concrete that will not promote rock pockets around reinforcing steel or embedded items. The proportions shall be changed whenever necessary or desirable to meet the required results at no additional cost to the OWNER. All changes shall be subject to review by the RESIDENT ENGINEER.

2. Water-Cement Ratio and Compressive Strength: The minimum compressive strength and cement content of concrete shall be not less than that specified in the following tabulation.

Type of Work	Min 28-Day Compressive Strength (psi)	Max Size Aggregate (in)	Minimum Cement per cu yd (lb)	Max W/C Ratio (by weight)
Structural Concrete:				
Roof, floor slabs, columns, walls and all other concrete items not specified elsewhere	4,000	1	650	0.42
12" and thicker walls, slabs on grade and footings, with written approval of the CONSTRUCTION MANAGER	4,000	1	650	0.42
Pea Gravel Mix. Thin sections and areas with congested reinforcing, at the CONTRACTOR's option and with the written approval of the RESIDENT ENGINEER for the specific location	4,000	3/8	752	0.40
Maximum fine aggregate 43% by weight of aggregate				
Other Concretes:	3,000	1	520	0.50
Lean concrete	2,000	1-1/2"	376	0.60

Note: The CONTRACTOR is cautioned that the limiting parameters specified above are not a mix design. Additional cement or water reducing agent may be required to achieve workability demanded by the CONTRACTOR's construction methods and aggregates. The CONTRACTOR is responsible for any costs associated with furnishing concrete with the required workability.

3. Adjustments to Mix Design: The mixes used shall be changed whenever such change is necessary or desirable to secure the required strength, density, workability, and surface finish and the CONTRACTOR shall be entitled to no additional compensation because of such changes.

B. Consistency:

1. The quantity of water entering into a batch of concrete shall be just sufficient, with a normal mixing period, to produce a concrete which can be worked properly into place without segregation, and which can be compacted by the vibratory methods herein specified to give the desired density, impermeability and smoothness of surface. The quantity of water shall be changed as necessary, with variations in the nature or moisture content of the aggregates, to maintain uniform production of a desired consistency. The consistency of the concrete in successive batches shall be determined by slump tests in accordance with ASTM C143. The slumps shall be as follows:

Part of Work	Slump (in)
All concrete, unless note otherwise	3 inches ± 1 inch
With high range water reducer added	7 inches + 2 inches
Ductbanks	5 inches ± 1 inch

C. Trial Batch and Laboratory Tests

1. Before placing any concrete, a testing laboratory designated by the RESIDENT ENGINEER will prepare a trial batch of each class of structural concrete, based on the preliminary concrete mixes submitted by the CONTRACTOR. During the trial batch the aggregate proportions may be adjusted by the testing laboratory using the two coarse aggregate size ranges to obtain the required properties. If one size range produces an acceptable mix, a second size range need not be used. Such adjustments shall be considered refinements to the mix design and shall not be the basis for extra compensation to the CONTRACTOR. All concrete shall conform to the requirements of this Section, whether the aggregate proportions are from the CONTRACTOR's preliminary mix design, or whether the proportions have been adjusted during the trial batch process. The trial batch will be prepared using the aggregates, cement and admixture proposed for the project. The trial batch materials shall be of a quantity such that the testing laboratory can obtain six compression test specimens from each batch. The cost of not more than three laboratory trial batch tests for each specified concrete strength will be borne by the OWNER but the CONTRACTOR shall furnish and deliver the materials in steel drums at no cost. Any additional trial batch testing required shall be performed by the CONTRACTOR at no additional cost to the OWNER.

2. The determination of compressive strength will be made by testing 6-inch diameter by 12-inch high cylinders; made, cured and tested in accordance with ASTM C192 and ASTM C39. Three compression test cylinders will be tested at 7 days and 3 at 28 days. The average compressive strength for the three cylinders tested at 28 days for any given trial batch shall not be less than 125 percent of the specified compressive strength.

3. A sieve analysis of the combined aggregate for each trial batch shall be performed according to the requirements of ASTM C136. Values shall be given for percent passing each sieve.

4. In lieu of trial batch and laboratory tests specified in this Section, the CONTRACTOR may submit previously-designed, tested, and successfully-used concrete mixes, using materials similar to those intended for this project, together with a minimum of three certified test reports of the 28-day strength of the proposed concrete mix.

D. Measurement of Cement and Aggregate

1. The amount of cement and of each separate size of aggregate entering into each batch of concrete shall be determined by direct weighing equipment acceptable to the RESIDENT ENGINEER.

2. Weighing Tolerances:

Material	Percent of Total Weight
Cement	1
Aggregates	3
Admixtures	3

F. Measurement of Water

1. The quantity of water entering the mixer shall be measured by a suitable water meter or other measuring device of a type acceptable to the RESIDENT ENGINEER and capable of measuring the water in variable amounts within a tolerance of one percent. The water feed control mechanism shall be capable of being locked in position so as to deliver constantly any specified amount of water to each batch of concrete. A positive quick-acting valve shall be used for a cut-off in the water line to the mixer. The operating mechanism must be such that leakage will not occur when the valves are closed.

2.6 READY MIXED CONCRETE

A. At the CONTRACTOR's option, ready-mixed concrete may be used meeting the requirements as to materials, batching, mixing, transporting, and placing as specified herein and in accordance with ASTM C94, including the following supplementary requirements.

B. Ready-mixed concrete shall be delivered to the site of the Work, and discharge shall be completed within one hour after the addition of the cement to the aggregates or before the drum has been revolved 250 revolutions, whichever is first.

C. Truck mixers shall be equipped with electrically-actuated counters by which the number of revolutions of the drum or blades may be readily verified. The counter shall be of the resettable, recording type, and shall be mounted in the driver's cab. The counters shall be actuated at the time of starting mixers at mixing speeds.

D. Each batch of concrete shall be mixed in a truck mixer for not less than 70 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of equipment. Additional mixing, if any, shall be at the speed designated by the manufacturer of the equipment as agitating speed. All materials including mixing water shall be in the mixer drum before actuating the revolution counter for determining the number of revolution of mixing.

E. Truck mixers and their operation shall be such that the concrete throughout the mixed batch as discharged is within acceptable limits of uniformity with respect to consistency, mix, and grading. If slump tests taken at approximately the 1/4 and 3/4 points of the load during discharge give slumps differing by more than one inch when the specified slump is 3 inches or less, or if they differ by more than 2 inches when the specified slump is more than 3 inches, the mixer shall not be used on the Work unless the causing condition is corrected and satisfactory performance is verified by additional slump tests. All mechanical details of the mixer, such as water measuring and discharge apparatus, condition of the blades, speed of rotation, general mechanical condition of the unit, and clearance of the drum, shall be checked before a further attempt to use the unit will be permitted.

F. Each batch of ready-mixed concrete delivered at the job site shall be accompanied by a delivery ticket furnished to the RESIDENT ENGINEER in accordance with Subsection 03300-1.4B.

G. The use of nonagitating equipment for transporting ready-mixed concrete will not be permitted. Combination truck and trailer equipment for transporting ready-mixed concrete will not be permitted. The quality and quantity of materials used in ready-mixed concrete and in batch aggregates shall be subject to continuous inspection at the batching plant by the RESIDENT ENGINEER.

2.7 FLOOR HARDENER (SURFACE APPLIED)

A. Surface hardener shall be a light reflective nonoxidizing metallic aggregate dry shake surface hardener.

1. Surface hardener shall be premeasured, premixed and packaged at the factory.
2. Apply surface hardener at the rate of 1.8 to 2.5 lb per square foot
3. Surface hardener shall be Lumiplate, by BASF Building Systems, or approved alternate.

B. Curing Compound shall meet the moisture retention requirements of ASTM C309 and surface hardener manufacturer's recommendations.

C. Monomolecular Film: Evaporation retarder shall be used to aid in maintaining concrete moisture during the early placement stages of plastic concrete. Evaporation retarder shall be as recommended by surface hardener manufacturer.

PART 3 - EXECUTION

3.1 PROPORTIONING AND MIXING

A. Proportioning: Proportioning of the concrete mix shall conform to the requirements of Chapter 3 "Proportioning" of ACI 301.

B. Mixing: Mixing of concrete shall conform to the requirements of Chapter 7 "Production of Concrete" of ACI 301.

C. Slump: Maximum slumps shall be as specified herein.

D. Retempering: Retempering of concrete or mortar which has partially hardened shall not be permitted.

3.2 PREPARATION OF SURFACES FOR CONCRETING

A. General: Earth surfaces shall be thoroughly wetted by sprinkling, before the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, mud, and debris at the time of placing concrete.

B. Joints in Concrete: Concrete surfaces upon or against which concrete is to be placed, where the placement of the concrete has been stopped or interrupted so that, as determined by the RESIDENT ENGINEER, the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints. The surfaces of horizontal joints shall be given a compacted, roughened surface for good bond. The joint surfaces shall be cleaned of all laitance, loose or defective concrete, foreign material, and roughened to a minimum 1/4-inch amplitude. Such cleaning and roughening shall be accomplished by hydroblasting or sandblasting (exposing aggregate) followed by thorough washing. All pools of water shall be removed from the surface of construction joints, and the joint surface shall be coated with an epoxy-bonding agent, unless indicated otherwise, before the new concrete is placed.

C. Placing Interruptions: When placing of concrete is to be interrupted long enough for the concrete to take a set, the working face shall be given a shape by the use of forms or other means, that will secure proper union with subsequent Work; provided that construction joints shall be made only where acceptable to the RESIDENT ENGINEER.

D. Embedded Items: No concrete shall be placed until all formwork, installation of parts to be embedded, reinforcement steel, and preparation of surfaces involved in the placing have been completed and accepted by the RESIDENT ENGINEER at least 4 hours before placement of concrete. All surfaces of forms and embedded items that have become encrusted with dried grout from concrete previously placed shall be cleaned of all such grout before the surrounding or adjacent concrete is placed.

E. All inserts or other embedded items shall conform to the requirements herein.

F. All reinforcement, anchor bolts, sleeves, inserts, and similar items shall be set and secured in the forms where shown or by shop drawings and shall be acceptable to the RESIDENT ENGINEER before any concrete is placed. Accuracy of placement is the responsibility of the CONTRACTOR.

G. Casting New Concrete Against Old: Where concrete is to be cast against old concrete (any concrete which is greater than 60 days of age), the surface of the old concrete shall be thoroughly cleaned and roughened by hydro-blasting or sandblasting (exposing aggregate). The joint surface shall be coated with an epoxy bonding agent unless indicated otherwise by the RESIDENT ENGINEER.

H. No concrete shall be placed in any structure until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes, or other means, and carried out of the forms, clear of the Work. No concrete shall be deposited underwater nor shall the CONTRACTOR allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such manner and at such velocity as will injure the surface finish of the concrete. Pumping or other necessary dewatering operations for removing ground water, if required, will be subject to the review of the RESIDENT ENGINEER.

I. Corrosion Protection: Pipe, conduit, dowels, and other ferrous items required to be embedded in concrete construction shall be so positioned and supported before placement of concrete that there will be a minimum of 2 inches clearance between said items and any part of the concrete reinforcement. Securing such items in position by wiring or welding them to the reinforcement will not be permitted.

J. Openings for pipes, inserts for pipe hangers and brackets, and the setting of anchors shall, where practicable, be provided for during the placing of concrete.

K. Anchor bolts shall be accurately set, and shall be maintained in position by templates while being embedded in concrete.

L. Cleaning: The surfaces of all metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed.

3.3 HANDLING, TRANSPORTING, AND PLACING

A. General: Placing of concrete shall conform to the applicable requirements of Chapter 8 of ACI 301 and the requirements of this Section. No aluminum materials shall be used in conveying any concrete.

B. Nonconforming Work or Materials: Concrete which upon or before placing is found not to conform to the requirements specified herein shall be rejected and immediately removed from the Work. Concrete which is not placed in accordance with these Specifications, or which is of inferior quality, shall be removed and replaced at no additional expense to the OWNER.

C. Unauthorized Placement: No concrete shall be placed except in the presence of duly authorized representative of the RESIDENT ENGINEER. The CONTRACTOR shall notify the RESIDENT ENGINEER in writing at least 24 hours in advance of placement of any concrete.

D. Placement in Wall Forms: Concrete shall not be dropped through reinforcement steel or into any deep form, nor shall concrete be placed in any form in such a manner as to leave accumulation of mortar on the form surfaces above the placed concrete. In such cases, some means such as the use of hoppers and, if necessary, vertical ducts of canvas, rubber, or metal shall be used for placing concrete in the forms in a manner that it may reach the place of final deposit without separation. In no case shall the free fall of concrete exceed 4 feet below the ends of ducts, chutes, or buggies. Concrete shall be uniformly distributed during the process of depositing and in no case after depositing shall any portion be displaced in the forms more than 6 feet in horizontal direction. Concrete in forms shall be deposited in uniform horizontal layers not deeper than 2 feet; and care shall be taken to avoid inclined layers or inclined construction joints except where such are required for sloping members. Each layer shall be placed while the previous layer is still soft. The rate of placing concrete in forms shall not exceed 5 feet of vertical rise per hour. Sufficient illumination shall be provided in the interior of all forms so that the concrete at the places of deposit is visible from the deck or runway.

E. Conveyor Belts and Chutes: All ends of chutes, hopper gates, and all other points of concrete discharge throughout the CONTRACTOR's conveying, hoisting and placing system shall be so designed and arranged that concrete passing from them will not fall separated into whatever receptacle immediately receives it. Conveyor belts, if used, shall be of a type acceptable to the RESIDENT ENGINEER. Chutes longer than 50 feet will not be permitted. Minimum slopes of chutes shall be such that concrete of the specified consistency will readily flow in them. If a conveyor belt is used, it shall be wiped clean by a device operated in such a manner that none of the mortar adhering to the belt will be wasted. All conveyor belts and chutes shall be covered.

F. Placement in Slabs: Concrete placed in sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement. As the Work progresses, the concrete shall be vibrated and carefully worked around the slab reinforcement, and the surface of the slab shall be screeded in an up-slope direction.

G. Temperature of Concrete: The temperature of concrete when it is being placed shall be not more than 90 degrees F nor less than 55 degrees F for sections less than 12 inches thick nor less than 50 degrees for all other sections. Concrete ingredients shall not be heated to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, from falling below the specified minimum temperature. When the temperature of the concrete is 85 degrees F or above, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes. If concrete is placed when the weather is such that the temperature of the concrete would exceed 90 degrees F, the CONTRACTOR shall employ effective means, such as precooling of aggregates and mixing water using ice or placing at night, as necessary to maintain the temperature of the concrete, as it is placed, below 90 degrees F. The CONTRACTOR shall be entitled to no additional compensation on account of the foregoing requirements.

H. Hot Weather Placement:

1. Placement of concrete shall conform to ACI 305R – Guide to Hot Weather Concreting, and the following.

2. Only set retarding admixture shall be used in concrete when air temperature is expected to be consistently over 80 degrees F.

3. The maximum temperature of concrete shall not exceed 90 degrees F immediately before placement.

4. From the initial placement to the curing state, concrete shall be protected from the adverse effect of high temperature, low humidity, and wind.

3.4 PUMPING OF CONCRETE

A. General: If the pumped concrete does not produce satisfactory end results, discontinue the pumping operation and proceed with the placing of concrete using conventional methods.

B. The minimum diameter of the hose (conduits) shall be in accordance with ACI 304.2R.

C. Pumping equipment and hoses (conduits) that are not functioning properly shall be replaced.

D. Aluminum conduits for conveying the concrete shall not be permitted.

E. Field Control: Concrete samples for slump, air content, and test cylinders will be taken at the placement (discharge) end of the line.

3.5 ORDER OF PLACING CONCRETE

A. The order of placing concrete in all parts of the Work shall be acceptable to the RESIDENT ENGINEER. In order to minimize the effects of shrinkage, the concrete shall be placed in units as bounded by construction joints shown. The placing of units shall be done by placing alternate units in a manner such that each unit placed shall have cured at least 7 days for hydraulic structures and 3 days for all other structures before the contiguous unit or units are placed, except that the corner sections of vertical walls shall not be placed until the two adjacent wall panels have cured at least 14 days for hydraulic structures and 7 days for all other structures.

B. The surface of the concrete shall be level whenever a run of concrete is stopped. To ensure a level, straight joint on the exposed surface of walls, a wood strip at least 3/4 inch thick shall be tacked to the forms on these surfaces. The concrete shall be carried about 1/2 inch above the underside of the strip. About one hour after the concrete is placed, the strip shall be removed and any irregularities in the edge formed by the strip shall be leveled with a trowel and all laitance shall be removed.

3.6 TAMPING AND VIBRATING

A. As concrete is placed in the forms or in excavations, it shall be thoroughly settled and compacted, throughout the entire depth of the layer which is being consolidated, into a dense, homogeneous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of concrete during placement. Vibrators shall be Group 3 (per ACI 309R) high speed power vibrators (8,000 to 12,000 rpm) of an immersion type in sufficient number and with (at least one) standby units as required. Group 2 vibrators may be used only at specific locations when accepted by the RESIDENT ENGINEER.

B. Care shall be used in placing concrete around waterstops. The concrete shall be carefully worked by rodding and vibrating to make sure that all air and rock pockets have been eliminated. Where flat-strip type waterstops are placed horizontally, the concrete shall be worked under the waterstops by hand, making sure that all air and rock pockets have been eliminated.

Concrete surrounding the waterstops shall be given additional vibration, over and above that used for adjacent concrete placement to assure complete embedment of the waterstops in the concrete.

C. Concrete in walls shall be internally vibrated and at the same time rammed, stirred, or worked with suitable appliances, tamping bars, shovels, or forked tools until it completely fills the forms or excavations and closes snugly against all surfaces. Subsequent layers of concrete shall not be placed until the layers previously placed have been worked thoroughly as specified. Vibrators shall be provided in sufficient numbers, with standby units as required, to accomplish the results herein specified within 15 minutes after concrete of the prescribed consistency is placed in the forms. The vibrating head shall be kept from contact with the surfaces of the forms. Care shall be taken not to vibrate concrete excessively or to work it in any manner that causes segregation of its constituents.

3.7 FINISHING CONCRETE SURFACES

A. General: Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing, or roughness of any kind, and shall present a finished, smooth, continuous hard surface. Allowable deviations from plumb or level and from the alignment, profiles, and dimensions shown are defined as tolerances and are specified in Part 1, herein. These tolerances are to be distinguished from irregularities in finish as described herein. Aluminum finishing tools shall not be used.

B. Formed Surfaces: No treatment is required after form removal except for curing, repair of defective concrete, and treatment of surface defects. Where architectural finish is required, it shall be as specified or as shown.

1. Surface holes larger than 1/2 inch in diameter or deeper than 1/4-inch are defined as surface defects in basins and exposed walls.

C. Unformed Surfaces: After proper and adequate vibration and tamping, all unformed top surfaces of slabs, floors, walls, and curbs shall be brought to a uniform surface with suitable tools. Immediately after the concrete has been screeded, it shall be treated with a liquid evaporation retardant. The retardant shall be used again after each Work operation

as necessary to prevent drying shrinkage cracks. The classes of finish specified for unformed concrete surfaces are designated and defined as follows:

7. Finish U1 - Sufficient leveling and screeding to produce an even, uniform surface with surface irregularities not to exceed 3/8 inch. No further special finish is required.

8. Finish U2 - After sufficient stiffening of the screeded concrete, surfaces shall be float finished with wood or metal floats or with a finishing machine using float blades. Excessive floating of surfaces while the concrete is plastic and dusting of dry cement and sand on the concrete surface to absorb excess moisture will not be permitted. Floating shall be the minimum necessary to produce a surface that is free from screed marks and is uniform in texture. Surface irregularities shall not exceed 1/4-inch. Joints and edges shall be tooled where shown or as determined by the RESIDENT ENGINEER.

3. Finish U3 - After the floated surface (as specified for Finish U2) has hardened sufficiently to prevent excess of fine material from being drawn to the surface, steel troweling shall be performed with firm pressure such as will flatten the sandy texture of the floated surface and produce a dense, uniform surface free from blemishes, ripples, and trowel marks. The finish shall be smooth and free of all irregularities.

4. Finish U4 - Steel trowel finish (as specified for Finish U3) without local depressions or high points. In addition, the surface shall be given a light hairbroom finish with brooming perpendicular to drainage unless otherwise shown. The resulting surface shall be rough enough to provide a nonskid finish.

D. Unformed surfaces shall be finished according to the following schedule:

UNFORMED SURFACE FINISH SCHEDULE

Area	Finish
Grade slabs and foundations to be covered with concrete or fill material	U1
Floors to be covered with grouted tile or topping grout	U2
Slabs which are water bearing with slopes 10 percent and less	U3
Sloping slabs which are water bearing with slopes greater than 10 percent	U4
Slabs not water bearing	U4

UNFORMED SURFACE FINISH SCHEDULE

Area	Finish
Slabs to be covered with built-up roofing	U2
Interior slabs and floors to receive architectural finish	U3
Top surface of walls	U3

3.8 ARCHITECTURAL FINISH

A. General: Architectural finishes shall be required only where specifically called out on the Drawings. In all other cases, the paragraph above, entitled Finishing Concrete Surfaces, shall apply.

1. Immediately after the forms have been stripped, the concrete surface shall be inspected and any poor joints, voids, rock pockets, or other defective areas shall be repaired and all form-tie holes filled as indicated herein.

2. Architectural finishes shall not be applied until the concrete surface has been repaired as required and the concrete has cured at least 14 days.

3. All architecturally treated concrete surfaces shall conform to the accepted sample required herein in texture, color, and quality. It shall be the CONTRACTOR's responsibility to maintain and protect the concrete finish.

B. Smooth Concrete Finish:

1. The concrete surface shall be wetted, and a grout shall be applied with a brush. The grout shall be made by mixing one part Portland cement and one part of fine sand that will pass a No. 16 sieve with sufficient water to give it the consistency of thick paint. The cement used in said grout shall be 2 gray and 2 white Portland cement, as determined by the RESIDENT ENGINEER. White Portland cement shall be Atlas white, or equal. Calcium chloride in the amount of 5 percent by volume of the cement shall be used in the brush coat. The freshly applied grout shall be vigorously rubbed into the concrete surface with a wood float filling all small air holes. After all the surface grout had been removed with a steel trowel, the surface shall be allowed to dry and, when dry, shall be vigorously rubbed with burlap to remove completely all surface grout so that there is no visible paint-like film of grout on the concrete. The entire cleaning operation for any area shall be completed the day it is started, and no grout shall be left on the surface overnight.

2. Cleaning operations for any given day shall be terminated at panel joints. It is essential that the various operations be carefully timed to secure the desired effect which is a light-colored concrete surface of uniform color and texture without any appearance of a paint or grout film.

3. In the event that improper manipulation results in an inferior finish, rub such inferior areas with carborundum bricks.

4. Before beginning any of the final treatment on exposed surfaces, treat in a satisfactory manner a trial area of at least 200 square feet in some inconspicuous place selected by the RESIDENT ENGINEER and shall preserve said trial area undisturbed until the completion of the job.

3.9 CURING AND DAMPPROOFING

A. General: All concrete shall be cured for not less than 14 days after placing, in accordance with the methods specified herein for the different parts of the Work, and described in detail in the following paragraphs:

Surface to be Cured or Dampproofed	Method
Unstripped forms	1
Wall sections with forms removed	6
Construction joints between footings and walls, and between floor slab and columns	2
Encasement concrete and thrust blocks	3
All concrete surfaces not specifically provided for elsewhere in this Paragraph	4
Floor slabs on grade	4
Slabs not on grade	4
Meter Vault and Pipe Trench slabs on grade	6

B. Method 1: Wooden forms shall be wetted immediately after concrete has been placed and shall be kept wet with water until removed. If steel forms are used the exposed concrete surfaces shall be kept continuously wet until the forms are removed. If forms are removed within 14 days of placing the concrete, curing shall be continued in accordance with Method 6, herein.

C. Method 2: The surface shall be covered with burlap mats which shall be kept wet with water for the duration of the curing period, until the concrete in the walls has been placed. No curing compound shall be applied to surfaces cured under Method 2.

D. Method 3: The surface shall be covered with moist earth not less than 4 hours, nor more than 24 hours, after the concrete is placed. Earthwork operations that may damage the concrete shall not begin until at least1 days after placement of concrete.

E. Method 4: The surface shall be sprayed with a liquid curing compound.

1. It shall be applied in accordance with the manufacturer's printed instructions in such a manner as to cover the surface with a uniform film which will seal thoroughly.

2. Where the curing compound method is used, care shall be exercised to avoid damage to the seal during the curing period. Should the seal be damaged or broken before the expiration of the curing period, the break shall be repaired immediately by the application of additional curing compound over the damaged portion.

3. Wherever curing compound may have been applied by mistake to surfaces against which concrete subsequently is to be placed and to which it is to adhere, said compound shall be entirely removed by wet sandblasting just before the placing of new concrete.

4. Where curing compound is specified, it shall be applied as soon as the concrete has hardened enough to prevent marring on unformed surfaces, and within 2 hours after removal of forms from contact with formed surfaces. Repairs required to be made to formed surfaces shall be made within the said 2-hour period; provided, however, that any such repairs which cannot be made within the said 2-hour period shall be delayed until after the curing compound has been applied. When repairs are to be made to an area on which curing compound has been applied, the area involved shall first be wet-sandblasted to remove the curing compound, following which repairs shall be made as specified herein.

5. At all locations where concrete is placed adjacent to a panel which has been coated with curing compound, the previously coated panel shall have curing compound reapplied to an area within 6 feet of the joint and to any other location where the curing membrane has been disturbed.

6. Before final acceptance of the Work, all visible traces of curing compound shall be removed from all surfaces in such a manner that does not damage surface finish.

F. Method 6: This method applies to both walls and slabs.

1. The concrete shall be kept continuously wet by the application of water for a minimum period of at least 14 consecutive days beginning immediately after the concrete has reached final set or forms have been removed.

2. Until the concrete surface is covered with the curing medium, the entire surface shall be kept damp by applying water using nozzles that atomize the flow so that the surface is not marred or washed.

3. Heavy curing mats shall be used as a curing medium to retain the moisture during the curing period. The curing medium shall be weighted or otherwise held in place to prevent being dislodged by wind or any other causes and to be substantially in contact with the concrete surface. All edges shall be continuously held in place.

4. The curing blankets and concrete shall be kept continuously wet by the use of sprinklers or other means both during and after normal working hours.

5. Immediately after the application of water has terminated at the end of the curing period, the curing medium shall be removed, any dry spots shall be rewetted, and curing compound shall be immediately applied in accordance with Method 4, herein.

6. Dispose of excess water from the curing operation to avoid damage to the Work.

G. Dampproofing: The exterior surface of all buried walls shall be dampproofed as follows:

1. Immediately after completion of curing the surface shall be sprayed with a dampproofing agent consisting of an asphalt emulsion. Application shall be in two coats. The first coat shall be diluted to 2% strength by the addition of water and shall be sprayed on so as to provide a maximum coverage rate of 100 square feet per gallon of dilute solution. The second coat shall consist of an application of the specified material, undiluted, and shall be sprayed on so as to provide a maximum coverage rate of 100 square feet per gallon. Dampproofing material shall be as specified herein.

2. As soon as the asphalt emulsion, applied as specified herein, has taken an initial set, the entire area thus coated shall be coated with whitewash. Any formula for mixing the whitewash may be used which produces a uniformly coated white surface and which so remains until placing of the backfill. Should the whitewash fail to remain on the surface until the backfill is placed, apply additional whitewash.

3.10 PROTECTION

A. Protect all concrete against injury until final acceptance by the OWNER.

B. Fresh concrete shall be protected from damage due to rain, hail, sleet, or snow. Provide such protection while the concrete is still plastic and whenever such precipitation is imminent or occurring.

3.11 CURING IN COLD WEATHER

A. Water curing of concrete may be reduced to 6 days during periods when the mean daily temperature in the vicinity of the worksite is less than 40 degrees F; provided that, during the prescribed period of water curing, when temperatures are such that concrete surfaces may freeze, water curing shall be temporarily discontinued.

B. Concrete cured by an application of curing compound will require no additional protection from freezing if the protection at 50 degrees F for 72 hours is obtained by means of approved insulation in contact with the forms or concrete surfaces; otherwise the concrete shall be protected against freezing temperatures for 72 hours immediately following 72 hours protection at 50 degrees F. Concrete cured by water curing shall be protected against freezing temperatures for 3 days immediately following the 72 hours of protection at 50 degrees F.

C. Discontinuance of protection against freezing temperatures shall be such that the drop in temperature of any portion of the concrete will be gradual and will not exceed 40 degrees F in 24 hours. In the spring, when the mean daily temperature rises above 40 degrees F for more than 3 successive days, the specified 72-hour protection at a temperature not lower than 50 degrees F may be discontinued for as long as the mean daily temperature remains above 40 degrees F; provided, that the concrete shall be protected against freezing temperatures for not less than 48 hours after placement.

D. Where artificial heat is employed, special care shall be taken to prevent the concrete from drying. Use of unvented heaters will be permitted only when unformed surfaces of concrete adjacent to the heaters are protected for the first 24 hours from an excessive carbon dioxide atmosphere by application of curing compound; provided, that the use of curing compound for such surfaces is otherwise permitted by these Specifications.

3.12 TREATMENT OF SURFACE DEFECTS

A. As soon as forms are removed, all exposed surfaces shall be carefully examined and any irregularities shall be immediately rubbed or ground in a satisfactory manner in order to secure a smooth, uniform, and continuous surface. Plastering or coating of surfaces to be smoothed will not be permitted. No repairs shall be made until after inspection by the RESIDENT ENGINEER. In no case will extensive patching of honeycombed concrete be permitted. Concrete containing minor voids, holes, honeycombing, or similar depression defects shall have them repaired as specified herein. Concrete containing extensive voids, holes, honeycombing, or similar depression defects, shall be completely removed and replaced. All repairs and replacements herein specified shall be promptly executed by the CONTRACTOR at its own expense.

B. Defective surfaces to be repaired shall be cut back from trueline a minimum depth of 2 inch over the entire area. Feathered edges will not be permitted. Where chipping or cutting tools are not required in order to deepen the area properly, the surface shall be prepared for bonding by the removal of all laitance or soft material, and not less than 1/32-inch depth of the surface film from all hard portions, by means of an efficient sandblast. After cutting and sandblasting, the surface shall be wetted sufficiently in advance of shooting with shotcrete or with cement mortar so that while the repair material is being applied, the surfaces under repair will remain moist, but not so wet as to overcome the suction upon which a good bond depends. The material used for repair proposed shall consist of a mixture of one sack of cement to 3 cubic feet of sand. For exposed walls, the cement shall contain such a proportion of Atlas white Portland cement as is required to make the color of the patch match the color of the surrounding concrete.

C. Holes left by tie-rod cones shall be reamed with suitable toothed reamers so as to leave the surfaces of the holes clean and rough. These holes then shall be repaired in an approved manner with dry-packed cement grout. Holes left by form-tying devices having a rectangular cross-section, and other imperfections having a depth greater than their least surface dimension, shall not be reamed but shall be repaired in an approved manner with dry-packed cement grout.

D. All repairs shall be built up and shaped in such a manner that the completed Work will conform to the requirements of this Section, as applicable, using approved methods which will not disturb the bond, cause sagging, or cause horizontal fractures. Surfaces of said repairs shall receive the same kind and amount of curing treatment as required for the concrete in the repaired section.

E. Before filling any structure with water, all cracks that may have developed shall be "vee'd" and filled with construction joint sealant for water-bearing structures conforming to the materials and methods specified in Section 03290 - Joints in Concrete Structures. This repair method shall be done on the water bearing face of members. Before backfilling, faces of members in contact with fill, which are not covered with a waterproofing membrane, shall also have cracks repaired as specified herein.

3.13 PATCHING HOLES IN CONCRETE

A. Patching Small Holes:

1. Holes which are less than 12 inches in their least dimension and extend completely through concrete members, shall be filled as specified herein.

2. Small holes in members which are water-bearing or in contact with soil or other fill material, shall be filled with nonshrink grout. Where a face of the member is exposed to view, the nonshrink grout shall be held back 2 inches from the finished surface. The remaining 2 inches shall then be patched according to the paragraph in Part 3 entitled "Treatment of Surface Defects."

3. Small holes through all other concrete members shall be filled with nonshrink grout, with exposed faces treated as above.

B. Patching Large Holes:

1. Holes which are larger than 12 inches in their least dimension, shall have a keyway chipped into the edge of the opening all around, unless a formed keyway exists. The holes shall then be filled with concrete as specified herein.

2. Holes which are larger than 24 inches in their least dimension and which do not have reinforcing steel extending from the existing concrete, shall have reinforcing steel set in grout in drilled holes. The reinforcing added shall match the reinforcing in the existing wall unless shown.

3. Large holes in members which are water bearing or in contact with soil or other fill, shall have an extrudable, polyurethane-based type waterstop material placed around the perimeter of the hole as specified in the Section 03290 - Joints in Concrete Structures, unless there is an existing waterstop in place.

3.14 CARE AND REPAIR OF CONCRETE

A. The CONTRACTOR shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance by the OWNER. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time before the final acceptance of the completed Work, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete at the CONTRACTOR's expense.

*** END OF SECTION ***

SECTION 03310

CAST-IN-PLACE SITEWORK CONCRETE

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The Work of this Section includes providing finished cast-in-place lean concrete, sitework concrete, minor non-hydraulic concrete structures, air placed concrete, including formwork, steel reinforcement, mixing, placing curing, and repairing.

B. Sitework concrete includes curbs, gutters, catch basins, sidewalks, pavements, fence and guard post embedment, underground duct bank encasement, and all concrete Work indicated to be sitework concrete.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 03280 - Joints in Sitework Concrete

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated in this Section, the CONTRACTOR shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC) together with the latest adopted editions of the Regional and City of San Diego Supplement Amendments.

B. The current edition of the California Building Code (CBC) of International Code Council (ICC) as adopted by the City of San Diego Municipal Code.

1.4 CONTRACTOR SUBMITTALS

A. Submittals shall be made in compliance with the requirements of Section 01300 - Submittals and in compliance with SSPWC Section 201.

1.5 TESTS

A. Tests on component materials, for the compressive strength of concrete, and for construction tolerances shall be performed in accordance with the requirements of SSPWC Section 201.

PART 2 – PRODUCTS

2.1 CONCRETE MATERIALS

A. Concrete component materials, including curing materials and joint materials shall be in accordance with SSPWC Subsections 201-1, 201-4, and 201-5.

2.2 FORMWORK

A. Concrete formwork shall comply with SSPWC Subsection 204-1.

2.3 STEEL REINFORCEMENT

A. Reinforcing steel shall conform to SSPWC Subsection 201-2.

PART 3 - EXECUTION

3.1 GENERAL

A. Proportioning and mixing, preparation of surfaces for concreting, handling, transporting and placing concrete, finishing and curing concrete surfaces and related procedures shall be performed in accordance with SSPWC Subsections 303-1 and 303-5.

3.2 AIR-PLACED CONCRETE

A. Air-placed concrete construction (gunite and shotcrete) shall be in accordance with SSPWC Subsection 303-2 and the applicable provisions of Subsection 303-1.

*** END OF SECTION ***

SECTION

03315 GROUT

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide grout in accordance with the Contract Documents.

B. The following types of grout shall be covered in this Section:

1. Nonshrink Grout: This type of grout is to be used wherever grout is shown in the Contract Documents, unless another type is specifically referenced.

2. Cement Grout.

3. Epoxy Grout.

4. Pump and Motor Grout.

1.2 RELATED SECTIONS

A. The Work of the following Sections apply to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 03300 Cast-in-Place Concrete

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated, the current editions of the following standards apply to the work of this Section:

1. Commercial Standards :

CRD-C621	Corps of Engineers Specification for Non-shrink Grout

2. ASTM Standard in Building Codes:

ASTM C109	Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in or 50-mm Cube Specimens)
ASTM C531	Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes

ASTM C579	Test Methods for Compressive Strength of Chemical Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
ASTM C827	Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixture
ASTM C881	Epoxy Resin Base Bonding System for Concrete
ASTM C882	Test for Bond Strength of Epoxy Resin Systems Used with Concrete by Slant Shear
ASTM C884	Test Method for Thermal Compatibility between Concrete and an Epoxy-Resin Overlay
ASTM D638	Test Methods for Tensile Properties of Plastics.
ASTM D696	Test Method for Coefficient of Linear Thermal Expansion of Plastics Between 30°C and 30°C With a Vitreous Silica Dilatometer

1.4 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall submit certified test results verifying the compressive strength, shrinkage, and expansion requirements indicated herein; and manufacturer's literature containing instructions and recommendations on the mixing, handling, placement and appropriate uses for each type of nonshrink and epoxy grout used in the Work in accordance with the requirements of Section 01300 - Submittals.

1.5 QUALITY ASSURANCE

A. Field Tests:

1. Compression test specimens will be taken during construction from the first placement of each type of grout, and at intervals thereafter as selected by the RESIDENT ENGINEER to ensure continued compliance with these Specifications. The specimens will be made by the RESIDENT ENGINEER.

2. Compression tests and fabrication of specimens for cement grout will be performed as specified in ASTM C109 at intervals during construction as selected by the RESIDENT ENGINEER. A set of three specimens will be made for testing at 7 days, 28 days, and each additional time period as appropriate.

3. All grout, already placed, which fails to meet the requirements of these Specifications, is subject to removal and replacement at no additional cost to the OWNER.

4. The cost of all laboratory tests on grout will be borne by the OWNER, but the CONTRACTOR shall assist the RESIDENT ENGINEER in obtaining specimens for testing. However, the CONTRACTOR shall be responsible, without

additional cost to the OWNER, for the cost of any additional tests and investigation on work performed which does not comply with the Specifications. The CONTRACTOR shall supply all materials necessary for fabricating the test specimens.

B. Construction Tolerances: Construction tolerances shall be as specified in the Section 03300 - Cast-in-Place Concrete, except as modified herein and elsewhere in the Contract Documents.

PART 2 - PRODUCTS

2.1 CEMENT GROUT

A. Cement Grout: Cement grout shall be composed of one part cement, three parts sand, and the minimum amount of water necessary to obtain the desired consistency. Where needed to match the color of adjacent concrete, white Portland cement shall be blended with regular cement as needed. The minimum compressive strength at 28 days shall be 2,000 psi.

B. Cement grout materials shall be as specified in Section 03300 - Cast-in-Place Concrete.

2.2 PREPACKAGED GROUTS

A. Nonshrink Grout:

1. Nonshrink grout shall be a prepackaged, inorganic, nongas-liberating, nonmetallic, cement-based grout requiring only the addition of water. The manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of nonshrink grout indicated herein shall be that recommended by the manufacturer for the particular application.

2. Class A nonshrink grouts shall have a minimum 28 day compressive strength of 5,000 psi; shall have no shrinkage (0.0 percent) and a maximum 4.0 percent expansion in the plastic state when tested in accordance with ASTM C827; and shall have no shrinkage (0.0 percent) and a maximum of 0.2 percent expansion in the hardened state when tested in accordance with CRD-C 621.

3. Class B nonshrink grouts shall have a minimum 28-day compressive strength of 5,000 psi and shall meet the requirements of CRD-C 621.

4. Acceptable Manufacturers are HUB Patch All 20, RapidSet Mortar Mix, HUB Construction Grout, RapidSet Cemet, or approved alternate.

5. Application:

a. Class A nonshrink grout shall be used for the repair of all holes and defects in concrete members which are water bearing or in contact with soil or other fill material, grouting under all equipment base plates, and at all locations where grout is indicated; except, for the applications for Class B nonshrink grout and epoxy grout indicated herein. Class A nonshrink grout may be used in place of Class B nonshrink grout for all applications.

b. Class B nonshrink grout shall be used for the repair of all holes and defects in concrete members which are not water-bearing and not in contact with soil or other fill material, grouting under all base plates for structural steel members, and grouting railing posts in place.

B. Epoxy Grout:

1. Epoxy grout shall be a pourable, nonshrink, 100 percent solids system . The epoxy grout system shall have three components: resin, hardener, and specially blended aggregate, all premeasured and prepackaged. The resin component shall not contain any nonreactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are not acceptable. Variation of component ratios is not permitted unless specifically recommended by the manufacturer. Manufacturer's instructions shall be printed on each container in which the materials are packaged. Epoxy grout shall be as indicated on the Drawings.

2. The chemical formulation of the epoxy grout shall be that recommended by the manufacturer for the particular application.

3. The mixed epoxy grout system shall have a minimum working life of 45 minutes at 75 degrees F.

4. The epoxy grout shall develop a compressive strength of 5,000 psi in 24 hours and 10,000 psi in 7 days when tested in accordance with ASTM C579, Method B. There shall be no shrinkage (0.0 percent) and a maximum 4.0 percent expansion when tested in accordance with ASTM C 827.

5. The epoxy grout shall exhibit a minimum effective bearing area of 95 percent. This shall be determined by a test consisting of filling a 2-inch diameter by 4-inch high metal cylinder mold covered with a glass plate coated with a release agent. A weight shall be placed on the glass plate. At 24 hours after casting, the weight and plate shall be removed and the area in plan of all voids measured. The surface of the grout shall be probed with a sharp instrument to locate all voids.

6. The peak exotherm of a 2-inch diameter by 4-inch high cylinder shall not exceed 95 degrees F when tested with 75 degree F material at laboratory temperature. The epoxy grout shall exhibit a maximum thermal coefficient of 30 x 10^{-6} inches/inch/degree F when tested according to ASTM C531 or ASTM D696.

7. Application: Epoxy grout shall be used to embed all anchor bolts and reinforcing steel required to be set in grout, and for all other applications in the Contract Documents where grout type is not specifically indicated.

8. For crack repair, the CONTRACTOR shall use pressure injection epoxy grout as recommended by manufacturer and approved by the RESIDENT ENGINEER.

C. Grout for Pumps and Motors:

1. Grout for pumps and motors shall be epoxy grouts meeting the following minimum requirements:

   a. Creep shall be less than 0.005 in/in when tested by ASTM C881 method. The test shall be at 70 degrees F and 140 degrees F with a load of 400 psi.

   b. Linear shrinkage shall be less than 0.080 percent and thermal expansion less than 17 x 10^{-6} in/in/degree F when tested by ASTM C531.

   c. The compressive strength shall be a minimum of 12,000 psi in 7 days when tested by ASTM C579 Method 8, modified.

   d. Bond strength of grout to Portland cement concrete shall be greater than 2,000 psi when using ASTM C882 test method.

   e. Grout shall pass the thermal compatibility test when overlayed on Portland cement concrete using test method ASTM C884.

   f. Tensile strength and modulus of elasticity shall be determined by ASTM D638. The tensile strength shall not be less than 1,700 psi and the modulus of elasticity shall not be less than 1.8 x 10^{6} psi.

   g. Peak exothermic temperature shall not exceed 110 degrees F when a specimen 6 inches in diameter by 12 inches high is used. Gel time shall be at least 90 minutes.

   h. The grout shall be suitable for supporting precision machinery subject to high impact and shock loading in industrial environments while exposed to elevated temperatures as high as 150 degrees F, with a load of 2,000 psi.

2. Primer, if required, shall conform to the written recommendations of the grout manufacturer.

3. Surface preparations shall conform to the written recommendations of the grout manufacturer.

4. Placement and Curing: Placement and curing procedures shall be in accordance with the written recommendations of the grout manufacturer.

5. Grout shall be Escoweld, Chockfast Red Epoxy Grout as manufactured by Philadelphia Resin Corp., Five Star DP Epoxy Grout as manufactured by Five Star Products, Inc., Sikadur 42, or approved alternate.

2.3 CURING MATERIALS

A. Curing materials shall be as specified in Section 03300 - Cast-in-Place Concrete for cement grout and as recommended by the manufacturer of prepackaged grouts.

2.4 MEASUREMENT OF INGREDIENTS

A. Measurements for cement grout shall be made accurately by volume using containers. Shovel measurement shall not be allowed.

B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

PART 3 - EXECUTION

3.1 GENERAL

A. All surface preparation, curing, and protection of cement grout shall be as indicated in Section 03300 - Cast-in-Place Concrete. The finish of the grout surface shall match that of the adjacent concrete.

B. The manufacturer of Class A nonshrink grout and epoxy grout shall provide onsite technical assistance to CONTRACTOR upon request.

C. Base concrete or masonry must have attained its design strength before grout is placed, unless authorized by the RESIDENT ENGINEER.

D. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow. Where "dry pack" is called for in the Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as indicated herein for the particular application.

E. The slump for topping grout and concrete fill shall be adjusted to match placement and finishing conditions but shall not exceed 4 inches.

3.2 GROUTING PROCEDURES

A. Prepackage Grouts: All mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.

B. Base Plate Grouting:

1. For base plates, the original concrete shall be blocked out or finished off a sufficient distance below the plate to provide for a minimum 1-inch thickness of grout or a thickness as indicated on the Drawings.

2. After the base plate has been set in position at the proper elevation by steel wedges or double nuts on the anchor bolts, the space between the bottom of the plate and the original pour of concrete shall be filled with non-shrink-type grout. The mixture shall be of a trowelable consistency and tamped or rodded solidly into the space between the plate and the base concrete. A backing board or stop shall be provided at the back side of the space to be filled with grout. Where this method of placement is not practical or where required by the RESIDENT ENGINEER, alternate grouting methods shall be submitted for acceptance by the RESIDENT ENGINEER.

3.3 CONSOLIDATION

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

*** END OF SECTION ***

SECTION 03400

PRECAST CONCRETE

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide precast concrete work, complete, in accordance with the Contract Documents.

B. This Section covers the design, fabrication, delivery, and installation of all precast boxes, manholes, and structural concrete including connections.

1.2 RELATED SECTIONS

A. The Work of the following Sections apply to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of the Work.

1. Section 03200 Reinforcement Steel
2. Section 03290 Joints in Concrete Structures
3. Section 03300 Cast-in-Place Concrete
4. Section 03315 Grout
5. Section 07920 Sealants and Caulking

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. The current edition of the California Building Code (CBC) as adopted by the City of San Diego Municipal Code.

B. Except as otherwise indicated, the current editions of the following standards apply to the Work of this Section:

1. Commercial Standards:

ACI 117	Tolerances for Concrete Construction and Materials
ACI 301	Specifications for Structural Concretes
ACI 315	Details and Detailing of Concrete Reinforcement
ACI 318	Building Code Requirements for Structural Concrete
AWS D1.1	Structural Welding Code - Steel
AWS D1.4	Structural Welding Code - Reinforcing Steel

PCI MNL-116	Manual for Quality Control for Plants and Production of Structural Precast Concrete Products
PCI MNL-120	Design Handbook - Precast and Prestressed Concrete

2. ASTM Standard in Building Codes:

ASTM A184	Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A185	Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A497	Steel Welded Wire Reinforcement, Deformed, for Concrete
ASTM A580	Stainless Steel Wire
ASTM A615	Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A706	Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM C33	Concrete Aggregates
ASTM C127	Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
ASTM C128	Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
ASTM C150	Portland Cement
ASTM C173	Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C204	Test Methods for Fineness of Hydraulic Cement by Air-Permeability Apparatus
ASTM C231	Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260	Air-Entraining Admixtures for Concrete

ASTM C311	Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland Cement Concrete
ASTM C494	Chemical Admixtures for Concrete
ASTM D2240	Test Method for Rubber Property -- Durometer Hardness

1.4 CONTRACTOR SUBMITTALS

A. Submittals shall be made in accordance with Section 01300 - Submittals.

B. Shop Drawings:

1. Shop drawings shall show details in accordance with ACI 315 and ACI 318 including installation details and design computations.

2. Shop drawings and design computations shall be stamped and signed by a Civil or Structural Engineer registered in the State of California.

3. Shop drawings shall indicate precast unit identification marks, the location of units in the Work, elevations, fabrication details, welding details, reinforcement, connections, dimensions, interface with adjacent members, and special handling instructions in sufficient detail to cover manufacture, handling, and erection. Shop drawings shall include erection drawings.

C. Mix Proportions: Before commencing operations a statement shall be submitted giving the nominal maximum aggregate size and proportions of all ingredients that will be used in the manufacture of concrete. The statement shall include test results from an approved testing laboratory, certifying that the proportions selected will produce concrete of the properties required. No substitutions shall be made in materials used in the concrete mix without approval and additional tests to verify that the concrete properties are satisfactory.

D. Test Reports: Tests for compressive strength of concrete shall be performed by an independent commercial testing laboratory. Copies of test reports including all test data and all test results shall be submitted.

E. Certificates of Compliance: Certificates of compliance shall be submitted attesting that materials and products meet or exceed specified requirements.

F. Manufacturer's Qualifications: Before commencing operations, a statement shall be submitted giving the qualifications of the precast concrete Manufacturer, and evidence that the Manufacturer and plant are PCI certified.

1.5 QUALITY ASSURANCE

A. General Requirements: Design members under direct supervision of a professional Civil or Structural Engineer experienced in design of precast concrete units, registered in the State of California, and conforming to requirements of PCI MNL-116, and to ACI 318.

1. Precast Manufacturer and erectors shall be qualified in accordance with PCI MNL-116.

2. Welding shall be in accordance with AWS D1.1, AWS D1.4 and AWS A5.4.

3. Manufacture, Transportation and Installation: The Manufacturer shall specialize in providing precast products and services normally associated with precast concrete construction, using procedures complying with PCI MNL-116.

4. Certificate of compliance meeting the requirement of Chapter 17 of the current edition of the California Building Code (CBC) of International Code Council (ICC) as adopted by the City of San Diego Municipal Code and acceptance by the City of San Diego shall be submitted to the OWNER.

1.6 DESIGN REQUIREMENTS

A. Standards and Loads: The precast design and construction shall conform to all applicable loads and standards as specified on the contract drawings.

B. Concrete Mix: The concrete mix shall be designed by the Manufacturer and be approved by the RESIDENT ENGINEER, to meet or exceed all of the requirements in specification Section 03300.

C. Reinforcing Steel: The reinforcing steel shall be designed by the Manufacturer and be approved by the RESIDENT ENGINEER, to meet or exceed all of the requirements in specification Section 03200.

1.7 DELIVERY, STORAGE AND HANDLING

A. General: Unless specified otherwise herein, fabrication, handling and erection of precast elements shall be in accordance with the recommendations made by ACI 318 and ACI Committee 533. Precast members shall be handled to position consistent with their shape and design; they shall be lifted and supported from design support points and provided with strong backs and other devices as required. Lifting or handling equipment shall be capable of maintaining units during manufacture, storage, transportation, erection, and in position for fastening.

B. Blocking and supports, lateral restraints and protective materials during transport and storage shall be clean, nonstaining, without causing harm to exposed surfaces, including temporary support to prevent bowing and warping. Lateral restraints shall be provided to prevent undesirable horizontal movement. Edges and exposed faces of members shall be protected to prevent straining, chipping, or spalling of concrete.

C. Precast units shall be stored off the ground in a manner to prevent warpage and shall be protected from weather, marring, and overload. Lifting devices shall have a minimum safety factor of 4.

PART 2 -- PRODUCTS

2.1 CONCRETE MATERIALS

A. Concrete: Concrete in contact with soil or liquids shall be formulated using Type II or Type V portland cement conforming to ASTM C150. Concrete not in contact with soil or liquids may be formulated using Type I or Type III portland cement. Cement shall contain less than 0.60 percent alkalies and shall be from one source throughout the entire project.

B. Aggregates: Aggregates for normal weight concrete shall conform to ASTM C33 with a maximum size of 3/4 inch.

C. Water: Water shall be clean, potable, and free from injurious amounts of oil, alkalies, organic materials and other deleterious substances.

D. Admixture: Admixture shall be Pozzolith 300R by BASF Admixture Systems, Plastocrete by Sika Corporation, or approved alternate. Admixture shall be used in strict accordance with manufacturer's recommendations. Calcium chloride or any admixture containing calcium chloride shall not be used.

E. Reinforcing Steel: Reinforcing steel shall conform to ASTM A615, including supplementary requirements, and shall be Grade 60 except that bars to be welded shall be ASTM A706.

F. Molds:

1. Molds shall be designed to withstand high-frequency vibration and to ensure finished units. Material from which molds are to be fabricated shall be wood, steel, concrete, fiberglass, reinforced plastic or wood. The selection of materials for molds shall be at the manufacturer's option. All elements shall be cast in molds of rigid construction, accurate in detail with precise corners and arises, and designed to provide a close control of dimensions and details as indicated on the drawings.

2. Prior to casting of precast elements, molds shall have all surface joints, radii, corners, etc., filled, ground, filed, straightened or otherwise removed to provide a finished concrete surface that is smooth and dense, free of honeycombing, large air pockets, offsets, sinkages, or other irregularities.

G. Embedded Items and Anchorage Devices: All embedded items, inserts, and anchorage devices exposed to view, moisture or weather shall be hot-dipped galvanized steel. Anchorage devices shall be fabricated from ASTM A36 steel.

H. Penetrations: All required penetrations and openings larger than 6-inches in diameter or 6-inches square shall be formed in place at the time of casting. Additional reinforcing shall be added where required to meet loading requirements. Openings and penetrations smaller than 6-inches may be core drilled.

I. Parting Compound: All molds shall be coated with parting compound to facilitate removal of elements from molds. Parting compound shall be non-petroleum, nonstaining and shall be of a nature and composition not deleterious to concrete.

J. Manhole Steps: Manhole steps shall be fabricated from ASTM A36 steel and shall be hot dip galvanized.

2.2 ACCESSORIES

A. Plates, Angles, Anchors, and Studs: Hot dip galvanized ASTM A36.

B. Reglets: Plastic, shaped and flanged to remain in place once cast; tape closed to prevent concrete intrusion.

C. Bearing Pads: Neoprene, molded to size or cut from molded sheet, 70-80 Type A durometer, ASTM D2240.

D. Sealant: In accordance with in Section 07920 - Sealants and Caulking.

2.3 FABRICATION

C. General: Precast concrete units shall be fabricated by a licensed shop in accordance with ACI 318, PCI MNL-116. Plant records and quality control program shall be maintained during production of precast units. Records and access to plant shall be available to the RESIDENT ENGINEER upon request.

D. Rigid molds shall be used, constructed to maintain precast unit uniform in shape, size, and finish, free from castings and dents, gouges, oil canning, or other irregularities that will adversely affect appearance or strength of units. Consistent quality shall be maintained during manufacture.

E. Reinforcing steel, anchors, inserts, plates, angles, and other cast-in-place items shall be embedded as shown on shop drawings. Reinforcement shall be fabricated and placed in conformance with ACI 318. No tack welding of or to reinforcement is permitted. Welding, when allowed, shall conform to AWS D1.4 requirements. No carbon steel chairs, spacers, nails or tie wire shall be used in positioning reinforcing and embedments.

D. Adequate reinforcing steel shall be provided to control cracking.

E. Anchors, inserts, lifting devices, and other accessories shall be placed and embedded in accordance with approved shop drawings, accurately positioned in their designed location and anchored to prevent dislocation during panel construction. Flashing reglets shall be placed and embedded continuous and straight, with lifting devices to permit removal after erection.

F. Units shall be moist cured with water mist to develop concrete quality and to minimize surface drying and appearance blemishes such as nonuniformity, staining, or surface cracking.

G. Erection slings, cables, blocking, hardware and restraints shall be nonmetallic or stainless steel. Cribbing or crating shall be wood.

2.4 FINISH OF PRECAST UNITS

A. Exposed and Unexposed Faces. Smooth, dense, uniform surface free from blemishes. Defects in unexposed edges shall be repaired as approved.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Casting:

1. Casting shall be accomplished by methods and equipment that are in conformance with generally acceptable systems for this type of Work. All precast concrete shall be manufactured by a plant thoroughly experienced in this type of Work. The manufacturer shall meet all production schedules. Surfaces on which units are cast shall be level and free from any imperfections detrimental to the surface appearance of the finished units. Parting compound shall be applied evenly as per manufacturer's recommendations.

2. Concrete shall be so handled as to prevent segregation of materials and shall be continuously vibrated during casting, either internally or externally, to achieve proper compaction, finish and distribution of concrete. All precautions must be taken to keep the reinforcing steel in the proper location during placing and consolidation of the concrete. Unless shown otherwise and except at concrete faces exposed to soil or liquids, all reinforcing steel shall have a minimum cover of 3/4 inch. At concrete faces exposed to soil or liquids, cover shall be 1-1/2 inches minimum. Embedded items shall be accurately placed and maintained in their proper location during the casting operation. Special inserts or other devices for handling of panels for the convenience of the manufacturer shall not be exposed to view after members are erected. Embedded anchors, inserts, plates, angles and other cast-in items shall have sufficient anchorage and embedment for design requirements.

3. Casting, bowing, warpage and dimensional tolerances shall be in accordance with MNL-116.

B. Curing: All precast units shall be steam cured for a period of at least 12 hours. Fog spraying may be used when reviewed by the RESIDENT ENGINEER. Precast elements shall not be removed from molds for a minimum period of 12 hours after casting, or until concrete has attained a minimum compressive strength of 3,500 pounds per square inch, whichever governs. After removal from the forms, curing by steam or fog spraying shall be continued until concrete has attained specified strength and confirmed by standard tests. Curing procedures shall be consistent and uniform throughout the entire project.

C. Welding: The quality of material and fabrication of all welded connections shall conform to the latest AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings." All weldments shall be made in accordance with the applicable provisions of AWS. All welding, other than tacks, shall be done by certified welders. All units shall be protected from damage by field welding or cutting operations. Noncombustible shields shall be provided as necessary for this purpose.

D. Joints and Joint Sealants:

1. In all instances, the edges of precast concrete units and of adjacent material shall be sound, smooth, clean and free of all contaminants prior to joint treatment.

2. Sealant and primer shall be supplied by the same manufacturer and the primer, when required, shall be as recommended for the particular sealant used. All sealant compounds shall be delivered to the job in the manufacturer's original sealed containers with labels intact and shall be applied in strict accordance with the manufacturer's recommendations. Sealant shall be as specified in specification Section 07920 of these specifications.

3.2 ERECTION

A. Any errors or misalignment in the structure which would prevent the proper setting of the elements shall be corrected by the CONTRACTOR before the erection is commenced. Erection shall be supervised and performed by workmen skilled in this type of Work. Each element shall be set in the proper position, carefully plumbed and anchored securely to the structural frame. Adjustments or changes in connections which could involve additional stresses in the products or connections shall not be permitted without approval of the RESIDENT ENGINEER. All bearing surfaces shall be true to line and grade. Erection tolerances shall be in accordance with MNL-116. All joints shall be uniform and straight.

3.3 CLEANING AND REPAIRING

A. After installation, precast elements shall be protected from all damage until final acceptance by the RESIDENT ENGINEER. Precast units with cracks, spalls, and other defects shall be subject to rejection. Units reviewed for repair shall be repaired to the satisfaction of the RESIDENT ENGINEER.

3.4 ALTERNATIVE DESIGN

A. The CONTRACTOR may offer an alternative design for any precast element. Such design shall be comparable in terms of strength, deflection, finish and all other design criteria indicated. Complete drawings prepared and sealed by a civil or structural engineer registered in the State of California where applicable shall be submitted to the RESIDENT ENGINEER for his review in accordance with these Specifications. No alternative design will be permitted unless it has been specifically accepted in writing by the RESIDENT ENGINEER. If an alternative design is accepted, all expenses resulting therefrom shall be borne by the CONTRACTOR.

*** END OF SECTION ***

SECTION 04232

REINFORCED CONCRETE BLOCK MASONRY

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide concrete masonry and appurtenant Work, complete, in accordance with the Contract Documents.

B. Work Included in this Section. Principal items are:

1. Concrete block masonry.
2. Installing reinforcing steel in masonry.
3. Grout and mortar for masonry.
4. Shoring, bracing and scaffolding incidental to work of this Section.
5. Setting and incorporating into masonry all bolts, anchors, inserts and ledgers.
6. Building in of frames, vents, pipes, conduits and inserts.
7. Continuous inspections, test specimens and samples of material, as specified.
8. Pointing, cleaning and protection.
9. Submittals.

1.2 RELATED SECTIONS

A. The Work of the following Sections apply to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 03300 Cast-in-Place Concrete
2. Section 03200 Reinforcement Steel
3. Section 07100 Waterproofing
4. Section 07920 Sealants and Caulking

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. The current edition of the California Building Code (CBC) as adopted by the City of San Diego Municipal Code.

B. Commercial Standards (Current Edition)

1. ACI 315 — Manual of Standard Practice for Detailing Reinforced Concrete Structures

2. ACI 531 — Building Code Requirements for Concrete Masonry Structures

C. ASTM Standards in Building Codes (Current Edition)

1.	ASTM A 615	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
2.	ASTM C 5	Specification for Quicklime for Structural Purposes
3.	ASTM C 55	Concrete Building Brick
4.	ASTM C 90	Specification for Load-Bearing Concrete Masonry Units
5.	ASTM C 140	Tests Methods for Sampling and Testing Concrete Masonry Units and Related Units
6.	ASTM C 144	Specification for Aggregate for Masonry Mortar
7.	ASTM C 150	Specification for Portland Cement
8.	ASTM C 207	Specification for Hydrated Lime for Masonry Purposes
9.	ASTM C 270	Specification for Mortar for Unit Masonry
10.	ASTM C 404	Specification for Aggregates for Masonry Grout
11.	ASTM C 426	Test Method for Linear Drying Shrinkage of Concrete Masonry Units
12.	ASTM C 476	Specification for Grout for Masonry
13.	ASTM E 447	Test Methods for Compressive Strength of Masonry Prisms

1.4 CONTRACTOR SUBMITTALS

A. Samples of concrete masonry unit colors with texture ranges as indicated shall be submitted to the RESIDENT ENGINEER for selection of the color in accordance with the requirements of Section 01300 - Submittals. Full size samples of the blocks selected shall be submitted for final approval by the RESIDENT ENGINEER after color selection, if requested. If the material indicated is a colored and textured unit, the samples submitted shall be colored and textured units. Samples of mortar colors shall be submitted for color selection by the RESIDENT ENGINEER.

B. A 4-foot minimum square free-standing sample panel shall be prepared for approval by the RESIDENT ENGINEER before starting masonry Work and shall remain at the Work site for reference until all masonry Work is completed.

1.5 QUALITY ASSURANCE

A. Applicable Standards: Concrete masonry shall conform to the CBC and other applicable codes and standards of governing authorities.

B. All Work shall conform to the standard of quality established by the RESIDENT ENGINEER's acceptance of the free-standing sample panel required to be constructed before starting the masonry work.

C. Concrete block masonry units shall be sampled and tested in accordance with ASTM C 140.

D. Testing of Mortar and Grout: The CONTRACTOR shall have the mortar and grout tested by a recognized testing laboratory approved by the RESIDENT ENGINEER to ensure compliance with the Specifications and the governing codes. Test reports shall be submitted to the RESIDENT ENGINEER in accordance with Section 01300 - Submittals.

E. Tests shall be taken at the following times:

1. At the start of the masonry Work, at least two test samples each of mortar and grout shall be taken on three successive working days.

2. At any change in materials or job conditions, at least two samples of each modified material, grout and mortar shall be tested.

3. Four random tests each of mortar and grout shall be made. The random test samples shall be taken when requested by the RESIDENT ENGINEER.

4. Additional samples and tests may be required whenever, in the judgment of the RESIDENT ENGINEER, additional tests (beyond the random tests) are necessary to determine the quality

F. The costs of tests and test reports, except for additional tests requested by the RESIDENT ENGINEER, shall be paid by the CONTRACTOR at no additional cost to the OWNER. The costs of the additional tests and reports, when such reports verify compliance with the Contract Documents, will be paid by the OWNER. When tests or reports do not verify compliance, the cost of all additional tests and reports shall be paid by the CONTRACTOR at no additional cost to the OWNER.

G. Test samples shall be stored in a moist environment until tested, unless directed otherwise by the RESIDENT ENGINEER or the testing laboratory. Tests shall be in accordance with CBC Section 1708.1. The grout and mortar strengths shall be not less than the minimum strengths indicated herein.

H. Inspection: Continuous inspection by a special inspector approved by the City of San Diego Development Services Department and by the RESIDENT ENGINEER will be required where necessary to conform with code requirements. [Costs of special inspection shall be paid for by the CONTRACTOR. Inspection reports shall be submitted.]

I. Weather Conditions: Concrete masonry units shall not be placed when air temperature is below 40 degrees F and shall be protected against direct exposure to the wind and sun

when erected when the ambient air temperature exceeds 99 degrees F in the shade with relative humidity less than 50 percent.

J. Product Storage: Cement, lime, and other cementitious materials shall be delivered to the site and stored in dry, weather-tight sheds or enclosures, in unbroken bags, barrels, or other approved containers, plainly marked and labeled with the manufacturers' names and brands. Mortar and grout shall be stored and handled in a manner which will prevent the inclusion of foreign materials and damage by water or dampness. Masonry units shall be handled with care to avoid chipping and breakage, and shall be stored as directed in the Building Code Requirements for Concrete Masonry Structures. Materials stored on newly constructed floors shall be stacked in such manner that the uniformly-distributed loading does not exceed 30 pounds per square foot. Masonry materials shall be protected from contact with the earth and exposure to the weather and shall be kept dry and clean until used.

PART 2 -- PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. Concrete masonry units shall conform to ASTM C 90, Type I, hollow load bearing units with maximum linear shrinkage of 0.6 percent from standard to oven-dried condition. Units shall be medium weight units unless indicated otherwise.

B. Concrete masonry units at exterior walls shall be 8-inch by 8-inch by 16-inch, 8-inch by 12-inch by 16-inch or 8-inch by 16-inch by 16-inch modular size, as indicated on the drawings, with smooth and split faces. Off-set cells when called out in the drawings. The color and finish of concrete masonry units shall be as specified on the Drawings.

C. Concrete masonry units at interior walls shall be medium weight block 8-inch by 8-inch by 16-inch or 8-inch by 12-inch by 16-inch modular size, as indicated on the drawings, with smooth faces, of color matching the integrally colored block.

D. All bond beam, corner, lintel, sill, and other specially shaped blocks shall be provided and used where required or necessary. Specially shaped nonstructural blocks may be constructed by saw cutting. The color and texture of specially shaped blocks shall match that of adjacent units.

E. Concrete masonry units hidden from view entirely may be natural color units the same size as other adjacent masonry units.

2.2 MATERIALS FOR MORTAR AND GROUT

A. Portland cement shall be Type II, low alkali, conforming to ASTM C 150.

B. Lime paste shall be made with pulverized quicklime, or with hydrated lime, which shall be allowed to soak not less than 72 hours before use; except, that hydrated lime processed by the steam method shall be allowed to soak not less than 24 hours and shall be made by adding the lime to the water. In lieu of hydrated lime paste for use in mortar, the hydrated lime may be added in the dry form. Hydrated lime shall be Type S, conforming

to ASTM C 207. Pulverized quicklime shall conform to ANSI/ASTM C 5, shall pass a No. 20 sieve, and 90 percent shall pass a No. 50 sieve.

C. Sand shall conform to ASTM C 144. Coarse aggregate shall conform to ASTM C 404.

D. Water for mixing shall be clear potable water.

E. Reinforcing steel shall be deformed bars conforming to ASTM A 615, Grade 60.

F. Admixture for mortar shall be BASF Aktiengesellschaft Rheopel Mortar Admixture; Grace Construction Products, W. R. Grace & Co. Conn. Dry-Block Mortar Admixture or approved alternate. The admixture shall not be detrimental to the bonding or help the process of efflorescence.

G. Admixture for grout shall be Sika Co. Sika Grout Aid; BASF Aktiengesellschaft Pozzolith or approved alternate.

2.3 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane, or PVC.

B. Elastomeric Sealant: Per Section 07920 "Sealants and Caulking."

PART 3 -- EXECUTION

3.1 GENERAL

A. Measurements for mortar and grout shall be accurately made. Shovel measurements are not acceptable. Mortar proportions shall be accurately controlled and maintained.

3.2 MORTAR

A. Mortar for concrete block masonry shall be Type S, with a minimum 28-day compressive strength of 1,800 psi. Proportions shall be one part portland cement, 3- to 2-part lime paste or hydrated lime, and damp, loose sand in an amount (by volume) of not less than 2-3 or more than three times the sum of the volumes of cement and lime used, with the precise amount of water required to produce the required workability and strength.

B. Mortar color shall match block color.

3.3 GROUT

A. Grout shall have a minimum 28-day compressive strength of 2,000 psi. Proportions shall be one part portland cement, not more than 1/10-part lime paste or hydrated lime, 2-3 to 3 parts damp, loose sand, not more than two parts pea gravel, and water in the amount necessary to produce a consistency for pouring without segregation of components. Where the grout space is less than 4 inches, pea gravel shall be omitted.

B. Admixtures may only be used when approved by the RESIDENT ENGINEER. When it has been approved for use, it shall be used in accordance with the manufacturer's published recommendations for the grout.

3.4 CONSTRUCTION - GENERAL

A. All Work shall be performed in accordance with the provisions of the applicable code for reinforced concrete unit masonry.

B. Set or embed all anchors, bolts, reglets, sleeves, conduits, and other items in Work as required.

C. All block cutting shall be by machine.

D. Masonry units shall be supported off ground and shall be covered to protect them from rain. Only clean, dry, uncracked units shall be incorporated into the Work.

E. All reinforcing steel shall be cleaned of all loose rust and scale, and all oil, dirt, paint, laitance, or other substances which may be detrimental to or reduce bonding of the steel and concrete.

F. Immediately before starting Work, the concrete upon which the masonry will be laid shall be cleaned with water under pressure.

G. Full mortar joint for first course shall be provided.

H. Units shall be shoved tightly against adjacent units to assure good mortar bond.

I. The CONTRACTOR shall provide safe and adequate scaffolding, planking, ladders and/or ramps conforming with all applicable CAL/OSHA State of California Construction Safety Orders.

3.5 MASON'S IRON WORK

A. The CONTRACTOR shall furnish, set and build into the masonry, all iron work necessary for the masonry construction, and which is enclosed in the masonry.

B. The CONTRACTOR shall set and build into the masonry all items which are furnished and located by other trades, or indicated on the Drawings, such as bolts and sleeves for securing the work of such other trades, metal attachments, sleeves, inserts and similar items. Setting shall consist of the bedding, or setting in mortar or dry pack, of all items to be set hereunder.

C. The CONTRACTOR shall build into the masonry all items furnished, located and set by others, such as door frames, vents, conduit, pipes and the like. Building into masonry shall consist of filling-in with mortar or grout around all items to be built into masonry, including hollow metal door frames. The CONTRACTOR shall set and build-in all such items so that there will be no voids anywhere, and so that the items are installed rigid, solid, and held accurately and securely in place.

D. The CONTRACTOR shall bear full responsibility for the accurate placement of all mason's iron work. The CONTRACTOR shall fully and solidly grout anchors in place. Unless otherwise noted, the CONTRACTOR shall provide embedment of not less than 2/3 of the wall thickness.

3.6 EQUIPMENT

A. All equipment for mixing and transporting the mortar and grout shall be clean and free from set mortar, dirt, or other foreign matter.

3.7 MIXING

A. Mortar shall be mixed by placing 1/2 of the water and sand in the operating mixer, followed by the cement, lime, and remainder of the sand and water. After all ingredients are in the mixer, they shall be mechanically mixed for not less than 5 minutes. Retempering shall be done on the mortar board by adding water within a basin formed within the mortar, and the mortar reworked into the water. Mortar which is not used within one hour shall be discarded.

3.8 ERECTION OF CONCRETE BLOCK MASONRY

A. Masonry Work shall be erected in-plane, plumb, level, straight, and true to dimensions shown and executed in accordance with acceptable practices of the trade.

B. Unless indicated otherwise, masonry shall be laid up in straight uniform courses with running bond.

C. All masonry shall be erected to preserve the unobstructed vertical continuity of the cells measuring not less than 3-inch by 3-inch in cross-section. Walls and cross webs shall be full bedded in mortar. All head (or end) joints shall be solidly filled with mortar for a distance in from the face of the wall or unit not less than the thickness of the longitudinal face shells.

3.9 SHORING AND BRACING

A. All shoring and bracing shall be provided as required for work. Shoring and bracing shall be constructed to required shapes and sizes, capable of supporting and sustaining the loads to which they will be subjected without failure or deflection. Shores and bracing shall be left in place until concrete masonry can safely carry all required live and dead loads.

B. Concrete masonry wall shall be adequately 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.

3.10 JOINTS

A. Vertical and horizontal joints shall be uniform and approximately 3/8 inch wide. Exterior joints and interior exposed block joints shall be concave-tooled to a dense surface. Special care shall be used in tooling joints so as to match existing construction. Interior or exterior nonexposed masonry and masonry behind plaster shall have flush joints.

3.11 CLEANOUTS

A. Cleanout openings shall be provided at the bottoms of all cells to be filled at each lift or pour of grout, where such lift or pour is over 4 ft in height. Any overhanging mortar or other obstructions or debris shall be removed from the insides of such cell walls. The cleanouts shall be sealed before grouting and after inspection. Cleanout openings shall match the finished wall in exposed masonry.

3.12 REINFORCEMENT

A. Deep cut bond beam blocks shall be used where horizontal reinforcing steel is embedded. H-block bond beams may be used at locations other than openings.

B. Vertical reinforcement shall be held in position at top and bottom and at intervals not exceeding 192 diameters of the reinforcement.

3.13 GROUTING

A. All cells shall be filled solidly with grout unless indicated otherwise. Grouting shall not be started until the wall has cured for 24 hours. Grout shall not be poured in more than 8-foot lifts.

B. All grout shall be consolidated at time of pouring by puddling or vibrating. Where the grouting operation has been stopped for one hour or longer, horizontal construction joints shall be formed by stopping the grout pour 1-1/2 inches below the top of the uppermost unit.

3.14 PROTECTION

A. Wall surfaces shall be protected from droppings of mortar or grout during construction.

3.15 FINISHING AND CLEANING

A. Masonry shall not be wet-finished unless exposed to extreme hot weather or hot wind and then only by using a nozzle-regulated fog spray sufficient only to dampen the face but not of such quantity to cause water to flow down over the masonry.

B. Finished masonry shall be cleaned and painted in a manner satisfactory to the RESIDENT ENGINEER, based upon the standards established by the approved sample panel.

C. All exposed to view interior and exterior colored masonry Work shall be cleaned by light sandblasting to remove all stains and other imperfections.

D. All exposed masonry surfaces of openings and window and door openings such as sills, heads, and jambs shall be finish block surfaces, not formed surfaces, unless indicated otherwise. Closed bottom bond beam blocks shall be used at heads and sills. Pour holes may be used at the sill under window frame and where approved by the RESIDENT ENGINEER.

*** END OF SECTION ***

SECTION 04815

GLASS UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide material and installation of glass unit masonry assemblies in accordance with Contract Documents.

B. Work Included in this Section:

1. Glass block set in mortar.

1.2 RELATED SECTIONS:

A. Section 04232 "Reinforced Concrete Block Masonry"

B. Section 05500 "Metal Fabrications"

C. Section 07920 "Joint Sealants"

1.3 CONTRACTOR SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: Four full glass-block units.

1.4 QUALITY ASSURANCE

A. Source Limitations for Glass Block: Obtain glass block through single source from single manufacturer.

B. Source Limitations for Accessory Materials: Obtain each cementitious material and accessory component through single source from single manufacturer and each aggregate from single source or producer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store glass block in unopened cartons on elevated platforms, under cover, and in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

B. Store glass-block grid materials in unopened cartons in an enclosed, dry location.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

E. Store accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation of glass unit masonry assemblies only when ambient and material temperatures are 40 deg F or higher.

1. Maintain temperature in installation areas at 40 deg F or above for 48 hours after installing.

PART 2 - PRODUCTS

2.1 GLASS BLOCK

A. Hollow Glass Block: Hollow units made from transparent glass, with manufacturer's standard edge coating.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Pittsburgh Corning Corporation; Premier Series Decora or comparable product by one of the following:

a. Mulia Inc. (Distributed by Glass Blocks Unlimited and Mulia, Inc.).

b. Nippon Electric Glass Co., Ltd. (Distributed by Glass Blocks Unlimited and Nippon Electric Glass America, Inc.).

c. Oberland Glas AG, Bauglas Div.; Solaris Glasstein (Distributed by Glass Blocks Unlimited and North America Glass).

d. Seves (Distributed by Glass Blocks Unlimited, International Product Supply, and Seves North America).

e. J. Weck GmbH (Distributed by Glashaus, Inc. and Glass Blocks Unlimited).

2. Glass Color: Colorless.

3. Pattern: Wavy, light-diffusive design on inner faces, and smooth outer faces.

4. Edge-Coating Color: White.

5. Sizes: Manufacturer's standard sizes corresponding to nominal sizes indicated on Drawings.

6. Heavyweight glass providing a STC 50 noise control level.

2.2 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type II. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Colored Cement Product: Packaged blend made from portland cement and hydrated lime or masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.

E. Aggregate: ASTM C 144, with 100 percent passing No. 8 sieve.

1. For pointing mortar and joints narrower than 1/4 inch, use aggregate graded with 100 percent passing No. 16 sieve.

2. White Aggregates: Natural white sand or crushed white stone.

F. Water-Repellent Admixture: Manufacturer's standard dry mixture of stearates, water-reducing agents, and fine aggregates intended to reduce capillarity in mortar.

G. Water-Repellent Admixture for Use with Water Repellent Treated CMU: Liquid polymeric water-repellent mortar admixture that does not reduce flexural bond strength of mortar.

H. Water: Potable.

2.3 GLASS UNIT MASONRY ACCESSORIES

A. Panel Reinforcement: Ladder-type units, butt welded, not lapped and welded; complying with ASTM A 951 in straight lengths of not less than 10 feet, and as follows:

1. Exterior Walls: Hot-dip galvanized, carbon-steel wire.

2. Wire Size: W1.7 or 0.148-inch diameter.

3. Width: 2 inches.

4. Spacing of Cross Rods: Not more than 16 inches apart.

B. Fasteners, General: Unless otherwise indicated, provide Type 304 or Type 316 stainless-steel fasteners at exterior walls and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at interior walls. Select fasteners for type, grade, and class required.

C. Asphalt Emulsion: Cold-applied asphalt emulsion complying with ASTM D 1187 or ASTM D 1227.

D. Plastic-Foam Expansion Strips: Polyethylene foam complying with requirements of glass-block manufacturer; 3/8 inch thick.

1. Use plastic-foam expansion strips for all assemblies.

E. Sealants: Manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated below that comply with applicable requirements in Section 07920 "Joint Sealants."

F. Sealant Accessories: Provide sealant accessories, including primers, bond-breaker tape, and cylindrical sealant backing, that comply with applicable requirements in Section 07920 "Joint Sealants."

2.4 MORTAR MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, or antifreeze compounds unless otherwise indicated.

1. Do not use calcium chloride in mortar.

2. For mortar in exterior panels, use water-repellent admixture according to admixture manufacturer's written instructions.

3. For pointing mortar in exterior panels, use water-repellent admixture according to admixture manufacturer's written instructions.

4. Limit cementitious materials in mortar to portland cement and lime.

5. Do not retemper mortar.

B. Mortar for Glass Unit Masonry Assemblies: Comply with ASTM C 270, Proportion Specification for Type S mortar.

1. Combine and thoroughly mix cementitious materials, water, and aggregates in a mechanical batch mixer unless otherwise indicated. Mix mortar to produce a stiff but workable consistency that is drier than mortar for brick or concrete masonry. Discard mortar when it has reached initial set.

C. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments shall not exceed 10 percent of portland cement by weight.

2. Pigments shall not exceed 5 percent of masonry cement by weight.

3. Mix to match Architect's sample.

D. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Mix to match Architect's sample.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine sills, jambs, and heads surrounding glass unit masonry assemblies for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLING GLASS BLOCK WITH MORTAR

A. Apply a heavy coat of asphalt emulsion to sill and adhere expansion strips to jambs and heads with asphalt emulsion. Allow asphalt emulsion to dry before placing mortar. Trim expansion strips to width required to fit glass block and to full lengths of heads and jambs.

B. Set glass block with completely filled bed and head joints, with no furrowing, accurately spaced and coordinated with other construction. Maintain 1/4-inch exposed joint widths unless otherwise indicated.

C. Install panel reinforcement in horizontal joints at spacing indicated and continuously from end to end of panels; comply with the following requirements:

1. Vertical Spacing of Panel Reinforcement for Exterior Panels: Every other course but not more than 16 inches o.c., starting with first course above sill.

2. Do not bridge expansion joints with panel reinforcement.

3. Place panel reinforcement in joints immediately above and below all openings within glass unit masonry assemblies.

4. Lap panel reinforcement not less than 6 inches if more than one length is necessary.

5. Embed panel reinforcement in mortar bed by placing lower half of mortar bed first, pressing panel reinforcement into place and covering with upper half of mortar bed.

D. Install panel anchors at locations indicated and in same horizontal joints where panel reinforcement occurs. Extend panel anchors at least 12 inches into joints, and bend within expansion joints at edges of panels and across the head. Attach panel anchors as follows:

1. For new unit masonry assemblies, embed other ends of panel anchors, after bending portions crossing expansion joint, in horizontal mortar joints closest in elevation to joints in glass unit masonry assemblies containing panel anchors.

2. For steel members, attach panel anchors with 1/4-inch-diameter through bolts and nuts or bolts in tapped holes in steel members.

E. Use rubber mallet to tap units into position. Do not use steel tools, and do not allow units to come into contact with metal accessories and frames.

F. Use plastic spacers or temporary wedges in mortar joints to produce uniform joint widths and to prevent mortar from being squeezed out of joints.

1. If temporary wedges are used, remove them after mortar has set and fill voids with mortar.

G. Keep expansion joints free of mortar.

H. Rake out joints indicated to be pointed to a uniform depth sufficient to accommodate pointing material, but not less than joint width.

1. If temporary wedges are used, remove them before raking out and pointing joints.

2. Point joints at exterior face of exterior panels with mortar.

I. Point joints with mortar by filling raked joints and voids. Place and compact pointing mortar in layers not more than 3/8 inch thick. Compact each layer thoroughly and allow to become thumbprint hard before applying next layer.

1. Tool exposed joints slightly concave when pointing mortar is thumbprint hard. Use a smooth plastic jointer larger than joint width.

J.Clean glass unit masonry assemblies as work progresses. Remove mortar fins and smears immediately, using a clean, wet sponge or a scrub brush with stiff fiber bristles. Do not use harsh cleaners, acids, abrasives, steel wool, or wire brushes when removing mortar or cleaning glass unit masonry assemblies.

K. Install sealant at jambs, heads, mullions and other locations indicated 48 hours after installation of glass block. Prepare joints, including installation of primer and bond-breaker tape or cylindrical sealant backing, and apply elastomeric sealants to comply with requirements in Section 07920 "Joint Sealants."

L. Construction Tolerances: Set glass block to comply with the following tolerances:

1. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch in 40 feet or more.

2. Variation from Level: For bed joints, and other conspicuous lines, do not exceed, 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.

3. Variation of Location in Plan: For location of elements in plan do not vary from that indicated by more than plus or minus 1/4 inch.

4. Variation in Mortar-Joint Thickness: Do not vary from joint thickness indicated by more than plus or minus 1/16 inch.

5. For faces of adjacent exposed units, do not vary from flush alignment by more than 1/16 inch.

3.3 CLEANING

A. On surfaces adjacent to glass unit masonry assemblies, remove mortar, sealants, and other residue resulting from glass-block installation, in a manner approved by manufacturers of materials involved.

B. Remove excess sealants with commercial solvents according to sealant manufacturer's written instructions. Exercise care not to damage sealant in joints.

C. Perform final cleaning of glass unit masonry assemblies when surface is not exposed to direct sunlight. Start at top of panel using generous amounts of clean water. Remove water with clean, dry, soft cloths; change cloths frequently to eliminate dried mortar particles and aggregate.

*** END OF SECTION ***

SECTION 05120

STRUCTURAL STEEL

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide structural steel beams, columns, bracings, galvanizing, and appurtenances, complete, in accordance with the Contract Documents.

1.2 RELATED SECTIONS

A. The Work of the following Sections apply to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of the Work.

B. Related Work Specified in Other Sections.

1. Section 05500 Miscellaneous Metals
2. Section 03200 Reinforcement Steel
3. Section 09800 Protective Coating, except touch-ups of damaged shop coats
4. Section 09900 Architectural Paint Finishes
5. Steel supports, hangers, brackets and other miscellaneous items accessory to the mechanical and electrical installations, and indicated or detailed on the Drawings and in Divisions 15 and 16

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. The current edition of the California Building Code (CBC) as adopted by the City of San Diego Municipal Code.

B. Commercial Standards (Current Edition):

1.	AISC	Steel Construction Manual
2.	AISC 303	Code of Standard Practice for Structural Steel Buildings and Bridges
3.	AISC 326	Detailing for Steel Construction
4.	AISC 341 and 341s1	Seismic Provisions for Structural Steel Buildings
5.	AISC 360	Specification for Structural Steel Buildings
6.	AWS-B2.1	Welding Procedure and Performance Qualification

7.	AWS-D1.1	Structural Welding Code – Steel
8.	RCSC	Specification for Structural Joints Using High-Strength Bolts

C. ASTM Standards in Building Code (Current Edition):

1.	ASTM A6	General Requirements for Rolled Steel Bars, Plates, Shapes and Sheet Piling
2.	ASTM A36	Carbon Structural Steel
3.	ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
4.	ASTM A123	Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
5.	ASTM A153	Zinc Coating (Hot Dip) on Iron and Steel Hardware
6.	ASTM A283	Low and Intermediate Tensile Strength Carbon Steel Plates
7.	ASTM A325	Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
8.	ASTM A490	Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
9.	ASTM A500	Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

1.4 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall furnish submittals to the RESIDENT ENGINEER for review in accordance with Section 01300 - Submittals.

B. Shop Drawings and Erection Drawings: The shop drawings shall provide a list of materials and a list of specifications, construction and fabrication details, layout and erection diagrams, and the method of anchorage to adjacent construction. The shop drawings shall give the location, type, size and extent of welding and bolted connections, and clearly distinguish between shop and field connections. Before submittal of the shop drawings, the CONTRACTOR shall coordinate the shop drawings and related trades to ensure proper mating of assemblies. All work shall conform to the approved shop drawings.

C. Test Reports: The CONTRACTOR shall furnish certified physical and chemical mill test reports for material used for structural members. All tests shall be performed in accordance with applicable ASTM Standards.

D. Shop Painting Data: In coordination with the requirements of Section 09800 - Protective Coating, the CONTRACTOR shall submit a product list with product data sheets of intended shop coats, which for reasons of compatibility, shall be the same products and manufacturer as those of deferred field-applied systems intended to be used in work of Section 09900 - Architectural Paint Finishes.

1.5 DELIVERY

A. The Fabricator shall deliver the fabricated material to the job site in the sequence as approved by the RESIDENT ENGINEER.

B. All shipped material to be piece-marked for erection with metal tags or other appropriate method approved by the RESIDENT ENGINEER.

C. All material shipments shall include sufficient bolts for erection, plus at least the following extra bolts:

1. Add a minimum of 2% for high strength bolts.
2. Add a minimum of 5% for unfinished bolts.

D. The RESIDENT ENGINEER reserves the right to inspect fabricated material at Fabricator's shop. The RESIDENT ENGINEER's expenses for shop expenses will be borne by the OWNER. In the event the RESIDENT ENGINEER identifies faulty materials or workmanship in fabricated material at the Fabricator's shop, the costs of additional inspections shall be borne by the CONTRACTOR. The RESIDENT ENGINEER shall be notified at least 7 days before the shipment of material. Shipments of material shall not be deleted if the RESIDENT ENGINEER does not require inspection.

E. Material damaged in shipment shall be replaced or repaired at the CONTRACTOR's expense at no additional cost to the OWNER.

1.6 QUALITY ASSURANCE

A. The CONTRACTOR shall fabricate and erect structural steel work in accordance with the latest edition of AISC "Specification for Structural Steel Buildings", and "Code of Standard Practice for Steel Buildings and Bridges", except whenever there is a discrepancy between the Drawings and this Section, the Drawings will govern.

B. Continuous Inspections:

1. The CONTRACTOR shall perform all welding and high strength bolting of structural steel assemblies under continuous inspection of an ICC-certified Special Inspector selected by the CONTRACTOR with the costs borne by the CONTRACTOR. Should such fabrication be performed in the shop of a licensed Fabricator approved by the governing Building Official and certified by ICC, only the field welding and high strength bolting of structural steel assemblies will be required to be performed under continuous inspection of the ICC-certified Special Inspector.

2. The CONTRACTOR shall notify the RESIDENT ENGINEER at least 24 hours in advance of the needed inspection.

3. The CONTRACTOR shall provide copies of inspection reports to the RESIDENT ENGINEER and Development Services Department.

1.7 WARRANTY

A. The Fabricator shall furnish a warranty to the OWNER to replace or repair all defective material and workmanship within 18 months of shipment, or 12 months of plant startup, whichever occurs first, excluding defects due to normal usage.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. General: All materials shall be new, sound and conform to the requirements herein. Unless otherwise indicated, structural steel shall be galvanized.

B. Structural Steel: Rolled shapes, plates and bars shall conform to the latest edition of the AISC "Steel Construction Manual", and shall also conform to current ASTM Designation indicated on the Drawings.

C. Pipe: Pipe shall conform to ASTM A53, Grade B seamless galvanized as required, Schedule 40, except as otherwise shown on the Drawings.

D. Tubes: Tubes shall conform to ASTM A500 Grade B (Fy = 46ksi).

E. High Strength Structural Bolts: Bolts, nuts and washers shall conform to ASTM A325N, unless otherwise noted on the Drawings.

F. Welding Electrodes: The CONTRACTOR shall use steel electrodes conforming with AWS D1.1, except that E7024 rods or electrodes shall not be used.

G. Galvanizing:

1. Iron and Steel. ASTM A123, with an average weight of 2.0 ounces per square foot, and not less than 1.8 ounces per square foot.

2. Ferrous Metal Hardware Items. ASTM A153 with average weight of 1.3 ounces per square foot.

3. Touch-up Material for Galvanized Coatings. The CONTRACTOR shall repair galvanized coatings marred or damaged during erection or fabrication by use of AMCO 321, as manufactured by the American Solder and Flux Company, Galvalloy, Rust-Oleum Stops Rust Cold Galvanizing Spray, or approved alternate, applied in accordance with the manufacturer's instructions.

H. Patch Coat for Galvanized Surfaces. The CONTRACTOR shall patch all galvanized surfaces which are scratched, marred, or otherwise damaged with Carboline Carbozinc 11 HS, AMCO 321 by American Solder and Flux Co., Rust-Oleum Stops Rust Cold Galvanizing Spray, Glidden's Glid Zinc Organic 5526/5527/5528, Sherwin-William's Zinc Clad II Plus, Tnemec 90-97, or approved alternate.

2.2 FABRICATION

A. Fabrication shall be in accordance with AISC 326 and indicated requirements. All structural steel welding in off-site fabrication shops shall be continuously inspected by a City of San Diego Certified Special Inspector with the inspection cost of the Special Inspector to be borne by the CONTRACTOR. The continuous inspection will be waived if the work is done in a shop certified by the AISC and approved by the City of San Diego.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. General:

1. Structural assemblies and shop and field welding shall meet the requirements of AISC 303, AISC 326 and AISC 360.

2. Measurements and dimensions shall be verified at the site.

3. Bolt holes shall be 1/16 inch larger than the nominal size of bolts. Where thick metals are indicated, holes shall be sub-punched and drilled, or reamed.

4. Dissimilar metals shall be protected from galvanic corrosion by means of pressure tapes, coatings or isolators.

5. Bolts shall not be permitted to drift, and holes shall not be enlarged to correct misalignment. In the event of mismatching of holes, new materials shall be provided.

6. Structural steel completely encased in concrete shall not be galvanized or painted, and shall have a clean surface for bonding to concrete.

7. Damaged structural steel shall be replaced. Use of salvaged, reprocessed, or scrap materials shall not be permitted.

B. Welding: Welding shall be performed by operators who have been qualified by tests as prescribed by AWS-B2.1, to perform the type of welding indicated. Welding shall comply with AWS Code for Arc Welding in Building Construction. Electrodes shall be matching per AWS-D1.1.

C. Galvanizing: All structural steel plates shapes, bars and fabricated assemblies required to be galvanized shall, after the steel has been thoroughly cleaned of rust and scale, be galvanized in accordance with the requirements of ASTM A123. Any galvanized part that becomes warped during the galvanizing operation, shall be straightened. Bolts, anchor bolts, nuts and

similar threaded fasteners, after being properly cleaned, shall be galvanized in accordance with the requirements of ASTM A153. Field repairs to galvanizing shall be made as noted above.

D. Painting: The CONTRACTOR shall give one or more shop coats of paint on all structural steel, except galvanized metals. Before priming, the CONTRACTOR shall thoroughly clean surfaces. The CONTRACTOR shall allow shop coats to dry before materials are loaded for delivery to the job site. After erection, the CONTRACTOR shall paint all areas where the shop coats have been rubbed off or omitted, and all field bolting and welding as specified for shop priming. The CONTRACTOR shall perform surface preparation, prime coatings, finish painting and coatings in accordance with Section 09800 - Protective Coating.

2.3 INSPECTION

A. The OWNER reserves the right to inspect all materials and workmanship covered in this Specification. However, such inspection shall not relieve the CONTRACTOR of his responsibility to furnish materials and workmanship in accordance with the Contract requirements. If inspection indicates a weld or part of the material is defective, the CONTRACTOR shall remove and replace it at the CONTRACTOR's expense.

B. Shop inspection may include, but not be limited to, the following:

1. Verification of conformance of materials with this Specification and the Drawings. The limits of acceptability and repair of surface imperfections for structural steel shall be in accordance with ASTM A6.

2. Visual and dimensional inspection of shop-fabricated structural steel members and assemblies shall be in conformance with this Specification and the Drawings.

3. Inspection of high strength bolted connections shall be in accordance with RCSC "Specification for Structural Joints Using High-Strength Bolts ".

4. Verification of welding procedures, welding operations, and welder and tacker certificates of qualification shall be in accordance with this Specification and AWS-D1.1.

*** END OF SECTION ***

SECTION 05220

CONCRETE BOLTS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide concrete anchor bolts, inserts, complete, in accordance with the Contract Documents. Principal items are anchor bolts placed in concrete, adhesive anchors, expansion bolts, and drilled anchors.

1.2 RELATED SECTIONS

A. The WORK of the following Sections apply to the WORK of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 03200 Reinforcement Steel

2. Section 03300 Cast in Place Concrete

3. Section 03315 Grout

4. Section 05120 Structural Steel

5. Section 05500 Miscellaneous Metals

6. Steel supports hangers, brackets and other miscellaneous items accessory to mechanical and electrical installations indicated or detailed on the Contract Drawings, and in Divisions 15 and 16.

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC), together with the latest adopted editions of the Regional and City of San Diego Supplement Amendments.

B. The current edition of the California Building Code (CBC) as adopted by the City of San Diego Municipal Code.

C. Federal Specifications

1. MIL-A-907E Antiseize Thread Compound, High Temperature

D. Commercial Standards (Current Edition):

1.	AWS B2.1	Welding Procedure and Performance Qualifications
2.	AWS D1.1	Structural Welding Code – Steel
3.	AISC	Steel Construction Manual

E. ASTM Standards in Building Codes (Current Edition):

1.	ASTM A36	Carbon Structural Steel
2.	ASTM A123	Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
3.	ASTM A153	Zinc Coating (Hot Dip) on Iron and Steel Hardware
4.	ASTM A193	Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications
5.	ASTM A194	Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
6.	ASTM A307	Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength
7.	ASTM A320	Alloy Steel and Stainless Steel Bolting for Low Temperature Service
8.	ASTM A563	Carbon and Alloy Steel Nuts
9.	ASTM F1554	Anchor Rods, 36, 55, and 105 ksi Yield Strength

1.4 CONTRACTOR SUBMITTALS

A. Shop Drawings: Shop drawings of all concrete bolts shall be submitted to the RESIDENT ENGINEER for review in accordance with Section 01300 - Submittals.

B. An International Code Council (ICC) report listing the ultimate load capacity in tension and shear for each size and type of adhesive and expansion concrete anchor used shall be submitted for review. The CONTRACTOR shall submit manufacturer's recommended installation instructions and procedures for all adhesive and expansion anchors for review and approval. The CONTRACTOR shall follow approved procedures during installation of concrete anchors.

C. No substitution for the indicated adhesive anchors will be considered unless accompanied with ICC report verifying strength and material equivalency, including temperature at which load capacity is reduced to 90 percent of that determined at 75 degrees F.

PART 2 -- PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Anchor Bolts: Anchor bolts shall be fabricated of materials complying with SSPWC Subsections 206-1.4.1 and 209-2.2, and as follows:

1.	Steel bolts	ASTM F1554, Grade 36
2.	Fabricated steel bolts	ASTM A36
3.	Stainless steel bolts, nuts, washers	ASTM A320, Type 316

B. Standard Service Bolts (Not Buried or Submerged): Except where otherwise indicated, all bolts, anchor bolts, and nuts shall be steel, galvanized after fabrication as indicated herein. Threads on galvanized bolts and nuts shall be formed with suitable taps and dies such that they retain their normal clearance after hot-dip galvanizing. Except as otherwise indicated, steel for bolts, anchor bolts and cap screws shall be in accordance with the requirements of ASTM F1554, Grade 36, or threaded parts of ASTM A36.

C. Buried, Outdoor or Submerged Bolts: Unless other corrosion-resistant bolts are indicated, all bolts, anchor bolts, nuts and washers which are buried, outdoor, submerged, or below the top of the wall inside any hydraulic structure shall be Type 316 stainless steel conforming to ASTM A193 for bolts, and to ASTM A194 for nuts. All threads on stainless steel bolts shall be protected with an antiseize lubricant suitable for submerged stainless steel bolts, to meet government specification MIL-A-907E.

1. Antiseize lubricant shall be classified as acceptable for potable water use.

2. Antiseize lubricant shall be "PURE WHITE" by Anti-Seize Technology, Franklin Park, IL, 60131, or approved alternate.

D. Bolt Requirements:

1. The bolt and nut material shall be free-cutting steel.

2. The nuts shall be capable of developing the full strength of the bolts. Threads shall be Coarse Thread Series conforming to the requirements of the American Standard for Screw Threads. All bolts and cap screws shall have hexagon heads, and nuts shall be Heavy Hexagon Series.

3. The length of all bolts shall be such that after joints are made up, each bolt shall extend through the entire nut, but in no case, more than 2-inch beyond the nut.

E. Adhesive Anchors: Unless otherwise indicated, all drilled, concrete or masonry anchors shall be adhesive anchors. No substitutions will be considered unless accompanied with ICC report verifying strength and material equivalency.

1. Epoxy adhesive anchors are required for drilled anchors where exposed to weather, in submerged, wet, splash, overhead, and corrosive conditions, and for anchoring handrails, pumps, mechanical equipment, and reinforcing bars. Epoxy anchor grout shall comply with Section 03315 - Grout. Threaded rod shall be stainless steel Type 316.

F. Expanding-Type Anchors: Expanding-type anchors, if indicated or permitted, shall be steel expansion-type HILTI "KB-TZ" or approved alternate. Lead caulking anchors will not be permitted. Size shall be as indicated. Expansion-type anchors, which are to be embedded in grout, may be steel. Nonembedded buried, or submerged anchors shall be stainless steel.

G. Powder-Driven Pins: Powder-driven pins for installation in concrete are not allowed.

2.2 GALVANIZING

A. Iron and Steel. ASTM A123, with average weight per square foot of 2.0 ounces, and not less than 1.8 ounces per square foot.

B. Ferrous Metal Hardware Items. ASTM A153 with average coating weight of 1.3 ounces per square foot.

C. Touch-up Material for Galvanized Coatings. Repair galvanized coatings marred or damaged during erection or fabrication by use of AMCO 321, as manufactured by the American Solder and Flux Company, Galvalloy, Rust-Oleum Stops Rust Cold Galvanizing Spray, or approved alternate, applied in accordance with the manufacturer's instructions.

2.3 WELDING ELECTRODES

A. Steel Electrodes. Use welding electrodes conforming with AWS D1.1, except E7024 rods or electrodes are not to be used.

B. Stainless Steel Electrodes. Perform welding of stainless steel with electrodes and techniques as contained in pertinent AWS A5 series specification and as recommended in Welded Austenitic chromium-Nickel Stainless Steel Techniques and Properties as published by the International Nickel Company, Inc., New York, New York.

PART 3 -- EXECUTION

3.1 FABRICATION AND INSTALLATION REQUIREMENTS

A. Fabrication and Installation: Except as otherwise indicated, the fabrication and installation of anchor bolts shall conform to the requirements of the American Institute of Steel Construction "Steel Construction Manual."

B. Install adhesive expansion and drilled anchor bolts in accordance with method specified in ICC for manufacturer product.

3.2 WELDING

A. Perform all welding in accordance with the "Structural Welding Code-Steel", AWS D1.1, and current revisions. Use only welders qualified by tests in accordance with AWS B2.1.

3.3 GALVANIZING

A. Bolts, anchor bolts, nuts and similar threaded fasteners, after being properly cleaned, shall be galvanized in accordance with the requirements of ASTM A123 and ASTM A153. Field repairs to galvanized coatings shall be made as noted above.

3.4 INSPECTION

A. The OWNER reserves the right to inspect all materials and workmanship covered in this Section. Such inspections will not relieve the CONTRACTOR of its responsibility to furnish materials and workmanship in accordance with the Specifications. If inspections indicate that materials or workmanship are defective, the CONTRACTOR shall remove and replace the defective work at no additional cost to the OWNER.

*** END OF SECTION ***

SECTION 05310

STEEL DECK PANELS

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide material and installation of steel roof deck panels in accordance with Contract Documents.

B. Work Included in this Section. Principal items are:

1. Steel roof deck panels.
2. Installation.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 05500 Miscellaneous Metals
2. Section 09900 Architectural Paint Finishes

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated in this Section, the CONTRACTOR shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC), together with the latest adopted editions of the Regional and City of San Diego Supplement Amendments.

B. The WORK of this Section shall comply with the current editions, with revisions, of the following codes and City of San Diego Supplements:

1. California Building Code (CBC)
2. California Mechanical Code (CMC)
3. California Plumbing Code (CPC)
4. California Fire Code (CFC)
5. National Electrical Code (NEC)

C. Federal Specification

1.	DOD-P-21035	Paint, High Zinc Dust Content Galvanizing Repair
2.	TT-P-664	Primer Coating, Alkyd, Corrosion-Inhibiting Lead and Chromate Free, VOC Compliant

D. Except as otherwise indicated, the current editions of the following commercial standards apply to the Work of this Section:

1.	AISI	North American Specification for Design of Cold-Formed Steel Structural Members
2.	AWS-B2.1	Welding Procedure and Performance Qualifications
3.	AWS-D1.1	Structural Welding Code - Steel
4.	AWS-D1.3	Structural Welding Code - Sheet Steel
5.	SDI COSP	Code of Standard Practice
6.	SDI MOC2	Manual of Construction with Steel Deck
7.	UL	Fire Resistance Directory

E. Except as otherwise indicated, the current editions of the following ASTM Standards in Building Codes apply to the Work of this Section: ASTM Standards in Building Codes:

1.	ASTM A36	Carbon Structural Steel
2.	ASTM A123	Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
3.	ASTM A307	Carbon Steel Bolts, Studs and threaded rod 60,000 psi Tensile Strength
4.	ASTM A653	Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process
5.	ASTM A780	Practice for Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings
6.	ASTM A1008	Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
7.	ASTM E119	Test Methods for Fire Tests of Building Construction and Materials
8.	ASTM E699	Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components

1.4 CONTRACTOR SUBMITTALS

A. General: Submittals shall be in accordance with Section 01300 - Submittals.

B. Product Data: Product data submittals shall be provided for each type of panel, accessory and product specified.

C. Shop Drawings: Shop drawings shall show the layout and types of deck panels, anchorage details, reinforcing channels, pans, deck openings, special jointing, accessories, and attachments to other construction.

D. Product Certificates: Product certificates shall be provided that are signed by the manufacturers of steel panel and certify that the products comply with specified requirements.

E. Welder Certificates: Welder certificates shall be submitted and signed by CONTRACTOR certifying that welders comply with requirements specified herein under Quality Assurance.

F. Product Test Reports: Product test reports shall be submitted from qualified independent testing agencies evidencing compliance with requirements of mechanical fasteners based on comprehensive testing.

G. Reports: Research reports or evaluation reports shall be submitted on the model code organization acceptable to authorities having jurisdiction that evidence steel panel's compliance with the building code in effect for the Project.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: The CONTRACTOR shall engage an experienced Installer who has completed steel deck similar in material, design, and extent to that indicated for this Project, and has a record of successful in-service performance.

B. Testing Agency Qualifications: To qualify for acceptance, an independent testing agency must demonstrate to the satisfaction of the RESIDENT ENGINEER, based on evaluation of agency-submitted criteria conforming to ASTM E699, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

C. Welding Standards: Welding shall comply with applicable provisions of AWS D1.1 "Structural Welding Code - Steel" and AWS D1.3 "Structural Welding Code - Sheet Steel". The CONTRACTOR shall certify that each welder has satisfactorily passed AWS qualification tests for welding the processes involved and, if pertinent, has undergone recertification.

D. Fire-Test Response Characteristics: Where indicated, the CONTRACTOR shall provide steel deck panels identical to those tested as part of an assembly for fire resistance per ASTM E119 by a testing and inspection agency performing testing and follow-up services, and that is acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: As indicated by design designations listed in UL "Fire Resistance Directory", or another testing and inspecting agency.

2. Labeling: Identify steel deck with appropriate markings of applicable testing and inspecting agency.

E. Factory Mutual Listing: The CONTRACTOR shall provide steel roof deck evaluated by Factory Mutual and listed in Factory Mutual "Approved Guide" for Class 1 fire rating and Class 1-60 windstorm ratings.

1.6 DELIVERY, STORAGE AND HANDLING

A. Protection: Steel panels shall be protected from corrosion, deformation, and other damage during delivery, storage and handling. Special care shall be exercised not to damage the material or overload the deck during the entire construction period.

B. Storage: Steel panels shall be stacked on platforms or pallets and slope to provide drainage. Panels shall be protected with a waterproof covering and ventilated to avoid condensation.

C. The deck shall not be used as a working platform until the units have been welded in position and shall not be used for storage of material without authorization by the RESIDENT ENGINEER. All damaged material shall be removed and restoration made with new material by the CONTRACTOR at no additional cost to the OWNER.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include the following, or equal:

1. ASC Profiles, Inc.
2. Vulcraft Group - a Nucor Company
3. Canam Steel Corporation - United Steel Deck
4. Verco Decking, Inc. - a Nucor Company

2.2 MATERIAL

A. Steel Panels: Panels shall be fabricated without top-flange stiffening grooves conforming to SDI COSP "Code of Standard Practice" and the following:

1. Galvanized-Steel Sheet: G60 coating per ASTM A653.

2. Design Data: Minimum 20-gauge panel with intermediate rib.

3. Section Properties (per foot of width):

Roof Deck
$+S = 0.230in^3$
$-S = 0.237in^3$
$I = 0.219in^4$

4. Roof Deck Profile: Verco Type HSB-36, ribbed, minimum 20-gauge, or approved alternate.

2.3 ACCESSORIES

A. General: Accessory materials for the steel deck shall comply with requirements and recommendations of the steel deck manufacturer.

B. Mechanical Fasteners are not permitted.

C. Side Lap Fasteners are not permitted.

D. Rib Closure Strips: Rib closure strips shall be the manufacturer's standard vulcanized, closed-cell, synthetic rubber.

E. Weld Washers: Weld washers shall be the manufacturer's standard uncoated-steel sheet weld washers, shaped to fit the deck rib, 0.061 inch thick with 3/8-inch minimum diameter prepunched hole.

F. Galvanizing:

1. Iron and Steel. ASTM A123, with an average weight of 2.0 ounces per square foot, and not less than 1.8 ounces per square foot.

2. Ferrous Metal hardware Items. ASTM A153 with average weight of 1.3 ounces per square foot.

3. Touch-up Material for Galvanized Coatings. The CONTRACTOR shall repair galvanized coatings marred or damaged during erection or fabrication by use of AMCO 321, as manufactured by the American Solder and Flux Company, Galvalloy, Rust-Oleum Stops Rust Cold Galvanizing Spray, or approved alternate, applied in accordance with the manufacturer's instructions.

G. Preset Inserts: Preset inserts shall be the manufacturer's standard, UL-labeled, single-piece preset inserts, fabricated from steel sheet galvanized according to ASTM A653.

PART 3 - EXECUTION

3.1 EXAMINATION

A. The supporting framing and field conditions shall be examined for compliance with requirements for installation tolerances and other conditions affecting performance of steel deck.

3.2 INSTALLATION, GENERAL

A. General: Deck panels and accessories shall be installed according to applicable specifications and commentary of SDI MOC2, SDI COSP, the manufacturer's recommendations, and the requirements of this Section.

B. Temporary Shoring: Temporary shoring shall be installed before placing deck panels when required to meet deflection limitations.

C. Placement: Deck panels shall be placed on supporting framing and shall be adjusted to final position with the ends accurately aligned and bearing on supporting framing before being permanently fastened. Deck panels shall not be stretched or contract side lap interlocks. Deck panels shall be placed flat and square and fastened to supporting framing without warp or deflection. Deck panels and accessories shall be cut and neatly fit around openings and other work projecting through or adjacent to the decking. Additional reinforcement and closure pieces shall be provided at openings as required for strength, continuity of decking, and support of other work.

D. Special care shall be exercised not to damage or overload the deck during installation. The deck shall not be used for storage or working platform until permanently secured in position. Construction load shall not exceed deck carrying capacity.

E. Welding Requirements: Welding shall comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.

3.3 PANEL INSTALLATION

A. Fastening: The roof deck panels shall be fastened to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter, but not less than 1½ inches long, and as follows:

1. Weld Diameter: 3/4 inch, nominal.

2. Weld Spacing: Space and locate welds as indicated.

3. Weld Washers: Install weld washers at each weld location as indicated.

B. Side Lap and Perimeter Edge Fastening: Side laps and perimeter edges of panels between supports shall be fastened at intervals as indicated.

C. End Bearing: Install deck ends over supporting framing with a minimum end bearing of 2 inches, with end joints lapped 2 inches minimum.

D. Roof Sump Pans and Sump Plates: Roof sump pans and sump plates shall be installed over openings provided in roof decking, and flanges shall be welded to the deck. Welds shall be spaced not more than 12 inches apart with at least one weld at each corner.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: A qualified independent testing agency employed and paid by the CONTRACTOR will perform field quality-control testing.

B. Inspection: Field welds will be subject to inspection.

C. Reporting: The testing agency will report test results promptly and in writing to the OWNER.

3.5 REPAIRS AND PROTECTION

A. Galvanizing Coatings: The CONTRACTOR shall prepare and repair damaged galvanized coatings on both surfaces with galvanized repair paint according to ASTM A780 and the manufacturer's instructions.

B. Touchup Painting. The CONTRACTOR shall wire brush, clean, and paint-scarred areas, welds, and rust spots on exposed surfaces of installed deck panels.

1. Touch up painted surfaces with same type of shop paint used on adjacent surfaces.

2. Where shop-painted surfaces are exposed in-service, apply touchup paint to blend into adjacent surfaces.

3. Clean and touchup painting of field welds, abraded areas, and rust spots after erection and before proceeding with field painting. Field paint in accordance with Section 09900 - Architectural Paint Finishes.

C. Provide final protection and maintain conditions to ensure steel panels are without damage or deterioration at time of Final Completion.

D. Welding:

1. Care shall be exercised in the selection of electrodes and amperage to provide positive welds and to prevent high amperage blow holes. Welds shall be made from the top side of the deck immediately after alignment.

2. The metal decking shall be welded to all supporting members with 3/4-inch effective diameter puddle welds spaced as indicated. Welding washers shall be used when welding steel decking of less than 0.028-inch thickness. Welding washers shall not be used when welding steel decking of 0.028-inches or greater.

3. Side laps shall be welded with either 3/4-inch effective diameter puddle welds or 1-1/2-inch long seam welds, spaced as indicated.

4. All welds found to be defective shall be replaced.

5. All welds shall be free of sharp points or edges. All welds shall be cleaned immediately by chipping or wire brushing and shall be coated with an organic zinc primer as recommended by the metal deck manufacturer.

6. Welding shall conform to the applicable requirements of AWS D1.3 "Structural Welding Code - Sheet Steel." Welders shall be AWS certified.

*** END OF SECTION ***

SECTION 05500

MISCELLANEOUS METALS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide miscellaneous metals and appurtenances, complete, in accordance with the Contract Documents.

B. Work Included in this Section. Principal items are:

1. Shop/erection drawings and samples.
2. Metal grating with incidental supports and attachments.
3. Checkered plate.
4. Iron castings.
5. Steel channels and/or angle frames and thresholds with anchors.
6. Welding electrodes.
7. Shop prime paint.
8. Pipe supports with saddles, hangers, bracing and attachments as detailed and required, except as provided by other trades.
9. Miscellaneous iron and steel items indicated, specified, or required for completion of the Contract, unless included under other Sections.
10. Warning signs.
11. Galvanizing and shop primer finishes, including field touch-up.

1.2 RELATED SECTIONS

A. The Work of the following Sections apply to the Work of this Section. Other, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 03200 Reinforcement Steel
2. Section 03300 Cast-in-Place Concrete
3. Section 03315 Grout
4. Section 05120 Structural Steel

5. Section 05220 Concrete Bolts

6. Section 07720 Roof Accessories

7. Section 09800 Protective Coating

8. Section 16500 Lighting

9. Steel supports, hangers, brackets and other miscellaneous items accessory to mechanical and electrical installations indicated on the Drawings, or covered in Divisions 15 and 16.

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC), together with the latest adopted editions of the Regional and City of San Diego Supplement Amendments.

B. The current edition of the California Building Code (CBC) as adopted by the City of San Diego Municipal Code.

C. Except as otherwise indicated, the current editions of the following commercial standards apply to the Work of this Section:

1. Commercial Standards:

AASHTO	HS-20 Truck Loading
AISC	Steel Construction Manual
AISC 303	Code of Standard Practice for Structural Steel Buildings and Bridges
AISC 360	Specification for Structural Steel Buildings
AISI	Design of Light Gauge, Cold-Formed Steel Structural Members
AWS	A5 Series
AWS-D1.1	Structural Welding Code - Steel
AWS-B2.1	Welding Procedure and Performance Qualification
NFPA 101	Life Safety Code
NAAMM AMP 510	Metal Stairs Manual
AWS-D1.6	Structural Welding Code – Stainless Steel

2. ASTM Standards in Building Codes:

ASTM A6	General Requirements for Rolled Steel Bars, Plates, Shapes and Sheet Piling
ASTM A36	Carbon Structural Steel
ASTM A48	Gray Iron Castings
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A123	Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
ASTM A125	Steel Springs, Helical, Heat Treated
ASTM A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A167	Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
ASTM A193	Alloy Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
ASTM A194	Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service, or Both
ASTM A276	Stainless Steel Bars and Shapes
ASTM A283	Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A307	Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength
ASTM A320	Alloy Steel and Stainless Steel Bolting for Low Temperature Service
ASTM A424	Steel, Sheet, for Porcelain Enameling
ASTM A500	Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A536	Ductile Iron Casting
ASTM A563	Carbon and Alloy Steel Nuts

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
ASTM A575	Steel Bars, Carbon, Merchant Quality, M-Grades
ASTM A786	Hot Rolled Carbon, Low Alloy, High Strength Low Alloy, and Alloy Steel Floor Plates
ASTM B98	Copper-Silicon Alloy Rod, Bar, and Shapes
ASTM B438	Bronze Base Powder Metallurgy (PM) Bearings (Oil-Impregnated)

3. Trade Standards:

   a. Welded Austenitic Chromium-Nickel Stainless Steel Technique and Properties, as Published by the International Nickel Company, Inc., New York, New York.

   b. Porcelain Enamel Institute, Inc.

1.4 CONTRACTOR SUBMITTALS

A. Shop Drawings: Shop drawings shall be submitted in accordance with Section 01300 - Submittals.

B. Layout Drawings: Layout drawings for grating shall be submitted showing the direction of span, type and depth of grating, size and shape of grating panels, seat angle details, and details of grating hold down fasteners. Load and deflection tables shall be submitted for each style and depth of grating used.

C. Product List and Product Data Sheets: In coordination with Section 09800 - Protective Coating, a product list shall be submitted with product data sheets of intended shop coats. Shop coats shall be the same products and manufacturer as those of deferred field-applied systems described in Section 09800 - Protective Coating.

1.5 QUALITY ASSURANCE

A. Miscellaneous metals shall be fabricated and erected in accordance with the latest edition of the AISC "Specification for Structural Steel Buildings ", and "Code of Standard Practice for Structural Steel Buildings and Bridges ", except whenever there is a discrepancy between the design drawings and this specification, the Drawings shall govern.

B. Continuous Inspections: All welding and high strength bolting of structural steel assemblies shall be conducted under the continuous inspection of an International Code Council (ICC) certified "Special Inspector" selected by the CONTRACTOR with costs borne by the CONTRACTOR. Should such fabrication be performed in the shop of a licensed fabricator approved by the governing building official and certified by the ICC Evaluation Services, Inc.

Only the field welding and high strength bolting of structural steel assemblies will be required to be performed under continuous inspection of the ICC-certified "Special Inspector." The OWNER shall be notified at least 24 hours in advance of needed inspections. Copies of inspection reports for shall be provided for the OWNER, CONTRACTOR, and governing building official.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Steel: Steel shall conform to the following requirements:

1.	Shapes, Plates, Bars	ASTM A36 unless otherwise indicated on the Drawings
2.	Pipe, Pipe Columns, Bollards	ASTM A53, Type E or S, Grade B Schedule 40, unless noted otherwise
3.	Tubes	ASTM A500, Grade B

B. Stainless Steel: Unless otherwise designated or approved, stainless steel alloy types shall conform to ASTM A167 and ASTM A276 as follows:

1. Stainless steel plates, pipe and structural shapes: Type 316L.
2. Stainless steel bolts, nuts and washers: Type 316L where connecting or bearing on aluminum.

C. Cast Iron: Cast iron shall conform to ASTM A48, except as otherwise noted.

D. Ductile Iron: Ductile iron shall conform to ASTM A536, using Grade 60-40-18 or better, except as otherwise noted.

2.2 STEEL PIPE HANDRAILS / GUARDRAILS

A. Steel Pipe Handrails: Steel pipe handrails, including brackets and related hardware, which may be partially or wholly submerged, or which are located inside a hydraulic structure, shall be entirely of Type 316L stainless steel. All other steel pipe handrail shall be as specified on the Drawings and shall be picked at fabrication plant and hot-dip galvanized after fabrication.

2.3 METAL GRATING

A. General: Metal grating shall be of the design, sizes, and types indicated. All grating shall be completely banded at all edges and cutouts using material and cross section equivalent to the bearing bars. Such banding shall be welded to each cut bearing bar. Grating shall be supported on all sides of an opening by support members. Where grating is supported on concrete, embedded support angles matching grating material shall be used on all sides, unless indicated otherwise. Such angles shall be mitered and welded at corners. Grating shall conform to the following requirements:

1. All pieces of grating shall be fastened in two locations to each support.

2. Where grating forms the landing at the top of a stairway, the edge of the grating, which forms the top riser, shall have an integral nonslip nosing, width equal to that of the stairway.

3. Where grating depth is not given, grating shall be provided which will be within allowable stress levels, and which shall not exceed a deflection of 3 inch or the span divided by 180, whichever is less. For standard duty plank, and safety grating, the loading to be used for determining stresses and deflections shall be the uniform live load of the adjacent floor or 100 psf, whichever is greater or a concentrated load of 1,000 pounds. For heavy duty grating, the loading used for determining stresses and deflections shall be AASHTO HS-20.

B. Grating Materials: Grating materials shall conform to the following requirements:

1. Grating which may be partially or wholly submerged shall be fabricated entirely of Type 316 stainless steel. All other grating shall be as specified on the Drawings and shall be hot-dip galvanized after fabrication.

C. Standard-Duty Grating:

1. No single piece of grating shall weigh more than 80 pounds, unless indicated otherwise. Standard duty grating shall be serrated bar grating.

2. Cross bars shall be welded or mechanically locked tightly into position so that there is no movement allowed between bearing and cross bars.

D. Safety Grating: Safety grating shall be made of sheet metal punched into an open serrated diamond pattern and formed into plank sections. The open diamond shapes shall be approximately 1/2 inch by 11/16 inch in size.

E. Heavy-Duty Grating: Heavy-duty grating shall be of welded steel, galvanized after fabrication. Cross bars shall be welded in position.

F. Grating Fastening Devices: For metal gratings, either welded or mechanical attachments shall be used except where otherwise noted for locations such as stair treads and incidental landings.

2.4 CHECKERED PLATE

A. Checkered Plate: Checkered plate shall conform to Federal Specification QQ-F461. Checkered plate shall be not less than 3/16 inch thick, and shall have a pattern of raised lugs on one face and shall be smooth on the opposite face. Lugs shall be a minimum of one inch in length and raised a minimum of 0.050 inch above the surface. The lugs shall be located in a pattern in which the lugs are oriented at 90 degrees from the adjacent lugs in two orthogonal directions. The rows of lugs shall be oriented at 45 degrees from the edges of the plates.

B. Plate material: Where no plate material is indicated, stainless steel shall be provided. Unless indicated otherwise, the minimum plate thickness shall be as required to limit deflection, resulting from a live load of 100 psf, to 3 inch or the span divided by 240, whichever is less.

2.5 IRON CASTINGS

A. General: Iron castings shall be of uniform quality, free from blowholes, porosity, hard spots, shrinkage, distortion, or other defects. They shall be smooth and well cleaned by shotblasting.

B. Covers and Grates: Covers and grates shall fit together evenly, so that the cover fits flush with the surrounding surface and so that the cover does not rock or rattle when loading is applied. Round covers and frames shall have machined bearing surfaces.

C. Design Loads: Covers and grates with matching frames shall be designed to support the following loadings:

1. Where located within a structure, the design loading shall match that required for the adjacent floor area, or, if no loading is given, a minimum of 300 pounds per square foot, unless indicated otherwise.

2. Exterior covers and grates shall be designed for AASHTO HS-20 loading unless indicated otherwise.

D. Cover Details: Unless indicated otherwise, access manway covers shall be two-part street type removable covers. Larger cover shall be for a 48-inch diameter clear opening with 24-inch diameter cover offset from the center as indicated. Raised lettering shall be as indicated.

2.6 GALVANIZING

D. Galvanizing for Iron and Steel: Galvanizing for iron and steel shall conform to ASTM A123, with the average weight of 2.0 ounces per square foot, and not less than 1.8 ounces per square foot.

E. Ferrous Metal Hardware Items: Ferrous metal hardware items shall conform to ASTM A153, with average coating weight of 1.3 ounces per square foot.

2.7 WELDING ELECTRODES

A. Steel Electrodes: Welding electrodes shall conform with AWS D1.1, except E7024 rods or electrodes shall not be used.

B. Stainless Steel Electrodes: Welding of stainless steel with electrodes and techniques shall conform to the pertinent AWS A5 series specification, and as recommended in Welded Austenitic Chromium-Nickel Stainless Steel Techniques and Properties as published by the International Nickel Company, Inc., New York, New York.

2.8 BOLTS

A. Bolt Requirements: Bolts shall comply with the following:

1. Nuts shall be capable of developing the full strength of the bolts. Threads shall be Coarse Thread Series conforming to the requirements of the American Standard for Screw Threads. Bolts and cap screws shall have hexagon heads and nuts shall be Heavy Hexagon Series.

2. The length of all bolts shall be such that after joints are made up, each bolt shall extend through the entire nut, but in no case more than 2-inch beyond the nut.

B. Standard Service Bolts (Not Buried or Inside Tanks or Channels): Except where otherwise indicated, bolts and nuts shall be steel and shall be galvanized after fabrication. Threads on galvanized bolts and nuts shall be formed with suitable taps and dies such that they retain their normal clearance after hot-dip galvanizing. Except as otherwise indicated herein, steel for bolts, anchor bolts and cap screws shall be in accordance with the requirements of ASTM A307, or threaded parts of ASTM A36.

C. Bolts Buried or Inside Tanks or Channels: Unless otherwise indicated, bolts, anchor bolts, nuts and washers which are buried, submerged, or below the top of the wall inside any hydraulic structure shall be of Type 316 stainless steel.

2.9 SHOP PRIME PAINT

A. Shop Prime Paint: To ensure compatibility with deferred field-applied paint or coating systems, for ferrous metals other than stainless steel, galvanized steel and cast iron, provide surface preparations, and use shop prime paint product and manufacturer as painting, or protective coating system intended for field application specified in Section 09800 - Protective Coating. Shop prime shall not be provided on portions of work immediately adjacent to intended field welds, or on portions intended for embedment. Steel stair nosings shall be painted with industrial "Safety Yellow" enamel prime and finish coats conforming with California OSHA requirements.

2.10 MANUFACTURERS

A. Products of the type or model (if any) indicated shall be manufactured by one of the following (or approved alternate):

1 Steel Gratings:

a. Irving Type IWA
b. Gary Type GW

2. Floor and Cover Plates:

a. Steel Tread Plate

3. Fall Prevention System:

a. Research and Trading Corporation, Wilmington, Delaware Everest Lifeline System Model No. 6006

b. North Consumer Products, Inc., California Saf-T-Climb

4. Manhole Frames and Covers:

   a. Neenah Foundry Company R-1642 with Self-Sealing Cover
   b. Phoenix Iron Works P-1090 R/G

5. Field Repairs to Galvanizing:

   a. "Carbozinc 11 HS"
   b. "AMCO 321"
   c. "Galvalloy"

PART 3 -- EXECUTION

3.1 FABRICATION AND INSTALLATION REQUIREMENTS

A. Fabrication and Erection: Except as otherwise indicated, the fabrication and erection of structural steel shall conform to the requirements of the American Institute of Steel Construction "Steel Construction Manual."

   1. The Work of this Section shall be coordinated with related trades. Particular attention is required for items to be embedded in concrete work. All punchings and drillings, indicated or required, shall be provided for attachment of other work to that of this Section.

   2. Compliance with Safety Requirements. Dimensions required for the fabrication and installation of handrails, ladders, grating, plate, pipe hangers and etc. which are not shown on the Drawings, shall conform to the Division of Occupational Health and Safety, General Industrial Safety Orders, State of California.

B. Protection: The CONTRACTOR shall provide and be responsible for protection and repair of adjacent surfaces and areas which may become damaged as a result of work in this Section. Work performed hereunder shall be protected until completion and final acceptance of project by the OWNER. The CONTRACTOR shall repair or replace all damaged or defective work to original specified condition at no additional cost to the OWNER.

   1. Finished floor surfaces and adjacent work shall be protected from damage. Concrete floors shall not be overloaded. Mobile equipment used in placing steel shall have pneumatic tires. Steel members shall not be placed directly on floors; pads of timber or other material shall be used for cushioning.

   2. Where welding is done in proximity to glass or finished surfaces, such surfaces shall be protected from damage due to weld sparks, spatter or tramp metal.

C. Pipe Rails and Railings: Pipe rails and railing shall be fabricated complete with stanchions, toe plates, welded and bolted fittings, attachments and expansion/contraction provisions true to size configurations to meet or exceed the requirements of CAL/OSHA, and as shown on the Drawings. The CONTRACTOR shall grind and polish welds flush and smooth. Curves, where indicated or necessary, shall be bent on a radius of not less than 5 inches.

1. Safety chains shall be 1/2-inch link chain of same material as the railing with stainless steel harness-type snap to meet or exceed the requirements of CAL/OSHA.

2. Provisions shall be made to drain water from rail systems by drilling weep holes in concealed locations at the lowest possible elevations.

D. Pipe and Conduit Supports and Bracing: Supports and bracing for pipe and conduit shall be fabricated and installed as detailed on the Drawings, and in accordance with the requirements described in Section 15020 - Pipe Supports, in a fully coordinated manner with the Work of other trades. Where shown or indicated, hot-dip galvanized shall be provided after fabrication, with touch-up of abraded or burned galvanizing using materials specified in this Section. Unless otherwise indicated, members shall be shop primed with a rust-inhibitive primer conforming with requirements of Section 09800 - Protective Coating.

E. Embedded Steel Channel and Angle Frames: Embedded steel channel and angle frames shall have continuously welded joints. Exposed welds shall be ground flush. Hot-dip galvanizing shall be provided after fabrication.

F. Warning Signs: Warning signs shall be furnished and installed in the locations specified below. Provide signs that are not less than designated sizes. Fabricate signs of porcelain enamel safety blanks with red lettering on a white background. Fabricate using 18 ga vitreous enameling steel (ASTM A424 - type II). Equip each with 6 eyeleted holes for No. 10 fastener. Provide fused porcelain enamel, both sides, suitable for exterior or industrial end use by experienced fabricators in strict conformance with pertinent requirements as published by Porcelain Enamel Institute, Inc.

1. Attach a 7-inch by 10-inch sign to each hose bib that reads:

"DO NOT DRINK"
"NO TOMAR AGUA"

2. Provide and post near all automatic machinery, a 10 inch by 14 inch sign that reads:

"CAUTION: AUTOMATIC MACHINERY MAY START AT ANY TIME"
"PRECAUCION: MAQUINARIA PUEDE EMPEZAR EN CUALQUIER MOMENTO"

3. Provide and attach to the interior side of all access doors which provide egress to the outside a 7 inch by 10 inch sign that reads:

"EXIT"
"SALIDA"

5. Where shown on the Drawings, provide illuminated exit signs specified in Section 16500 - Lighting.

3.2 WELDING

A. Welding Steel: Welding shall be performed in accordance with the "Structural Welding Code-Steel", AWS-D1.1, and current revisions, except where the Gas Metal Arc Welding (GMAW) process is used, the short-circuited mode shall only be used for light gauge material (12 gauge and lighter). Welders shall be qualified by tests in accordance with AWS-B2.1.

3.3 GALVANIZING

A. Galvanizing: All structural steel plates shapes, bars and fabricated assemblies required to be galvanized shall, after the steel has been thoroughly cleaned of rust and scale, be galvanized in accordance with the requirements of ASTM A123. Any galvanized part that becomes warped during the galvanizing operation shall be straightened. Bolts, anchor bolts, nuts and similar threaded fasteners, after being properly cleaned, shall be galvanized in accordance with the requirements of ASTM A153. Field repairs to galvanizing shall be made using "Galvalloy," "AMCO 321," or approved alternate.

3.4 PAINTING

A. Painting: One or more shop coats of paint shall be given on all ferrous metals, except cast-iron, ductile iron, stainless steel and galvanized metals. Before priming, surfaces shall be thoroughly cleaned. Shop coats shall be allowed to dry before materials are loaded for delivery to the job site. After erection, all areas shall be painted where the shop coats have been rubbed off or omitted, and all field bolting and welding areas as specified for shop priming. See Section 09800 - Protective Coating for surface preparation, prime coatings, finish painting and coatings.

B. Isolation of Dissimilar Metals: Aluminum members shall be isolated from contact with dissimilar metals, concrete and masonry to provide protection from electrolytic deterioration. The CONTRACTOR shall use nonabsorptive tape or gaskets, a heavy brush coat of approved zinc chromate primer made with a synthetic resin vehicle, or a heavy coat of approved alkali-resistant bituminous paint.

*** END OF SECTION ***

SECTION 06105

MISCELLANEOUS CARPENTRY

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide all miscellaneous carpentry and related items, complete, in accordance with the Contract Documents

B. Section Includes:

1. Rooftop equipment bases and support curbs.

2. Wood blocking, cants, and nailers.

3. Wood roof sheathing.

1.2 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. WCLIB: West Coast Lumber Inspection Bureau.

2. WWPA: Western Wood Products Association.

1.3 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.

2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated plywood.

2. Preservative-treated wood.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.

2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.

3. Provide dressed lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

E. Application: Treat all miscellaneous carpentry and sheathing unless otherwise indicated.

2.3 ROOF SHEATHING

A. Plywood Roof Sheathing: Exterior, Structural I sheathing.

1. Span Rating: Not less than 16/0.

2. Nominal Thickness: As indicated, or if not indicated, not less than 1/2 inch.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.

2. Nailers.

3. Rooftop equipment bases and support curbs.

4. Cants.

5. Batten Strips.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber and any of the following species:

1. Hem-fir; WCLIB or WWPA.

2. Western woods; WCLIB or WWPA.

C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or of Type 304 stainless steel].

B. Nails, Brads, and Staples: ASTM F 1667.

C. Wood Screws: ASME B18.6.1.

D. Screws for Fastening to Metal Framing: ASTM C 1002, length as recommended by screw manufacturer for material being fastened.

E. Lag Bolts: ASME B18.2.1.

F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.6 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Where wood-preservative-treated lumber or sheathing is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

C. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

D. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

E. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.

2. Use copper naphthenate for items not continuously protected from liquid water.

F. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.

2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

G. Use galvanized steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 SHEATHING INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated.

D. Where possible, select fasteners of size that will not fully penetrate substrate where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.3 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

*** END OF SECTION ***

SECTION 07100

WATERPROOFING

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The CONTACTOR shall provide waterproofing and moistureproofing of concrete and reinforced concrete block masonry surfaces.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 07920 Sealants and Caulking

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. The current edition of the California Building Code (CBC) as adopted by the City of San Diego Municipal Code.

B. Except as otherwise indicated, the current editions of the following apply to the Work of this Section:

1.	ASTM D 41	Specification for Asphalt Primer Used in Roofing and Waterproofing
2.	ASTM D 226	Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
3.	ASTM D 312	Specification for Asphalt Used in Roofing

1.4 SUBMITTALS

A. The following shall be submitted in compliance with Section 01300 - Submittals:

1. Manufacturer's product data including catalogue cuts.
2. Manufacturer's installation instructions.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials: Products shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer.

B. Storage: Products shall be carefully stored in a manner that will prevent damage and in an area that is protected from the elements.

PART 2 - PRODUCTS

2.1 GENERAL

A. Only products certified as complying with the indicated requirements shall be provided.

B. Products shall be new, of current manufacture, and shall be the products of reputable manufacturers specializing in the manufacture of such products.

C. Products shall be recommended by the manufacturer for the application indicated.

2.2 WATERPROOFING COATING

A. Waterproofing coating shall be a coal tar epoxy resin.

2.3 MOISTUREPROOFING COATING

A. Moistureproofing coating shall be a coal tar solution.

2.4 WATERPROOFING MEMBRANE

A. Waterproofing membrane shall be minimum 60-inchwide sheets of bituminous and synthetic resins reinforced with an inert material for puncture resistance of at least 200 pounds. Thickness of the sheet shall be 60 mils, minimum.

2.5 WATERPROOFING PROTECTIVE BOARD

A. Protective board shall be 1-inch asphalt impregnated insulation board.

2.6 MOISTUREPROOFING UNDERLAY

A. Plastic membrane for moistureproofing underlay shall be polyethylene film with a thickness of 10 mils.

2.7 MOISTUREPROOFING UNDERLAY TAPE

A. Pressure sensitive tape shall be 2-inch wide polyethylene tape.

2.8 BELOW-GRADE WATERPROOFING

A. Waterproofing materials for use below grade shall conform to the following:

1. Below-grade waterproofing shall be cold-applied waterproofing system for concrete block masonry or concrete walls. It shall consist of a primer coat covered with not less than 3 coats of fibrated asphalt emulsion, and not less than one layer of 15 pound asphalt thick bituminous-impregnated protective fiberboard for membrane protection during backfill. The waterproofing system shall be designed to withstand a 1-foot hydrostatic head.

2. Expansion joint sheets shall be tough, pliable, waterproof sheets of high quality polyethylene coated on one side with a thick, factory-applied layer of adhesive-consistency rubberized asphalt.

2.9 MANUFACTURERS

A. Products shall be of the type and manufacture as indicated below (or equal):

1. Waterproofing Coating:

   a. Kopper's Bitumastic 300-M
   b. Porter Maxi Build II
   c. or approved alternate

2. Moistureproofing Coating:

   a. Kopper's Bitumastic 50
   b. Porter Tarmastic 100
   c. or approved alternate

3. Waterproofing Membrane:

   a. W.R. Grace and Company's "Bituthene"
   b. Protecto Wrap Co.'s "Jiffy Seal"
   c. or approved alternate

4. Waterproofing Protective Board:

   a. Celotex Insulation Board
   b. or approved alternate

5. Below-Grade Waterproofing:

   a. Waterproofing System:

      1) EMW-1 Waterproofing System by Flintkote Company
      2) or approved alternate

   b. Expansion Joint Sheets:

      1) "Flash-bend" by Flintkote Co.
      2) "Bituthene" by W.R. Grace and Co.
      3) or approved alternate

   c. Emulsion:

      1) Liquid Boot, LBI Technologies, Inc.
      2) Sealmastic Emulsion, W.R. Meadows
      3) or approved alternate

d. Geotextiles:

1) Minardi 300 HV Protection Course
2) or approved alternate

PART 3 - EXECUTION

3.1 GENERAL

A. Products shall be installed in accordance with the manufacturer's installation instructions.

3.2 WATERPROOFING COATING

A. Location: Waterproofing coating shall be applied to the water side of walls and bottoms of channels or tanks which are common with rooms, tunnels or galleries to be occupied by equipment, piping, conduit, or personnel.

B. Surface Preparation: New concrete to be waterproofed shall have aged at least 28 days and allowed to dry to a moisture content recommended by the coating manufacturer. Concrete surfaces shall be sandblasted. Voids and cracks shall be repaired.

C. Applications: Prime coat shall be thinned and applied at the rate of approximately 200 to 300 square feet per gallon depending on surface condition. Finish coats shall be applied at the rate of 100 square feet per gallon. Final coat shall be black. Total dry film thickness shall be minimum 20 mils. Drying time between coats shall be as recommended by the coating manufacturer.

3.3 MOISTUREPROOFING COATING

A. Moistureproofing coating shall be applied to exterior of outside concrete walls which are below grade and are common with rooms, tunnels or galleries to be occupied by equipment, piping or personnel, unless a "below-grade waterproofing" system is indicated.

B. Surface Preparation: Masonry surfaces shall be allowed to age for at least 28 days. Holes or other joint defects shall be filled with mortar and repointed. Loose or splattered mortar shall be removed by scrapping and chipping. Masonry surfaces shall be cleaned with clear water by washing and scrubbing. Muriatic acid shall not be used. After cleaning, masonry surfaces shall be sealed or filled with sealer or block filler compatible with the indicated primer.

C. Application: Each prime and finish coat shall be applied at the rate of 70 square feet per gallon. The number of finish coats shall be sufficient to produce a dry film thickness of at least 15 mils. Drying time between coats shall be as recommended by the coating manufacturer.

3.4 WATERPROOFING MEMBRANE

A. Location: Waterproofing membrane shall be applied to surfaces indicated.

B. Surface Preparation: Concrete surfaces shall be clean, dry and free of voids, spalled areas, loose aggregate, and sharp protrusions, with no coarse aggregate visible.

C. Application:

1. Waterproofing membrane shall be applied in accordance with the manufacturer's recommendations. Surfaces shall be clean and primed before application of the membrane.

2. Pipes or conduits entering structures shall be watertight. The protective board shall be placed directly against membrane before backfilling. Where the membrane is turned up from the base of the walls, at angles in walls, and at any other place where the membrane may be subjected to unusual strain, strips, consisting of two additional plies of membrane shall be applied.

3.5 MOISTUREPROOFING UNDERLAY

A. Location: Unless otherwise indicated, moistureproofing underlay shall be provided under all concrete slabs-on-grade.

B. Surface Preparation: Backfilled surfaces to receive moistureproofing underlay shall be leveled off and smoothed over to minimize contact with sharp edges.

C. Application: At joints, moistureproofing membrane shall be lapped 6 inches and sealed with pressure sensitive tape. Where pipes and conduits pass through the membrane, they shall be wrapped tightly with separate sheets of membrane which shall then be sealed with tape to the main membrane. Reinforcing steel or wire mesh shall be supported to protect the membrane.

3.6 BELOW-GRADE WATERPROOFING

A. All buried planters and exterior of concrete walls, where indicated, shall be protected from moisture with below-grade waterproofing system.

*** END OF SECTION ***

SECTION 07210

BUILDING INSULATION

PART 1 - GENERAL

1.1_ WORK OF THIS SECTION

A. The CONTRACTOR shall provide material and installation of building insulation in accordance with Contract Documents.

B. Work included in this Section includes faced, semi-rigid roof insulation board.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 05310 Steel Deck Panels

1.3 CODES

A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

1. California Building Code

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

1. ASTM C 612

2. ASTM E 84 — Test Method for Surface Burning Characteristics of Building Materials

3. ASTM E 136 (Noncombustible)

4. ANSI/ASTM D 41 — Specification for Asphalt Primer Used in Roofing and Waterproofing

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 01300:

1. Manufacturer's product data.
2. Manufacturer's installation instructions.
3. Certification that products meet the specifications indicated.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials: Manufactured materials shall be delivered in original unbroken packages, containers, or bundles bearing the name of the manufacturer.

B. Storage: Materials shall be carefully stored in an area which is protected from the elements in a manner recommended by the manufacturer to prevent damage to the material and marring of its finish.

PART 2 -- PRODUCTS

2.1 GENERAL

A. General: Only products certified as complying with the indicated requirements shall be provided.

B. Products: Products shall be new, of current manufacture, and shall be the products of reputable manufacturers specializing in the manufacture of such products.

C. Manufacturer's Recommendations: Products shall be recommended by the manufacturer for the application indicated.

D. General: Building insulation shall conform to the applicable requirement of the Underwriters Laboratories "Fire Resistance Index," Factory Mutual requirements, and specifications.

E. Flame Spread Rating: Insulation shall have a flame-spread rating of 25 or less and a smoke rating not exceeding 450 when tested in accordance with CBC.

2.3 ROOF INSULATION

A. Basis of Design: Johns Manville Insul-SHIELD, flexible, semi-rigid fiber glass boards with PSK (polypropylene-scrim-Kraft) facings, with minimum "R" value of 30.

2.16 STEEL DECK FASTENERS

A. Steel deck fasteners shall have integral rust-resistant stress distribution caps, and shall comply with the recommendations of the insulation and roofing manufacturer. Basis of Design: Gemco Insul-Anchors. Fastener length per fastener manufacturer for R-30 insulation thickness (approx 7.5").

PART 3 -- EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness

E. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, use mechanical anchorage to provide permanent placement and support of units.

3.3 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation

*** END OF SECTION ***

SECTION 07321

CONCRETE ROOF TILES

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide material and installation of concrete roof tiles in accordance with Contract Documents.

B. Work included in this Section Includes:

1. Concrete roof tiles.

2. Underlayment.

C. Related Sections:

1. Section 05310 "Steel Deck Panels".

2. Section 06105 "Miscellaneous Carpentry".

1.2 DEFINITIONS

A. Roofing Terminology: See ASTM D 1079, glossaries in TRI/WSRCA's "Concrete and Clay Roof Tile Design Criteria Installation Manual for Moderate Climate Regions," and NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For each type of concrete roof tile and accessory tile indicated.

C. Material Test Reports: For each type of concrete roof tile.

D. Research/Evaluation Reports: For concrete roof tiles, fasteners, and fastener systems, from the ICC.

E. Warranties: Sample of special warranties.

F. Maintenance Data: For roofing to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain concrete roof tiles and accessory tiles from single source from single manufacturer.

B. Fire-Test-Response Characteristics: Provide concrete roof tiles and related roofing materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure: Class A; UL 790 or ASTM E 108, for application and roof slopes indicated.

C. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store underlayment rolls on end, on pallets or other raised surfaces. Do not double stack rolls.

1. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.

B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

1.6 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing to be performed according to manufacturer's written instructions and warranty requirements.

1. Install self-adhering sheet underlayment within the range of ambient and substrate temperatures recommended by manufacturer.

1.7 WARRANTY

A. Special Warranty: Standard form in which manufacturer agrees to repair or replace concrete roof tiles that fail in materials within specified warranty period.

1. Materials-Only Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONCRETE ROOF TILES

A. Concrete Roof Tiles: ASTM C 1492, molded- or extruded-concrete roof tile units of shape and configuration indicated, with integral color, and free of surface imperfections. Provide with fastening holes prepunched at factory.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Eagle Roofing Products, Bel Air Concrete Tile or comparable product by one of the following:

   a. Bartile.
   b. Dectile.
   c. Entegra Sales, Inc.
   d. Hanson Roof Tile.
   e. MonierLifetile LLC.
   f. Staco Architectural Roof Tile.
   g. Boral Roofing Products

2. Weight: Standard.

3. Shape: Low Profile

4. Trim Tile: Rake/Ridge Type

5. Hip Starters: Flat Smooth

6. Color: Specified on drawings

7. Accessory Tiles: Ridge, ridge end. header course, rake edge, starter, end band and terminal units, in color matching concrete roof tiles.

2.2 ACCESSORIES

A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.

B. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied.

C. Elastomeric Sealant: ASTM C 920, elastomeric silicone-based joint sealant; Type M or Type S, Grade NS, Class 25, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O.

D. Mortar: ASTM C 270, Type M, with ASTM C 979, pigmented mortar matching the color of concrete roof tiles for exposed-to-view mortar, and natural color for concealed-from-view mortar.

E. Eave Closure: Manufacturer's standard eave closure formed to shape of concrete roof tiles.

F. Wood Nailers, Beveled Cant Strips and Wood Battens: Comply with requirements for pressure-preservative-treated wood in Section 06105 "Miscellaneous Carpentry."

2.3 FASTENERS

A. Roofing Nails: Electro Galvanized Smooth Shank nails; of sufficient length to penetrate 3/4 inch (19 mm) into roof sheathing.

1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.

B. Wood Batten Nails: ASTM F 1667; common or box, steel wire, flat head, and smooth shank.

C. Wire Ties: Stainless steel, 0.083-inch minimum diameter.

2.4 UNDERLAYMENT MATERIALS

A. Self-Adhering Sheet Underlayment, Granular Surfaced: ASTM D 1970, a minimum of 40-mil- (1.4-mm-) thick sheet;cold applied, self adhering membrane composed of high density cross laminated polyethylene film coated on one side with a layer of rubberized asphalt adhesive. Provide primer for adjoining concrete or masonry surfaces to receive underlayment.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ALCO-NVC Inc.
b. Atlas Roofing Corporation.
c. Carlisle Coatings & Waterproofing, Inc.
d. CertainTeed Corporation.
e. GAF Materials Corporation.
f. Henry Company.
g. Johns Manville.
h. Owens Corning.
i. Grace Ice
j. Water Shield

2.5 METAL FLASHING AND TRIM

A. General: Comply with requirements in Section 07600 "Flashing and Sheet Metal".

1. Sheet Metal: Zinc-tin alloy-coated steel.

B. Fabricate sheet metal flashing and trim to comply with recommendations that apply to design, dimensions, metal, and other characteristics of the item in SMACNA's "Architectural Sheet Metal Manual."

C. Vent-Pipe Flashings: ASTM B 749, Type L51121, at least 1/16 inch thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof and extending at least 4 inches from pipe onto roof.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.

2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored and that provision has been made for flashings and penetrations through roofing.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. General: Comply with concrete roof tile manufacturer's written instructions and recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

1. Cover ridge wood nailers with underlayment strips.

B. Self-Adhering Sheet Underlayment: Install wrinkle free; comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated, lapped in direction to shed water. Lap sides not less than 3-1/2 inches. Lap ends not less than 6 inches, staggered 24 inches between succeeding courses. Roll laps with roller. Cover underlayment within seven days.

1. Prime concrete and masonry surfaces to receive self-adhering sheet underlayment.

2. Extend self-adhering sheet underlayment over entire roof deck.

3.3 METAL FLASHING INSTALLATION

A. General: Install metal flashings and other sheet metal to comply with requirements in Section 07620 "Flashing and Sheet Metal."

1. Install metal flashings according to concrete roof tile manufacturer's written instructions and recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

B. Apron Flashings: Extend lower flange over and beyond each side of downslope tile roofing and up the vertical surface.

C. Step Flashings: Install with a head lap of 3 inches and extend both horizontally and vertically. Install with lower edge of flashing just upslope of, and concealed by, butt of overlying tile. Fasten to roof deck only.

D. Cricket Flashings: Install against roof-penetrating elements, extending concealed flange beneath upslope tile roofing and beyond each side.

E. Rake Drip Edges: Install over underlayment and fasten to roof deck.

F. Eave Drip Edges: Install beneath underlayment and fasten to roof deck.

G. Pipe Flashings: Form flashing around pipe penetrations and tile roofing. Fasten and seal to tile roofing.

H. Sheet Metal Ridge Vents: Install centrally, and mechanically fasten to wood ridge. Adhere each side to concrete roof tile with elastomeric sealant.

1. Install fabric mesh over roof-deck air ventilation gaps to prevent insect entry.

3.4 CONCRETE ROOF TILE INSTALLATION

A. General: Install concrete roof tiles according to manufacturer's written instructions, to recommendations in TRI/WSRCA's "Concrete and Clay Roof Tile Design Criteria Installation Manual for Moderate Climate Regions," and to NRCA's "The NRCA Roofing and Waterproofing Manual."

1. Maintain uniform exposure and coursing of concrete roof tiles throughout roof.

2. Extend tiles 2 inches over eave fasciae.

3. Nail Fastening: Drive nails to clear the concrete roof tile so the tile hangs from the nail and is not drawn up.

a. Install wire through nail holes of cut tiles that cannot be nailed directly to roof deck, and fasten to nails driven into deck.

4. Mortar Setting: Install concrete roof tiles according to TRI/FRSA's "Concrete and Clay Roof Tile Installation Manual."

5. Install storm clips to capture edges of longitudinal sides of concrete roof tiles and securely fasten to roof deck.

6. Cut and fit concrete roof tiles neatly around roof vents, pipes, ventilators, and other projections through roof. Fill voids with mortar.

7. Install concrete roof tiles with color blend approved by RESIDENT ENGINEER.

3.5 ADJUSTING AND CLEANING

A. Remove and replace damaged or broken concrete roof tiles.

B. Remove excess concrete roof tiles and debris from Project site.

3.6 ROOFING INSTALLER'S WARRANTY

A. WHEREAS <Insert name> of <Insert address>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: <Insert name of Owner>.
2. Address: <Insert address>.
3. Building Name/Type: <Insert information>.
4. Address: <Insert address>.
5. Area of Work: <Insert information>.
6. Acceptance Date: <Insert date>.
7. Warranty Period: <Insert time>.
8. Expiration Date: <Insert date>.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

   a. Lightning;

   b. Peak gust wind speed exceeding 80 mph;

   c. Fire;

   d. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;

   e. Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;

   f. Vapor condensation on bottom of roofing; and

   g. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of the foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until

cost and expense thereof have been paid by Owner or by another responsible party so designated.

3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.

4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.

5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.

6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.

7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this <Insert day> day of <Insert month>, <Insert year>.

1. Authorized Signature: <Insert signature>.
2. Name: <Insert name>.
3. Title: <Insert title>.

*** END OF SECTION ***

SECTION 07600

FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide all sheet metal work and appurtenant work, complete, in accordance with the Contract Documents.

B. The principal items of sheet metal work include sheet metal flashings, collars, pitch pockets (pans), equipment platforms, and equipment (sleeper) supports at all roof penetrations. Also included are gutters and downspouts and precast concrete splash blocks for use with roof downspouts.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 07920 Sealants and Caulking
2. Section 08620 Unit Skylights
3. Section 09800 Protective Coating
4. Section 16050 Basic Electrical Materials and Methods

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated in this Section, the CONTRACTOR shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC), together with the latest adopted editions of the Regional and City of San Diego Supplement Amendments.

B. The Work of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego.

1. California Building Code.
2. California Mechanical Code.
3. California Plumbing Code.

C. Except as otherwise indicated, the current editions of the following apply to the Work of this Section:

1. Federal Specifications

A-A-51145C	Flux, Soldering, Paste and Liquid
MIL-P-24441/20	Primer Coating, Zinc Dust-Zinc Oxide (For Galvanized Surfaces)

UU-B-790A REINST2	Building Paper, Vegetable Fiber (Kraft, Waterproofed, Water Repellent and Fire Resistant)

2. ASTM Standards in Building Codes:

ASTM A 176	Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip
ASTM A 653	Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 32	Specification for Solder Metal
ASTM B 209	Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM D 1187	Test Method for Asphalt-Base Emulsions for Use as Protective Coatings for Metal
ASTM D 2822	Specification for Asphalt Roof Cement

3. Trade Standards:

Sheet Metal and Air Conditioning Contractor's National Association "Architectural Sheet Metal Manual" (SMACNA) fifth edition, 1993.

The Aluminum Association "Specifications for Aluminum Sheet Metal Work in Building Construction."

AWS	American Welding Society

1.4 SUBMITTALS

A. General: The following shall be submitted to the RESIDENT ENGINEER for review, approval, or verification in accordance with Section 01300 - Submittals.

B. Samples: Color samples and samples shall be submitted where required for color selections and/or review by the RESIDENT ENGINEER.

C. Shop Drawings: Shop drawings showing materials, gauges, finishes, layout, jointing, profiles, fasteners, fabrication of special shapes, and method of attachment to adjacent construction shall be submitted to RESIDENT ENGINEER.

D. Manufacturers Information: Manufacturers literature indicating materials, finish, construction, and method of installation of prefabricated items and sealants.

PART 2 - PRODUCTS

2.1 GENERAL

A. Sheet metal shall be aluminum or galvanized steel unless otherwise indicated. Sheet metal work in connection with roofing shall be in accordance with roofing manufacturer's published specifications.

B. All sheet metal flashings necessary to make building weathertight shall be provided, whether or not specifically indicated.

2.2 ALUMINUM PRODUCTS

A. Aluminum shall be 0.032-inch minimum thickness and shall conform to ASTM B 209, alloy 3003-H 14, with dark bronze anodized finish AA-C12-A42. Thickness of aluminum to be welded shall be as necessary for welding method being used per AWS.

B. Reglets shall be of aluminum such as manufactured by Superior Concrete Accessories; Morrison and Company "Cushion-Lock"; Fry Reglet; or equal.

2.3 FERROUS METALS

A. Galvanized steel shall be 24-gauge minimum thickness conforming to ASTM A 653.

B. Stainless steel shall be 24-gauge minimum thickness conforming to ASTM A 176, Type 304, dull No. 2D finish.

2.4 LEAD AND SOLDERING MATERIALS

A. Lead shall be 4 to 6 percent antimony and remainder shall be lead. Lead sheet shall be soft temper, except hard temper for flanges. Weight shall be not less than 4 pounds per square foot unless otherwise shown.

B. Solder shall conform to ASTM B 32 Alloy 5b, 50 percent tin, 50 percent lead.

C. Soldering flux shall meet Federal Specification A-A-51145C, of a type not injurious to metal surface being treated.

2.5 FASTENERS

A. Fastening devices shall be of the same material as the sheet metal being used or corrosion-resistant metal compatible with sheet metal being used. Fasteners exposed to the weather shall have neoprene washers. Washers shall be 0.04-inch minimum thickness. A rubber-type washer shall be used beneath the aluminum washer or fastener head where weathertightness is required.

2.6 PLASTIC CEMENT

A. Plastic cement shall conform to ASTM D 2822.

2.7 SEALANT MATERIALS

A. Sealants shall be as specified under Section 07920 - Sealants and Calking or shall be of the silicone type. Colors will be selected by the RESIDENT ENGINEER from manufacturers standard colors.

B. Sealer tape shall be polyisobutylene sealer tape specifically formulated for setting flanges on bituminous roofing, as manufactured by Morrison and Company CL-50; or approved equal.

2.8 COATING MATERIALS

A. Primer coat for galvanized steel shall conform to Federal Specification MIL-P-24441/20 Type II.

B. Asphaltic coating compound shall conform to ASTM D 1187.

2.9 BUILDING PAPER OR FELT

A. Building paper shall conform to Federal Specification UU-B-790A REINST2 Class B for Kraft waterproof building paper and CBC Standard Specifications, with Revisions dated October 28, 1975, of Underwriters Laboratories, Inc. for asphalt or coal tar-saturated felt.

2.10 SHOP FABRICATION REQUIREMENTS

A. Gutters shall be of size 16 –gauge galvanized steel, with wire basket type strainers of 14-gauge stainless steel wire. Gutters shall be constructed similar to SMACNA Figure 1-17.

B. Downspouts shall be fabricated from Schedule 40 galvanized steel pipe. Telescope end joints 1-1/2 inches and lock longitudinal joints. Hold downspouts in position as indicated on drawings and securely fasten to the wall with expansion anchors, unless otherwise indicated.

C. All aluminum shall be welded where indicated.

D. Galvanized steel corner joints shall be soldered. Other joints shall be as indicated or as required by paragraph 1.3 of this Section.

E. All Work and finishes shall be protected from scratches and abrasions.

F. All flashings, reglets and counter-flashing and associated flashings shall be fabricated by the same manufacturer and be installed as a complete flashing system. All flashings shall be creased longitudinally or otherwise formed with sufficient spring action to hold bottom edges firmly against base flashing or similar material.

G. Flashing required through concrete or clay tile shall be flexible flashing in order to assure against undue separation between tiles on account of rigidity of the flashing material. Flashing around pipes, vents, flues, and chimneys shall be of lead, copper, or other approved flexible flashing material.

2.11 FABRICATED SHEET METAL WORK

A. Stamped sheet metal vents or louver-type vents (where indicated) shall be designed to provide watertight flush corners and shall be of size indicated. Each vent shall be equipped with 1/4-inch square aluminum mesh hardware cloth insect screen. Stamped metal items shall be made of coated aluminum sheet metal.

B. Fixed wall louvers shall be extruded aluminum louvers conforming to SMACNA Figure 7-5, unless otherwise indicated. Operable wall louvers shall be designed as indicated and conform to SMACNA Figure 7-3. Louvers and screens shall have dark bronze anodized finish. All exterior louvers shall be provided with 1/8-inch by 1/8-inch mesh bird screen and frame. Screen units shall be removable.

C. Pitch pockets and equipment supports shall be provided where required or necessary and may be of galvanized steel construction unless otherwise indicated.

D. The roof penetrations sheet metal work items shall be provided and shall be coordinated with the roofing system. The design and details shall conform to the Reference Standards unless otherwise indicated.

E. The roof penetrations shall be provided with the following flashing:

1. Vent pipes: Lead collars vent pipe flashing with top of lead sleeve flashing bent into vent pipe. Ref. SMACNA, Figure 4-14B.

2. Single pipes: Sheet metal or lead collars with sheet metal or lead draw band with sealant or cap top. Ref. SMACNA, Figure 4-14A or 4-14B.

3. Multi-pipes: Lead collar with cap. Ref. Stoneman Engineering and Mfg. Co.

4. Multi-pipes w/curb: Sheet metal with sealant and draw bands. Ref. SMACNA, Figure 4-13.

5. Equipment support: Sheet metal. Ref. SMACNA, Figure 4-16.

6. Pitch pockets for supports: Sheet metal with all joints welded or soldered. Ref. SMACNA, Figure 4-16E.

Note (1): Prefabricated products, curbs, supports, and platforms which are part of mechanical equipment may be indicated in other Sections of these Specifications.

2.12 PRECAST CONCRETE SPLASH BLOCKS

A Provide precast concrete splash blocks as manufactured by Modern Precast, Inc., Salt Lake City, Utah, or approved equal. Size shall be as indicated, or if not indicated 12 inches wide by 30 inches long. Color shall be as selected by RESIDENT ENGINEER from manufacturer's standard colors.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate the flashings necessary with the different trades to make sure all items which penetrate the roof are provided with all necessary sheet metal items and work, such as: pipes, ducts, support racks, and equipment supports. Sheet metal shop manufactured curbs, equipment supports, and equipment platforms shall be provided where prefabricated items are not indicated in other Sections of these Specifications.

B. Flashing work shall be coordinated with roofing work. Sheet metal and roofing shall provide a weathertight and watertight assembly.

C. Sheet metal work shall be accurately formed to dimensions and shapes indicated. Work shall be fitted snugly, with straight, true lines with exposed faces aligned in proper plane, free from waves and buckles. Arises and angles shall have true and sharp lines, and surfaces shall be free from waves and buckles. All exposed edges shall be hemmed. Holes for fasteners within sheet metal work exposed to temperature changes shall be elongated holes for material expansion and movement.

D. All sheet metal work shall be furnished complete with supports, hangers, bracing, anchors, and other devices as required for reinforcement and proper attachment to adjacent construction. Fastenings shall be concealed wherever possible. Joints, fastenings, reinforcements, and supports shall be sized and located as required to preclude distortion or displacement due to thermal expansion and contraction.

E. All surfaces upon which sheet metal is to be placed shall be dry, smooth, even, and free of small projections and hollows. Sheet metal shall be laid with all joints true and even and firmly attached with all fastener heads flush with the top surface.

F. The underlayment shall be overlapped at least 2 inches so as to shed water and shall be secured along the lapped edges. Aluminum fasteners shall be used with aluminum sheet metal.

G. Dissimilar materials shall be isolated with two coats of asphaltic paint, asphaltic coating compound, or sealer tape. Only stainless steel fasteners shall be used to connect isolated dissimilar metals.

H. Joints shall be sized and spaced to permit sheet movement for thermal expansion and contraction of 1/4 inch per 10-foot length, on 100 degree F temperature difference. Holes for fasteners or anchors shall be elongated to provide for movement.

I. Roofing sheet metal items shall be built into the roofing in strict accordance with directions of roofing manufacturer.

3.2 INSTALLATION

A. Gutters shall have baffle-type expansion joint with expansion cap over 1-1/2-inch baffle flange at 40-foot centers. A 1-inch gap between the baffles shall be allowed.

B. Flashings at vertical surfaces shall be installed at intersections of roof with vertical surfaces and at projections through roof. Corner units shall be factory-fabricated and shall have mitered soldered or welded corner joints, and shall be installed with 3-inch (min) lap joint over flashings on each side.

C. Gutters shall be provided to indicated cross-section, complete with shop-fabricated corners, nipple sections, joining plates, concealed hangers and downspouts with standoff brackets.

D. Flanges of sheet metal items shall be set on continuous sealer tape on top edge envelope ply of roofing. Flanges shall be nailed through sealer tape at 3-inch (max) spacing or securely fastened per Reference Standards.

*** END OF SECTION ***

SECTION 07720

ROOF ACCESSORIES

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The Work of this Section includes providing all roof accessories and appurtenant work as needed to construct a complete roofing system with the roof accessories.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 07600 Flashing and Sheet Metal
2. Section 09800 Protective Coating

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated in this Section, the CONTRACTOR shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC), together with the latest adopted editions of the Regional and City of San Diego Supplement Amendments.

B. The Work of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

1. Uniform Building Code (UBC)
2. Uniform Fire Code (UFC)
3. National Electrical Code (NEC)

C. Except as otherwise indicated, the current edition of the National Roofing Contractor'sAssociation (NRCA) trade standard shall apply to the Work of this Section.

1.4 SUBMITTALS

A. The following shall be submitted in compliance with Section 01300 - Submittals:

1. Manufacturer's specifications, literature, and published installation instructions for each roof accessory, product, or system.

2. Shop drawings for each product showing materials, gauges, sizes, finishes, profiles, fabrication of special shapes, fasteners, and method of attachment to adjacent construction shall be submitted.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials: Manufactured materials shall be delivered in original, unbroken, packages, containers, or bundles bearing the name of the manufacturer.

B. Storage: Products shall be carefully stored on wood blocking in an area that is protected from all deleterious elements. Storage shall be in a manner that will prevent damage or marring of the products and their finishes.

PART 2 - PRODUCTS

2.1 GENERAL

A. Roof accessories shall be in accordance with the manufacturer's literature and published specifications for the products indicated.

B. Sizes of openings indicated are minimum allowable.

C. Hatches, fire hatches, and openable fire and smoke hatch with skylights shall be provided complete with all necessary hardware. Hatch hardware shall be stainless steel products. Hardware for hatches shall include the following: inside-outside handles and latching hardware which is padlockable from side, hinges, compression struts, and neoprene gaskets for weatherstripping.

D. Roof hatches and openable fire and smoke hatches with skylights shall be insulation lined and weatherstripped metal covered designed hatch units with insulated metal integral flange curb (12-inch minimum height).

2.2 ROOF VENTS

A. Roof relief vents with bird screens shall be provided, and shall be of the type recommended by the National Roofing Contractor's Association and approved by the roofing manufacturer.

2.3 ROOF SKYLIGHTS

A. Skylight frames shall be installed per specification section 08620

2.4 PREFABRICATED CURBS

A. Opening dimensions shall be coordinated with skylight penetrations, duct penetration, and roof-mounted equipment sizes. Heights shall be as required to place top of the curb not less than 8 inches above top of insulation unless otherwise indicated. Top of the curb shall be level. Sides of curbs shall be adjusted in accordance with field conditions and roof slopes. Base flange shall be not less than 4 inches wide. Curbs shall be fabricated of 14 gauge or thicker galvanized steel with continuously welded corners and shall be provided with a pressure preservative treated, kiln dried, fire-treated wood nailer at top.

2.5 MANUFACTURERS

A. Products shall be of the following manufacturer and type or model (or approved equal):

1. Roof Hatches:

a. Single leaf: Bilco S-50; Milcor RDS-1; Babcock Davis 7-104
b. Double leaf: Babcock-Davis, "B-D" (modified); Bilco, "D"
c. Single leaf with skylight: Bilco GS 50; Milcor RDS-Skylight

2. Openable Fire and Smoke Hatches with Skylight:

a. Bohem Manufacturing Co., Model "Type FH-D"
b. PAM Hillsdale Industries, Series "1600"

3. Prefabricated Curbs:

a. Pate Company
b. S & L Manufacturing Company
c. Thybar Corporation

PART 3 - EXECUTION

3.1 GENERAL

A. The installation shall conform to applicable codes and the manufacturer's published or written recommendations, specifications, and installation instructions for the type of work being performed.

B. All roof openings, roof-mounted equipment, duct openings and skylights shall be provided with a prefabricated curb unless the equipment above the roof opening is supplied with its own curb which extends to 8 inches or higher beyond the top of the roof insulation.

3.2 INSTALLATION

A. Roof hatches, openable fire and smoke hatches, and roof ventilators shall be installed over prepared openings with their own curb or a prefabricated curbs, and shall be fastened to the roof deck in accordance with the manufacturer's printed directions. Lifting mechanisms and accessories shall be adjusted to insure proper operation. Abraded prime and finish coat surfaces shall be touched-up after completion of installation with the same type of finish and the same dry-film thickness. Primer coats of hatches and ventilators exposed to view after installation shall be primed with a primer coat that is compatible with the finish coating system.

B. Roof Hatches: Dissimilar metals shall be properly isolated. Thermal movement for up to 100 degrees F change shall be accommodated without distress in assembly of fasteners.

C. Roof Vents: Roof vents shall be provided on lightweight concrete or lightweight insulating concrete and shall be placed in such a manner so that one vent will be used for venting 1,000 square feet of roof fill. No area shall have fewer than 2 vents. Vents shall not be installed in walk pads or other traffic areas. Vent pipes shall have a coat of plastic cement applied at the joint between the vent pipe and the roofing before aggregate is applied. Roof insulation shall be removed from below each vent per NRCA instructions. Roof vents shall be painted to match roofing color.

D. Roof accessory metal items exposed to the exterior atmosphere shall be painted with a protective coating complying with Section 09800 - Protective Coating.

*** END OF SECTION ***

SECTION 07920

SEALANTS AND CAULKING

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide caulking, sealing, moisture protection, and appurtenant Work for sealing joints in non-water bearing surfaces, complete and in accordance with the Contract Documents.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 03290 Joints in Concrete Structures

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC), together with the latest adopted editions of the Regional and City of San Diego Supplement Amendments.

B. The current edition of the California Building Code (CBC) as adopted by the City of San Diego Municipal Code.

C. Except as otherwise indicated, the current editions of the following apply to the work of this Section:

1. Federal Specifications:

TT-S-001543A	Sealing Compound, Silicone Rubber Base, (For Caulking, Sealing and Glazing in Buildings and Other Structures).
A-A-1556	Sealing Compound, Elastomeric Type, Single Component, (For Caulking, Sealing, and Glazing in Buildings and Other Structures).
TT-S-00227E (3)	Sealing Compound, Elastomeric Type, Multi-Component, (For Caulking, Sealing and Glazing in Buildings and Other Structures).

SS-S-200E (2)	Sealant, Joint, Two Component, Cold Applied, for Portland Cement Pavement

2. ASTM Standards in Building Codes:

ASTM C 557	Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing
ASTM C 834	Specification for Latex Sealing Compounds.
ASTM C 919	Practice for Use of Sealants in Acoustical Applications.
ASTM C 920	Specification for Elastomeric Joint Sealants.
ASTM D 41	Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
ASTM D 226	Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
ASTM D 312	Specification for Asphalt Used in Roofing.
ASTM D 1752	Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

D. Manufacturer's Standards: In addition to the standards listed above, the sealants and caulking products and their application shall be in accordance with the manufacturer's published recommendations and specifications.

1.4 SUBMITTALS

A. The CONTRACTOR shall provide submittals in accordance with Section 01300 - Submittals.

B. Samples: The CONTRACTOR shall submit samples (including color samples) of all the caulking and sealant materials and other moisture protection materials proposed for use on the Work. The samples shall be clearly marked with the manufacturer's name and product identification.

C. Technical Data: The CONTRACTOR shall submit a complete materials list along with the manufacturer's technical data and literature, specifications, joint width and depth tables, and installation instructions.

D. Certificates: The CONTRACTOR shall submit, if requested by the RESIDENT ENGINEER, certificates from an independent testing laboratory approved by the RESIDENT ENGINEER, certifying that the submitted materials meet all the requirements of the ASTM and Federal Specifications cited.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials: Manufactured materials shall be delivered in original, unbroken packages or containers bearing the manufacturer's label. Packages or containers shall be delivered to the site with seals unbroken.

B. Shelf Life: Materials whose shelf life dates have expired shall not be used in the Work. Such materials shall be promptly removed from the project site.

C. Storage: All materials shall be carefully stored in accordance with the manufacturer's instructions, in an area that is protected from deleterious elements, and in a manner that will prevent damage to the product.

PART 2 - PRODUCTS

2.1 SEALANTS AND CAULKING MATERIALS

A. Caulking and sealing materials shall conform to the following requirements:

1. Significant Movement Sealants (± 25% movement capability):

a. Expansion wall joints; masonry; perimeter sealing (windows, doors); control joints; interior and nontraffic horizontal joints:

(1) One component, nonsag, medium modulus, neutral cure, silicone sealant conforming to Federal Specification TT-S-001543A, Class A, and ASTM C 920; Type S; Class 25; Grade NS.

a) Products Research & Chemical Corp. APRC-4000".
b) Dow Corning A795"; or approved equal.

b. Horizontal joints exposed to fuel spillage:

(1) Two component, self-leveling, fuel resistant, polyurethane or polysulfide sealant conforming to Federal Specification SS-S-200E(2), Type H, and ASTM C 920; Type M;Class 25; Grade P.

a) Products Research & Chemical Corp. "3105-S".
b) Pacific Polymers Inc. "ElastoThane 200"; or approved equal.

c. Horizontal joints not exposed to fuel spillage:

(2) One component, self-leveling, polyurethane or polysulfide sealant conforming to Federal Specification A-A-1556, Class A, Type I, and ASTM C 920; Type S; Class 25; Grade P.

a) Products Research & Chemical Corp. "6006".
b) Mameco "Vulkem 45"; or approved equal.

2. Glazing Sealants:

   a. Nonstructural Applications:

      (1) One component, nonsag, medium modulus, neutral cure, silicone sealant conforming to Federal Specification TT-S-1543A, Class A, and ASTM C 920; Type S; Class 25; Grade NS.

         a) Products Research & Chemical Corp. "4000".
         b) Dow Corning "795"; or approved equal.

3. Interior Sealant and Caulking:

   a. General Applications:

      (1) One component, acrylic latex caulking conforming to ASTM C 834.

         a) Pecora Corp. "AC-20".
         b) Bostic "Chem-Calk 600"; or approved equal.

   b. Nonexposed Acoustical Applications:

      (1) One component, nondrying, nonhardening, nonshrinking, acoustical caulking conforming to ASTM C 919 as manufactured by:

         a) Inmont Company "Prestite 579.64".
         b) Tremco Acoustical Sealant.
         c) United States Gypsum, "Acoustical Sealant".
         d) W.W. Henry Type 313 Acoustical Sealant.

4. Caulking tapes shall be of the butyl-base, vulcanized type.

5. Filler material shall be resilient, closed-cell polyethylene foam conforming to ASTM D 1752, Type II or III, and/or bond breakers of proper size for joint widths. Filler shall be compatible with sealant manufacturer's product and shall not stain the sealant or the materials to which they are applied.

6. Primer shall be used in accordance with manufacturer's instructions, with all primers being applied prior to the installation of any backer rod or bond breaker tape. Primers shall be as recommended in the manufacturers printed instructions for caulking and sealants and shall not stain the sealant nor the materials to which they are applied. Manufacturer shall be consulted for all surfaces not specifically covered in submittal application instructions.

7. Cleaning and cleanup solvents shall be as recommended in the manufacturer's printed instructions for caulking and sealants.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. Manufacturer's Recommendations: All work under this Section and all testing, where applicable, shall be performed in accordance with manufacturer's printed recommendations, specifications, and installation instructions except where more stringent requirements are indicated herein; and, except where project conditions require extra precautions or provisions to assure performance of the waterproofing system.

B. Authorized Installers: Caulking, sealants, and moisture protection shall be complete systems, and installed only by installers authorized and approved by the respective material manufacturers.

3.2 SEALANT FILLED JOINTS

A. Manufacturer's Representative: The CONTRACTOR shall furnish the onsite services of the sealant manufacturer's representative (before starting sealant work) for inspection of the joints to be sealed and for instructing the installer in the proper use of the materials.

B. Surface Preparation: Joints and spaces to be sealed shall be clean, dry, and free of dust, loose mortar, and other foreign materials. Ferrous metal surfaces shall be cleaned of all rust, mill scale, and other coatings by wire brush, grinding, or sandblasting. Oil and grease shall be removed by cleaning in accordance with sealant manufacturer's printed recommendations. Protective coatings shall be removed from all aluminum surfaces against which caulking or sealing compound is to be placed. Bituminous or resinous materials shall be removed from surfaces to receive caulking or sealants.

C. Sealant Depth: Sealant depth in joints shall be 2 the width of joint, but not less than 1/8 inch deep and 1/4 inch wide nor more than 2 inch deep and 1 inch wide. All joints shall have a rigid filler material installed to proper depth prior to application of sealant.

D. Joints In Porous Materials: Where required by the manufacturer, sides of joints of porous *materials shall be primed immediately prior to caulking or sealing.

E. Applications: A full bead of sealant shall be applied into the joint under sufficient pressure, with the nozzle drawn across sealant, to completely fill the void space and to ensure complete wetting of contact area to obtain uniform adhesion. During application the tip of the nozzle shall be kept at the bottom of the joint thereby forcing the sealant to fill from the bottom to the top. Sealants shall be tooled immediately after exposure with caulking tool or soft bristled brush moistened with solvent. The finished sealant filled joint shall be slightly concave unless otherwise indicated.

F. Cleaning: After application of sealant and caulking materials, adjacent materials which have been soiled shall be cleaned and left in a neat, clean, undamaged or unstained condition. On porous surfaces, excess sealant shall be removed per sealant or caulking manufacturer's printed instructions.

3.3 ACOUSTIC CAULKING

A. Preparation: Joints and surfaces to be sealed shall be clean, dry, and free of loose materials.

B. Concealed Joints: Concealed joints in acoustic partitions including perimeters and intersections of walls and penetrations through finish work and at conduit ends with boxes shall be sealed with acoustic caulking compound. Backs of electrical boxes shall be sealed with acoustic sheet caulking, covering all holes and knockouts.

*** END OF SECTION ***

SECTION 08110

STEEL DOORS AND FRAMES

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing steel doors, frames, and appurtenances.

1.2 RELATED SECTIONS

A, The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 04232 Reinforced Concrete Block Masonry
2. Section 08710 Finish Hardware
3. Section 09800 Protective Coating

1.3 CODES

A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

1. California Building Code

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

1.	ASTM A 366	Specification for Steel, Carbon, Cold-Rolled Sheet, Commercial Quality
2.	ASTM B 117	Method of Salt Spray (Fog) Testing
3.	ASTM D 1735	Method for Water Fog Testing of Organic Coatings
4.	ASTM E 90	Method for Laboratory Measurement of Airborne-Sound Transmission Loss of Building Partitions
5.	ANSI A115 Series	Door and Frame Preparation
6.	UL Standards	Underwriters' Laboratories, Inc.

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 01300:

1. Manufacturer's product data including catalogue cuts.
2. Manufacturer's maintenance procedures.
3. Manufacturer's installation instructions.
4. Certification that products comply with the specifications indicated.
5. Door schedules showing sizes, types, louvers, and glass.
6. Certified Sound Transmission Coefficients.
7. Shop drawings showing frame jamb depths, trim profile, stops, and backbends.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Doors and frames shall be shipped and stored with temporary stiffeners and spacers in place to prevent distortion.

B. Doors and frames shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer.

PART 2 -- PRODUCTS

2.1 GENERAL

A. General: Only products certified as complying with the indicated requirements shall be provided.

B. Products: Products shall be new, of current manufacture, and shall be the products of reputable manufacturers specializing in the manufacture of such products.

C. Manufacturer's Recommendation: Products shall be recommended by the manufacturer for the application indicated.

2.2 MATERIALS AND FABRICATION

A. Factory Fabrication: Steel doors and frames shall be factory fabricated and assembled. Temporary stiffeners, spacers, and other accessories necessary to facilitate handling and erection shall be included. After fabrication, tool marks and other surface imperfections shall be filled and ground smooth.

B. Fire Rating and Labeling: Fire-rated doors and frames shall bear a UL label indicating the type of rating. Design and construction of fabricated products shall have UL approval for the fire rating indicated. Hollow steel doors and frames for fire-rated openings shall conform to Underwriters' Laboratories listing and shall be UL labeled.

C. Materials for Doors and Frames: Exterior doors and frames shall be fabricated of galvanized steel. Other doors and frames shall be fabricated from commercial grade, cold-rolled steel conforming to ASTM A 366, Type II or III.

D. Priming and Painting: Doors and frames shall be chemically treated to ensure maximum paint adhesion and exposed surfaces shall be painted with a rust-inhibitive primer after fabrication. Prime coat shall be capable of passing a 120-hour salt spray test in accordance with ASTM B 117 and a 250-hour humidity test in accordance with ASTM D 1735.

E. Hardware: Doors and frames shall be reinforced and drilled or tapped for templated mortised hardware and shall be reinforced with plates for surface-mounted hardware complying with ANSI A115 Series requirements. Hardware shall comply with Section 08710.

2.3 METAL FRAMES

A. Pressed Metal Frames: Pressed steel frames for doors, windows, and other openings shall be combination buckled frame and trim of type and sizes indicated. Metal shall not be lighter than 16-gauge steel. Frames shall be of the welded unit type. Special frames, oversized frames, and frames with transom shall be provided where indicated.

B. Frame Jamb Depths, Trim Profile, Stops, and Backbends: Frame jamb depths, trim profile, stops, and backbends shall be as shown on the shop drawings.

2.4 FRAME ANCHORS

A. Floor Anchors: Floor anchors shall be welded inside each frame jamb head, and holes shall be provided for floor anchorage. Minimum thickness of floor anchors shall be 14-gauge.

B. Anchors for Masonry/Concrete Installations: Frames for installation in masonry and concrete walls shall include adjustable jamb anchors of the T-strap, stirrups and strap, or wire type. The number of anchors provided for each frame jamb and head shall comply with the applicable standard and the following:

1. Frames up to 7 feet 6 inches in height: 3 anchors.

2. Frames over 7 feet 6 inches to 8 feet 0 inches in height: 4 anchors.

3. Frames over 8 feet 0 inches in height: One anchor for each 2 feet or fraction in height.

2.5 DUST COVER BOXES AND MORTAR GUARDS

A. Dust cover boxes or mortar guards of not less than 24-gauge steel shall be provided at all hardware mortises on frames to be set in masonry, concrete, or plaster walls.

2.6 SILENCER HOLES

A. Appropriate holes for silencers shall be provided in the door frames which are not designated to receive weatherstripping, seals, or sound seals.

2.7 STEEL DOORS

A. Design and Construction: Steel doors shall be of hollow metal construction and shall be of full flush design with no visible seams. Face sheets shall be not less than cold-rolled, stretcher-leveled, galvanized, 14-gauge steel. Doors shall have flush seamless face sheets with continuously and fully welded seam edges. Doors shall be rigid and neat in appearance, and shall be free from warpage or buckle. Corner bends shall be true and straight and shall be of not less than the minimum radius for the gauge of metal used. The door top and bottom shall be internally reinforced by steel members welded in place. Tops of exterior doors shall be provided with flush, water and weather tight, top enclosures.

B. Transom Panels: Transom panels shall be provided where indicated and shall comply with the requirements for doors.

C. Door and Transom Cores: Doors and transom cores shall be water-resistant polystyrene. Fire rated doors shall be solid or fiber mineral core doors and shall comply with code requirements.

2.9 MANUFACTURERS

A. Products shall be manufactured by one of the following (or equal):

1. Steel doors:

a. Krieger Steel Products Co.
b. Overly Manufacturing Co.
c. Trussbuilt, Inc.
d. Hollow Metal Express

PART 3 -- EXECUTION

3.1 GENERAL

A. General: Products shall be installed in accordance with the manufacturer's installation instructions.

3.2 FRAME INSTALLATION

A. Frames shall be set plumb and square in a true plane, and shall be securely anchored to the adjoining construction. Steel shims shall be provided and shall be tight and rigidly attached between frame anchors and structure. Finished metal frames shall be strong and rigid, neat in appearance, and square, true, and free of defects, warpage, or buckling.

B. Molded members, trims, and stops, shall be clean cut, straight, and shall be of a uniform profile throughout their lengths.

C. Corner joints shall have all contact edges tightly closed with all trim faces mitered, welded, and finished smooth. The use of gussets shall not be permitted.

3.3 DOOR INSTALLATION

A. Doors shall be installed plumb, square, and level. Doors shall operate freely, but not loosely. They shall be free from rattling while in a closed position.

B. The door clearances shall be plus 3/32-inch or minus 1/32-inch and shall not exceed the limits recommended by the manufacturer.

C. Doors shall not be installed with an out-of-plane warpage of more than 3/16-inch.

D. Doors and finish hardware shall be removed and rehung prior to painting.

3.4 FINISH HARDWARE

A. Finish hardware shall be installed in accordance with hardware manufacturer's standard templates. Operable parts shall be adjusted for proper function and operation.

*** END OF SECTION ***

SECTION 08347

SOUND CONTROL DOOR ASSEMBLIES

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide material and installation of sound control door assemblies in accordance with the Contract Documents.

B. This Section includes sound-control door assemblies consisting of swinging steel doors, steel door frames, steel window frames, sound-control seals, and related accessories to achieve STC ratings indicated.

1. Where scheduled, provide sound-control door assemblies listed and labeled to meet fire ratings indicated.

1.2 RELATED SECTIONS

A. Related Sections include the following:

1. Section 04232 Reinforced Concrete Masonry
2. Section 08710 Finish Hardware
3. Section 08800 Glazing
4. Section 09800 Protective Coating

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

1.4 PERFORMANCE REQUIREMENTS

A. Sound Rating: Provide sound-control door assemblies that have been fabricated and tested as sound-retardant units, are identical to assemblies tested according to ASTM E 90 by an independent testing agency, and have the following minimum certified STC rating according to ASTM E 413:

1. STC Rating: As indicated in the Door Schedule.

1.5 SUBMITTALS

A. Product Data: Include sound ratings, construction and hardware preparation details, material and gasketing descriptions, core descriptions, label compliance, dimensions of individual components and profiles, and finishes for sound-control door assemblies.

B. Shop Drawings: In addition to requirements below, provide a schedule of doors and frames using same reference numbers for details and openings as those on Drawings.

1. Elevations of each door design.
2. Details of sound-control seals, door bottoms, and thresholds.
3. Details of doors including vertical and horizontal edge details.
4. Frame details for each frame type including dimensioned profiles.

5. Details and locations of reinforcement and preparations for hardware.

6. Details of each different wall opening condition.

7. Details of anchorages, accessories, joints, and connections.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 125 mm).

D. Product Certificates: For each type of sound-control door assembly, signed by product manufacturer.

E. Qualification Data: For Installer

F. Field quality-control test reports.

G. Product Test Reports: Based on evaluation of comprehensive sound-rating tests performed by a qualified testing agency, for each type of sound-control door assembly.

H. Maintenance Data: For sound-control door assemblies to include in maintenance manuals.

I. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Acoustical Testing Agency Qualifications: An independent agency accredited as an acoustical laboratory according to the National Voluntary Laboratory Accreditation Program of NIST.

C. Source Limitations: Obtain sound-control door assemblies, including doors, frames, sound-control seals, hinges (when integral for sound control), thresholds, and other items essential for sound control, through one source from a single manufacturer.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to finish of factory-finished wood doors.

B. Deliver frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store doors and frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (100-mm-) high, wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber.

1. If wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install sound-control wood doors until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.9 COORDINATION

A. Coordinate installation of anchorages for sound-control door assemblies. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in masonry. Deliver such items to Project site in time for installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sound-control door assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet sound rating requirements.

b. Faulty operation of sound seals.

c. Deterioration of metals, metal finishes, and other materials beyond normal use or weathering.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Sound-Control Door Assemblies with Steel Doors:

a. Ambico Limited.

b. Amweld Building Products, LLC.

c. Ceco Door Products; an ASSA ABLOY Group Company.

d. CURRIES Company; an ASSA ABLOY Group Company.

e. Firedoor Corporation.

f. Fleming Door Products Ltd.; an ASSA ABLOY Group Company.

g. Krieger Steel Products Co.

h. Overly Door Company.

i. Pioneer Industries.

j. Security Acoustics; Div. of Security Metal Products Corp.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with G60 (Z180) zinc (galvanized) or A40 (ZF120) zinc-iron-alloy (galvannealed) coating designation.

D. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M.

F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching sound-control door frames of type indicated.

G. Grout: Comply with Division 04 Section "Unit Masonry."

H. Grout: Comply with ASTM C 476, with a slump of 4 inches (102 mm) for sound-control door frames built into concrete or masonry, as measured according to ASTM C 143/C 143M.

I. Mineral Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6 to 12 lb/cu. ft. (96 to 192 kg/cu. m) density; with maximum flame-spread and smoke-developed indexes of 25 and 50 respectively; passing ASTM E 136 for combustion characteristics.

J. Fire Rating and Labeling: Fire-rated doors and frames shall bear a UL label indicating the type of rating. Design and construction of fabricated products shall have UL approval for the fire rating indicated. Hollow steel doors and frames for fire-rated openings shall conform to Underwriters' Laboratories listing and shall be UL labeled.

2.3 STEEL DOORS

A. General: Provide flush-design doors, not less than 1-3/4 inches (44 mm) thick for STC 42 rated doors, of seamless hollow construction, unless otherwise indicated. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges.

1. Visible joints or seams around glazed lites are permitted.
2. Bevel both vertical edges 1/8 inch in 2 inches (3 mm in 50 mm).
3. Core: Manufacturer's standard as required to provide STC rating indicated.

B. Exterior Door Face Sheets: Fabricated from minimum 0.042-inch- (1.0-mm-) thick, metallic-coated steel sheet.

C. Interior Door Face Sheets: Fabricated from minimum 0.042-inch- (1.0-mm-) thick, cold-rolled steel sheet, unless otherwise indicated.

D. Top and Bottom Channels: Minimum 0.053-inch- (1.3-mm-) thick, metal channel spot welded, not more than 6 inches (150 mm) o.c., to face sheets.

1. Tops and bottoms of doors reinforced with inverted horizontal channels, continuous across full width of door, of same material as face sheets so flanges of channels are even with bottom and top edges of face sheets.

2. Top and bottom edges closed with closing channels of same material and thickness as face sheets; welded so webs of channels are flush with door edges.

E. Hardware Reinforcement: Reinforcement plates fabricated from same material as door face sheets to comply with the following minimum sizes:

1. Hinges: Minimum 0.167 inch (4.2 mm) thick by 1-1/2 inches (38 mm) wide by 6 inches (150 mm) longer than hinge, secured by not less than 6 spot welds.

2. Lock Face Closers, and Concealed Holders: Minimum 0.093 inch (2.3 mm) thick.

3. All Other Surface-Mounted Hardware: Minimum 0.067 inch (1.7 mm) thick.

F. Miscellaneous Components: Fabricated from hot- or cold-rolled steel sheet.

2.4 STEEL FRAMES

A. General: Fabricate sound-control door frames of full-welded unit construction, with corners mitered, reinforced, and continuously welded full depth and width of frame. Knocked-down frames are not acceptable.

1. Exterior Frames: Formed from minimum 0.067-inch- (1.7-mm-) thick, metallic-coated steel sheet.

B. Hardware Reinforcement: Fabricate reinforcement plates from same material as door frame to comply with the following minimum sizes:

1. Hinges: Minimum 0.167 inch (4.2 mm) thick by 1-1/2 inches (38 mm) wide by 6 inches (150 mm) longer than hinge, secured by not less than 6 spot welds.

2. Strikes and Closers: Minimum 0.093 inch (2.3 mm) thick.

3. Surface-Mounted Hardware: Minimum 0.093 inch (2.3 mm) thick.

C. Head Reinforcement: Minimum 0.093-inch- (2.3-mm-) thick, steel channel or angle stiffener.

D. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed of same material as frame, not less than 0.053 inch (1.3 mm) thick, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.156 inch (4.0 mm) wide.

2. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall with throat reinforcement plate, welded to frame at each anchor location.

E. Floor Anchors: Formed of same material as door frame, not less than 0.067 inch (1.7 mm) thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

F. Windows: Window frames shall include anchors and metal stops for glazing. Stops shall be miter-cut and dipped for countersunk flathead fasteners.

G. Glazed Openings: Glazed openings in door assemblies shall be of sizes indicated, and shall include mitered metal stops. Glazed openings in fire-rated door assemblies shall meet UL requirements. Glass shall conform to Section 08800.

H. Miscellaneous Components: Fabricated from hot- or cold-rolled steel sheet.

2.5 STOPS AND MOLDINGS

A. Fixed Frame Moldings: Formed integral with sound-control frames, unless otherwise indicated.

2.6 DOOR HARDWARE

A. General: Provide manufacturer's standard sound-control system, including head and jamb seals, door bottoms, cam-lift hinges, astragals, and thresholds, as required by testing to achieve STC/Fire rating as indicated. Coordinate hardware with other hardware specified for same door assembly in Section 08710, Finish Hardware.

B. Compression Seals: One-piece units; consisting of closed-cell sponge neoprene seal held in place by metal retainer; with retainer cover of same material as door frame; attached to door frame with concealed screws.

C. Magnetic Seals: One-piece units; consisting of closed-cell sponge neoprene seal and resiliently mounted magnet held in place by metal retainer; with retainer cover of same material as door frame; attached to door frame with concealed screws.

D. Automatic Door Bottoms: Neoprene or silicone gasket, held in place by metal housing, that automatically drops to form seal when door is closed; mounted to bottom edge of door with screws.

1. Mounting: Mortised or semimortised into bottom of door or surface mounted on face of door as required by testing to achieve STC rating indicated.

E. Door Bottoms: Neoprene or silicone gasket held in place by metal housing; mortised into bottom edge of door.

F. Cam-Lift Hinges: Full-mortise template type that raises door 1/2 inch (13 mm) when door is fully open; with hardened pin; fabricated from stainless steel.

G. Thresholds: Flat, smooth, unfluted type as recommended by manufacturer; fabricated from aluminum

1. Finish: Clear anodic finish.

2.7 FABRICATION

A. General: Fabricate sound-control door assemblies to be rigid and free of defects, warp, or buckle. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Steel Doors: Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Fabricate doors with faces joined at vertical edges by welding; welds shall be ground, filled, and dressed to make them invisible and to provide a smooth, flush surface.

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.

C. Steel Frames: Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Weld exposed joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners, unless otherwise indicated.

2. Plaster Guards: Weld guards to frame at back of hardware cutouts and glazing-stop screw and sound-control seal preparations to close off interior of openings and prevent mortar or other materials from obstructing hardware operation or installation.

3. Where installed in masonry, leave vertical mullions in frames open at top for grouting.

4. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.

5. Jamb Anchors: Provide number and spacing of anchors as follows:

a. Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

1) Two anchors per jamb up to 60 inches (1524 mm) in height.

2) Three anchors per jamb from 60 up to 90 inches (1524 up to 2286 mm) in height.

3) Four anchors per jamb from 90 up to 96 inches (2286 up to 2438 mm) in height.

4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof more than 96 inches (2438 mm) in height.

b. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.

6. Head Reinforcement: For frames more than 48 inches (1219 mm) wide, provide continuous head reinforcement for full width of opening, welded to back of frame at head.

D. Hardware Preparation:

1. Steel Doors and Frames: Factory prepare sound-control doors and frames to receive templated mortised hardware, including providing cutouts, reinforcement, mortising, drilling, and tapping, according to the door manufacturers furnished templates.

a. Reinforce doors and frames to receive non-templated mortised and surface-mounted door hardware as required.

b. Comply with HMMA 830, "Hardware Preparation and Locations for Hollow Metal Doors and Frames."

c. Locate door hardware as indicated, or if not indicated, according to HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."

2.8 STEEL FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish sound-control steel door assemblies after assembly.

B. Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel; comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

C. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils (0.018 mm).

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of sound-control door assemblies.

1. Examine roughing-in for embedded and built-in anchors to verify actual locations of sound-control door frame connections before frame installation.

2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory.

B. Prior to installation and with installation spreaders in place, adjust and securely brace sound-control door frames for squareness, alignment, twist, and plumb to the following tolerances:

1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.

3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.

4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive non-templated mortised and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install sound-control door assemblies plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Frames: Install sound-control door frames in sizes and profiles indicated.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

a. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, make splice smooth, flush, and invisible on exposed faces.

b. Remove temporary braces only after frames or bucks have been properly set and secured.

c. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

d. Apply bituminous coating to backs of frames that are filled with mortar, grout, and plaster containing antifreezing agents.

e. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with postinstalled expansion anchors.

1) Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors, if so indicated and approved on Shop Drawings.

f. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar as specified in Division 04 Section "Unit Masonry."

g. In-place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

2. Installation Tolerances: Adjust sound-control door frames for squareness, alignment, twist, and plumb to the following tolerances:

   a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

   b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.

   c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.

   d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.

C. Doors: Fit sound-control doors accurately in frames, within clearances indicated below. Shim as necessary.

1. Non-Fire-Rated Doors: Fit non-fire-rated doors accurately in frames with the following clearances:

   a. Jambs: 1/8 inch (3 mm).

   b. Head with Butt Hinges: 1/8 inch (3 mm).

   c. Head with Cam-Lift Hinges: As required by manufacturer, but not more than 3/8 inch (9.5 mm).

   d. Sill: Manufacturer's standard.

   e. Between Edges of Pairs of Doors: 1/8 inch (3 mm).

D. Sound-Control Seals: Where seals have been prefit and preinstalled in the factory and subsequently removed for shipping, reinstall seals and adjust according to manufacturer's written instructions.

E. Cam-Lift Hinges: Install hinges according to manufacturer's written instructions.

F. Thresholds: Set thresholds in full bed of sealant complying with requirements in Division 07 Section "Joint Sealants."

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and adjust operating hardware items just before final inspection. Leave work in complete and proper operating condition.

B. Remove and replace defective work, including defective or damaged sound seals and doors and frames that are warped, bowed, or otherwise unacceptable.

1. Adjust gaskets, gasket retainers, and retainer covers to provide contact required to achieve STC rating.

C. Clean grout off sound-control door frames immediately after installation.

D. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

E. Galvannealed Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

*** END OF SECTION ***

SECTION 08620

UNIT SKYLIGHTS

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The Work of this Section includes providing all skylights and appurtenant work, complete in accordance with the Contract Documents.

B. Section Includes:

1. Unit skylights mounted (removable) on site-erected curbs.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 07321 Concrete Roof Tiles

2. Section 07600 Flashing and Sheet Metal

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 REFERENCE SPECIFICATIOS, CODES AND STANDARDS

A. Except as otherwise indicated in this Section, CONTRACTOR shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC) together with the latest adopted editions of the Regional and City of San Diego Supplement Amendments.

B. The current edition of the California Building Code as adopted by the City of San Diego Municipal Code.

C. Except as otherwise indicated, the current edition of the National Roofing Contractors Association guidelines.

1.5 SUBMITTALS

A. Product Data: For each type of unit skylight.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for unit skylights.

B. Shop Drawings: Showing materials, gauges, sizes, finishes, profiles, fabrication of special shapes, fasteners and method of attachment to adjacent construction.

C. Aluminum Finish Samples: For each type of exposed finish required, in a representative section of each unit skylight in manufacturer's standard size.

D. Glazing Samples: For each color and finish of glazing indicated, 12 inches square and of same thickness indicated for the final Work.

E. Qualification Data: For qualified Installer and manufacturer.

F. Product Test Reports: For each type and size of unit skylight, for tests performed within the last four years by a qualified testing agency. Test results based on testing of smaller unit skylights than specified will not be accepted.

G. Sample Warranty: For special warranty.

H. Maintenance Data: For unit skylights to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating unit skylights that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.

B. Installer Qualifications: An installer acceptable to unit skylight manufacturer for installation of units required for this Project.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: Manufactured products shall be delivered in original, unbroken packages or containers bearing the name of the manufacturer.

B. Storage: All products shall be carefully stored on wood blocking in accordance with manufacturer's instructions in an area that is protected from deleterious elements. Storage shall be in a manner that will prevent damage or marring of finish.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of unit skylights that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Uncontrolled water leakage.

b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

c. Deterioration of insulating-glass hermetic seal.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide complying flat insulating glass product as manufactured by Industrial Skylights, Carlsbaad CA, (760)434-6001, or comparable product by one of the following:

1. Acralight International.
2. American Skylites; a division of the Andi Group, Inc.
3. Exarc Skylights, Inc.
4. Fox Lite, Inc.; Skymaster Skylights.
5. Glazed Structures Inc.
6. Lane-Aire Manufacturing Corporation.
7. Naturalite Skylight Systems; Oldcastle Glass Engineered Products.
8. Skyline Sky-Lites, LLC.
9. Solar Industries, Inc.
10. Sunglo Skylight Products.
11. Wasco Products, Inc.
12. Fiore Skylights, Inc.

2.2 PERFORMANCE REQUIREMENTS

A. Unit Skylight Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Performance Class and Grade: Class CW-PG 30.

B. Conform to the requirements of the California Building Code.

C. Skylights shall be designed to accommodate a temperature change of 100 deg. F without distress in assembly, fasteners, or glazing and shall be weathertight.

2.3 UNIT SKYLIGHTS

A. General: Provide factory-assembled unit skylights that include glazing, extruded-aluminum glazing retainers, gaskets, inner frames (rafters), sills with lifting points, lifting hooks and that are capable of withstanding performance requirements indicated.

B. Frames and Gaskets: Skylights shall include a 6063-T5 extruded aluminum curb frame, with an integral sloping gutter and insulated glass elevating leg, with continuous vinyl or neoprene support gasket and retaining frame. The site fabricated curb shall be 9 inches min in height. Approximate sizes of skylight openings are indicated on the Drawings. Skylights shall be removable as shown with lift rings in 4 locations with a minimum 400 lb capacity. The skylights shall remain intact and re-mountable without damage.

C. Insulating Glass: Clear, sealed units that comply manufacturer's standard overall thickness.

1. Exterior Lite: 0.25" PPG Solarban 70XL on Solexia Low-E #2.

2. Interior Lite: 0.25" Laminated glass; two plies of 0.125" clear heat-strengthened glass with 0.030-inch clear polyvinyl butyral interlayer.

3. Interspace Content: Argon.

4. Low-Emissivity Coating: Manufacturer's standard.

D. Glazing Gaskets: Manufacturer's standard.

E. Condensation Control: Fabricate unit skylights with integral internal gutters and nonclogging weeps to collect and drain condensation to the exterior.

F. Thermal Break: Fabricate unit skylights with thermal barrier separating exterior and interior metal framing.

2.4 ACCESSORY MATERIALS

A. Fasteners: Same metal as metal being fastened, nonmagnetic stainless steel, or other noncorrosive metal as recommended by manufacturer. Finish exposed fasteners to match material being fastened.

1. Provide tamperproof fasteners, which still allow removal of the unit for maintenance.

B. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat.

2.5 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: As selected by RESIDENT ENGINEER from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. The installation shall conform to applicable codes and the manufacturer's published recommendations, specifications, and installation instructions for the type of work being performed. The construction shall be coordinated with the work of other trades.

C. The CONTRACTOR shall verify the opening sizes required for the skylights prior to structural framing; shall notify the RESIDENT ENGINEER of conflicts and seek direction; and shall make modifications to the structural framing or skylight details as necessary.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate installation of unit skylight with installation of substrates, roofing, and flashing as required to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight.

B. Comply with recommendations in AAMA 1607 and with manufacturer's written instructions for installing unit skylights.

C. Install unit skylights level, plumb, and true to line, without distortion.

D. Anchor unit skylights securely to supporting substrates.

E. Where aluminum surfaces of unit skylights will contact another metal or corrosive substrates, such as preservative-treated wood, apply bituminous coating on concealed metal surfaces or provide other approved permanent separation recommended in writing by unit skylight manufacturer.

3.3 CLEANING

A. Clean exposed unit skylight surfaces according to manufacturer's written instructions. Touch up damaged metal coatings and finishes.

B. Remove excess sealants, glazing materials, dirt, and other substances.

C. Remove and replace glazing that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect unit skylight surfaces from contact with contaminating substances resulting from construction operations.

*** END OF SECTION ***

SECTION 08710

FINISH HARDWARE

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide all finish hardware and appurtenant work, complete in accordance with the Contract Documents.

B. The Work hereunder shall include all fabrication and mounting templates as needed for fabricators and for control of application of metal items. In addition thereto, the CONTRACTOR shall provide all trim, attachments, and fastenings indicated or required for proper and complete installation. The Work of this Section shall include all hardware that is not indicated in other Sections, whether or not such hardware is herein specifically scheduled.

C. The CONTRACTOR shall coordinate hardware with the Work of other Sections. The CONTRACTOR shall furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security, and similar requirements indicated, as necessary for proper installation and function

D. Section includes mechanical door hardware, and cylinders for doors fabricated with locking hardware.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work:

1. Section 07920 – Sealants and Caulking
2. Section 08110 – Steel Doors and Frames
3. Section 08347 – Sound Control Door Assemblies

1.3 REFERENCES

A. Use date of standard in effect as of bid date.

B. American National Standards Institute – ANSI 156.18 – Materials and Finishes.

C. ANSI A117.1 – Specifications for making buildings and facilities usable by physically handicapped people.

D. ADA – Americans with Disabilities Act

E. BHMA – Builders Hardware Manufacturers Association

F. DHI – Door and Hardware Institute

G. NFPA – National Fire Protection Association

1. NFPA 80 – Fire Doors and Windows
2. NFPA 101 – Life Safety Code
3. NFPA 105 – Smoke and Draft Control Door Assemblies
4. NFPA 252 – Fire Tests of Door Assemblies

H. UL – Underwriters Laboratories

1. UL10C – Fire Tests of Door Assemblies (Positive Pressure)
2. UL 305 – Panic Hardware

I. WHI – Warnock Hersey Incorporated

J. State of California Building Code

K. SDI – Steel Door Institute

L. NAAM – National Association of Architectural Metal Manufacturers

1.4 SUBMITTALS AND SUBSTITUTIONS

A. Submittals: Submit six copies of schedule per Section 01300. Organize vertically formatted schedule into "Hardware Sets" with index of doors and headings, indicating complete designations of every item required for each door or opening. Include following information:

1. Type, style, function, size, quantity and finish of hardware items. Use BHMA Finish codes per ANSI A156.18.

2. Name, part number and manufacturer of each item.

3. Fastenings and other pertinent information.

4. Location of hardware set coordinated with floor plans and door schedule.

5. Explanation of abbreviations, symbols, and codes contained in schedule.

6. Mounting locations for hardware.

7. Door and frame sizes, materials and degrees of swing.

8. List of manufacturers used and their nearest representative with address and phone number.

9. Catalog cuts.

10. Manufacturer's technical data and installation instructions for electronic hardware.

11. Date of jobsite visit.

B. Bid and submit manufacturer's updated/improved item if scheduled item is discontinued.

C. Make substitution requests in accordance with Contract Documents. Include product data and indicate benefit to the Project. Furnish operating samples on request.

D. Furnish as-built/as-installed schedule with closeout documents, including keying schedule, wiring/riser diagrams, manufacturers' installation, adjustment and maintenance information, and supplier's final inspection report.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Hardware supplier: direct factory contract supplier who employs a certified architectural hardware consultant (AHC), available at reasonable times during course Work for project hardware consultation to Owner, Architect and CONTRACTOR.

a. Responsible for detailing, scheduling and ordering of finish hardware

B. Hardware: New, free of defects, blemishes and excessive play. Obtain each kind of hardware, latch and locksets, exit devices, hinges and closers, from one manufacturer.

C. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.

D. Fire-Rated Openings: In compliance with NFPA 80. Hardware UL10C/UBC-7-2 (positive pressure) compliant for given type/size opening and degree of label. Provide proper latching hardware, non-flaming door closers, approved-bearing hinges, plus resilient and required intumescent seals. Furnish openings complete.

1. Note: scheduled seals may exceed selected door manufacturer's requirements. See Part 2 - Products for clarification.

E. Pre-Installation Meetings: Initiate and conduct with supplier, installer and related trades, coordinate materials and techniques, and sequence complex hardware items and systems installation. Convene at least one week prior to commencement of related work.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery: coordinate delivery to appropriate locations (shop or field).

1. Permanent keys and cores: secured delivery direct to Owner's representative.

B. Acceptance at Site: Items individually packaged in manufacturers' original containers, complete with proper fasteners and related pieces. Clearly mark packages to indicate contents, locations in hardware schedule and door numbers.

C. Storage: Provide locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, etc.

1.7 PROJECT CONDITIONS

A. Where exact types of hardware specified are not adaptable to finished shape or size of members requiring hardware, provide suitable types having as nearly as practical as the same operation and quality as type specified, subject to Architect's approval.

1.8 SEQUENCING AND COORDINATION

A. Coordinate with concrete.

B. Reinforce walls.

C. Coordinate finish floor materials and floor-mounted hardware.

D. Furnish manufacturer templates to door and frame fabricators.

E. Use hardware consultant to check Shop Drawings for doors and entrances to confirm that adequate provisions will be made for proper hardware installation.

1. Confirm that door manufacturers furnish necessary CBC compliant seal packages.

1.9 WARRANTY

A. Part of respective manufacturers' regular terms of sale. Provide manufacturers' warranties.

1. Closers: Ten years mechanical.

2. Exit Devices: Three years.

3. Hinges: Life of Building.

4. Other Hardware: Two years.

1.10 COMMISSIONING

A. Test door hardware operation with climate control system and stairwell pressurization system both at rest and while in full operation.

B. Test electrical, electronic and electro-pneumatic hardware systems for satisfactory operation.

C. Test hardware interfaced with fire/life-safety system for proper operation and release.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Listed acceptable alternate manufacturers: submit for review products with equivalent function and features of scheduled products. Approval of manufacturers other than those listed shall be in accordance with Section 4 of the SSPWC and City Supplements.

ITEM:	MANUFACTURER:
Hinges	(ST) Stanley
Locksets	(BE) Best
Cylinders	(BE) Best
Exit Devices	(PR) Precision
Closers	(SD) Stanley
Overhead Stops	(AB) ABH
Flush Bolts	(DJ) Don Jo
Astragals	(PE) Pemko
Gasketing	(RS) Reese
Threshold	(RS) Reese

B. Provide hardware items required to complete the work in accordance with these specifications and manufacturers' instructions.

1. Include items inadvertently omitted from this specification. Note these items in submittal for review.

2. Where scheduled item is now obsolete, bid and furnish manufacturers updated item at no additional cost to the project.

2.2 HANGING MEANS

A. Conventional Hinges: Hinge open widths minimum, but, of sufficient throw to permit maximum door swing. Stainless steel pins and concealed bearings with stainless steel fasteners.

1. Three hinges per leaf to 7 foot, 6 inch height. Add one for each additional 30 inches in height, or any fraction thereof.

2. Extra heavy weight hinges on doors over 3 foot, 5 inches in width.

3. Outswinging exterior doors: non-ferrous with non-removable (NRP) stainless steel pins.

4. Non-ferrous material exteriors and at doors subject to corrosive atmospheric conditions.

5. Provide shims and shimming instructions for proper door adjustment.

6. Continuous Hinges of Stainless Steel, both leafs mount between the frame stop and door edge.

2.3 EXIT DEVICES AND LOCKSETS

A. Exit devices: as scheduled.

1. Lever Trim: through-bolted, Schlage 17A or Security Trim Ives VR900. Filled hollow tube design unacceptable.

2. Strikes: 16 gage. Scheduled Schlage Lock Series L9000.

3. Type: Von Duprin 98 Series with Lever or Security Trim, Ives VR910.

2.4 CLOSERS

A. General: One manufacturer for closer units throughout the Work.

1. Full rack-and-pinion type cylinder with removable non-ferrous cover and cast iron body. Double heat-treated pinion shaft, single piece forged piston, chrome-silicon steel spring.

2. ISO 2000 certified. Units stamped with date-of-manufacture code.

3. Thru-bolts at wood doors unless doors are provided with closer blocking. Non-sized, non-handed, and adjustable.

4. Plates, brackets and special templating when needed for interface with particular header, door and wall conditions and neighboring hardware.

5. Opening pressure: Exterior doors 5 lb., interior doors 5 lb., labeled fire doors 5 lb or up to 15 lbs with permission from the Authority Having Jurisdiction.

6. Separate adjusting valves for closing speed, latching speed and backcheck, fourth valve for delayed action where scheduled.

7. Closers, interior and exterior are to have a special rust inhibitor on the body and arms.

8. Provide non corrosive fasteners of brass bronze or stainless steel.

9. Non-flaming fluid will not fuel door or floor covering fires.

10. Accepted: LCN 4000 Series, Norton 7500 with forged arms and Rust Inhibitor coating on the body and arm.

2.5 OTHER HARDWARE

A. Flush Bolts: Automatic, low operating force design with stainless steel fasteners. Provide full width coordinator with fill bars and closer brackets.

B. Kick Plates: Four beveled edges, .050 inches minimum thickness, height and width as scheduled. Sheet-metal screws of stainless steel to match other hardware.

C. Door Stops: Provide stops to protect walls, casework or other hardware with stainless steel fasteners.

D. Seals: Finished to match adjacent frame color.

E. Fire-rated Doors, Brush Seals: UL10C/UBC-7-2 compliant. Coordinate with selected door manufacturers and selected frame manufacturer's requirements. Where rigid housed brush seals are scheduled in this section and the selected door manufacturer only requires an adhesive mounted resilient seal, furnish rigid housed seal at minimum, or both the rigid housed seal and the adhesive applied seal if necessary to fulfill door manufacturer's requirement. Adhesive applied seal alone is deemed insufficient for this project where rigid housed seals are scheduled.

F. Fire-rated Doors, Intumescent Seals: Furnish fire-labeled opening assembly complete and in full compliance with UL10C/UBC-7-2. Furnished by selected door manufacturer, these seals vary in requirement by door type and door manufacture. Adhesive applied intumescent strips are not acceptable, use concealed-in-door-edge type.

G. Thresholds: As scheduled and per details. Substitute products: certify that the products equal or exceed specified material's thickness. Proposed substitutions: submit for approval.

1. Set in full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements in Division 7 "Thermal and Moisture Protection". Non-ferrous ¼ inch fasteners and lead expansion shield anchors, or Red-Head #SFS-1420 (or approved equivalent) Flat Head Sleeve Anchors (SS/FHSL).

2. Provide manufacturer's non skid surface.

H. Fasteners: Generally, exposed screws to be Phillips or Robertson drive. Provide stainless steel, plated brass or plated bronze fasteners.

I. Silencers: Interior hollow metal frames, 3 for single doors, 4 for pairs of doors. Omit where adhesive mounted seal occurs. Leave no unfilled/uncovered pre-punched silencer holes.

2.6 FINISH

A. BHMA 630, brush stainless, brushed chrome plated and BHMA 626, Brushed Stainless Steel.

B. Door closers: Powder coated to Stain Chrome.

C. Aluminum items: match predominant adjacent material. Seals to coordinate with frame color.

2.7 KEYING REQUIREMENTS

A. Key Systems: Where indicated in the hardware sets provide the Best interchangeable core in small format in the keyway of record . Where indicated in the hardware sets provide small format interchangeable core in keyway of record, in small format keyed to the existing system in the keyway of record. Key blanks available only from factory-direct sources, not available from after-market key blank manufacturers. For estimate use factory GMK charge. Initiate and conduct meeting(s) with Owner to determine system keyway(s) and structure, furnish Owner's written approval of the system.

1. Existing factory registered master key system. Meet with the owner to determine the continuation of the system and establish the keying nomenclature.

2. Construction keying: brass keyed-alike temporary cores plus 5 operating keys and 2 construction control keys. Temporary cores and keys remain property of hardware supplier.

B. Keys: Four Keys per cylinder, one Master and Control.

C. Locksets and cylinders: keyed at factory of lock manufacturer where permanent records are maintained. Locks and cylinders same manufacturer.

D. Permanent keys and cores: secured shipment direct from point of origination to Owner's representative.

E. Bitting List: Secured shipment direct from point of origination to Owner upon completion.

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLERS

A. Factory trained, certified, and carries a factory-issued card certifying that person as a "Certified Installer". Alternative: can demonstrate suitably equivalent competence and experience.

3.2 PREPARATION

A. Ensure that walls and frames are square and plumb before hardware installation.

B. Locate hardware per SDI-100 and applicable building, fire, life-safety, accessibility, and security codes.

1. Notify RESIDENT ENGINEER of any code conflicts before ordering material.

2. Where new hardware is to be installed near existing doors/hardware scheduled to remain, match locations of existing hardware.

3.3 INSTALLATION

A. Install hardware per manufacturer's instructions and recommendations. Do not install surface-mounted items until finishes have been completed on substrate. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate for proper installation and operation.

1. Gaskets: install jamb-applied gaskets before closers, overhead stops, rim strikes, etc. Install sweeps across bottoms of doors before astragals, cope sweeps around bottom pivots, trim astragals to tops of sweeps.

2. When hardware is to be attached to existing metal surface and insufficient reinforcement exists, use RivNuts, NutSerts or similar anchoring device for screws.

B. Locate floor stops not more than 4 inches from the wall.

C. Drill pilot holes for fasteners in wood doors and/or frames.

D. Lubricate and adjust existing hardware scheduled to remain. Carefully remove and give to Owner items not scheduled for reuse.

3.4 ADJUSTING

A. Adjust and check for proper operation and function. Replace units, which cannot be adjusted to operate freely and smoothly.

1. Hardware damaged by improper installation or adjustment methods to be repaired or replaced to Owner's satisfaction.

B. Inspection: Use hardware supplier. Include suppliers with closeout documents.

C. Follow-up inspection: Installer to provide letter of agreement to Owner that approximately 6 months after substantial completion, installer will visit Project with representatives of the manufacturers of the locking devices and door closers to accomplish following.

1. Re-adjust hardware.

2. Evaluate maintenance procedures and recommend changes or additions, and instruct Owner's personnel.

3. Identify items that have deteriorated or failed.

4. Submit written report identifying problems and likely future problems.

3.5 PROTECTION/CLEANING

A. Cover installed hardware, protect from paint, cleaning agents, weathering, carts/barrows, etc. Remove covering materials and clean hardware just prior to substantial completion.

B. Clean adjacent wall, frame and door surfaces soiled from installation/reinstallation process.

3.6 SCHEDULE OF FINISH HARDWARE

A. See door schedule in drawings for hardware set assignments.

B. The hardware sets represent the product design intent and direction of the owner and architect. They should not be considered a detailed hardware schedule. Detailed or omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

C. Manufacturer's Abbreviations:

1. BE BEST
2. NA National Guard Products
3. PE Pemko
4. PR Precision
5. ST Stanley Hinges
6. SD Stanley Door Closers
7. RS Reese
8. AB ABH Manufacturing
9. DJ Don Jo

Hardware Sets

SET #01

Doors: 101A, 101B

4	Hinges	FBB199 4 1/2 X 4 1/2 NRP	US26D	ST
1	Exit Device	2103 X 2003C LD	**626**	PR
1	Rim Cylinder	12E-72 PATD	626	BE
1	Door Closer	CLD-4550 HCS SRI	689	SD
1	Gasketing	797B @ Head & Jambs		RS
1	Door Sweep	354A		RS
1	Threshold	Per Detail		RS
1	Overhead Raindrip	R201A 4" ODW (as required)		RS

NOTE: Balance of gasketing by sound door manufacturer as required.

SET #02

Doors: 101C, 102A

8	Hinges	FBB199 4 1/2 X 4 1/2 NRP	US26D	ST
1	Removable Mullion	KR822 MCS	689	PR
1	Exit Device	2101 LD	**626**	PR
1	Exit Device	2103 X 2003C LD	**626**	PR
2	Rim Cylinder	12E-72 PATD	626	BE
2	Door Closer	CLD-4550 HCS SRI	689	SD
1	Gasketing	797B @ Head & Jambs		RS
1	Mullion Seal	5100S		NA
2	Door Sweep	354A		RS
1	Threshold	Per Detail		RS
1	Overhead Raindrip	R201A 4" ODW (as required)		RS

NOTE: Balance of gasketing by sound door manufacturer as required.

SET #03

Doors: 102B

3	Hinges	FBB199 4 1/2 X 4 1/2 NRP	US26D	ST
1	Exit Device	2103 X 4903A LD	**626**	PR
1	Rim Cylinder	12E-72 PATD	626	BE
1	Door Closer	CLD-4550 HCS SRI	689	SD
1	Gasketing	797B @ Head & Jambs		RS
1	Door Sweep	964C 36"		RS
1	Threshold	Per Detail		RS

NOTE: Balance of gasketing by sound door manufacturer as required.

SET #04

Doors: 103

8	Hinges	FBB199 4 1/2 X 4 1/2 NRP	US26D	ST
1	Removable Mullion	KR822 x MCS	AL	PR
1	Exit Device	2101 LD	**626**	PR
1	Exit Device	2103 x 4903A LD	626	PR
2	Rim Cylinder	12E-72 PATD	626	BE
1	Door Closer	CLD-4550 HCS SRI	689	SD
1	Mullion Seal	5100S		NG
1	Gasketing	797B @ Head & Jambs		RS
2	Door Sweep	354A		RS
1	Threshold	Per Detail		RS
1	Overhead Raindrip	R201A 4" ODW (as required)		RS

NOTE: Balance of gasketing by sound door manufacturer as required.

SET #05

Doors: 104

4	Hinges	FBB199 4 1/2 X 4 1/2 NRP	US26D	ST
1	Storeroom Lockset	45H-7D15H PATD	626	BE
1	Overhead Stop & Holder	N9010 Series	US32D	AB
1	Gasketing	797B @ Head & Jambs		RS
1	Door Sweep	354A		RS
1	Threshold	Per Detail		RS
1	Overhead Raindrip	R201A 4" ODW (as required)		RS

NOTE: Balance of gasketing by sound door manufacturer as required.

*** END OF SECTION ***

SECTION 08800

GLAZING

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide all glass, caulking materials, and related items, complete, in accordance with the Contract Documents.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 07920 Sealants and Caulking
2. Section 08347 Sound Control Door Assemblies

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. The Work of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego.

1. California Building Code (CBC)
2. California Code of Regulations - Title 24
3. CFR B Federal Safety Standards

B. Except as otherwise indicated, the current editions of the following standards apply to the Work of this Section.

1. Federal Specifications:

TT-S-001543A	Sealing Compound, Silicone Rubber Base (For Caulking, Sealing and Glazing in Buildings and Other Structures)

2. Commercial Standards:

ASTM D 412	Test for Rubber and Plastic Tension
ASTM C 920	Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
ASTM C 1036	Glass, Float or Plate, Sheet, Figures (Flat for Glazing, Mirrors and Other Uses)

ASTM C 1048	Glass, Float, Sheet, Figured, Coated (Heat-Strengthened and Tempered)
ASTM D 2287	Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
ASTM E 163	Methods of Fire Tests of Window Assemblies
ASTM E 774	Specification for Sealed Insulating Glass Units
ANSI Z 97.1	Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test

3. Trade Standards:

The Flat Glass Marketing Association.

"Glazing Manual" and "Glazing Sealing Systems Manual."

"Glazing Specifications for Sealed Insulating Glass Units" by the Sealed Insulating Glass Manufacturers Association (SIGMA 65-7-2).

The Safety Glazing Certification Council (SGCC).

1.4 SUBMITTALS

A. General: The CONTRACTOR shall provide submittals in accordance with the requirements of the Section 01300 - Submittals.

B. Product Data: Manufacturer's technical data shall be submitted for each glazing material and fabricated glass product required, including installation and maintenance instructions.

C. Samples: Samples shall be submitted for verification purposes; 12-inch square samples for each type of glass indicated except for clear single pane units, and 12-inch long samples of each color required (except black) for each type of sealant or gasket exposed to view. Sealant or gasket sample shall be installed between two strips of material representative of adjoining framing system in color.

D. Certificate: Certificates shall be submitted from respective manufacturers in compliance with Section 01300 - Submittals attesting that glass and glazing materials comply with Contract Document requirements. A separate certification is not required for glazing materials bearing the manufacturer's permanent labels designating type and thickness of glass, provided that the labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authorities having jurisdiction.

E. Compatibility and Adhesion Test Report: A statement shall be submitted from the sealant manufacturer indicating that glass and glazing materials have been tested for compatibility and adhesion with glazing sealants and interpreting test results relative to material performance, including recommendations for primers and substrate preparation needed to obtain adhesion.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials: Manufactured products shall be delivered in original, unbroken, packages, containers or bundles bearing the manufacturer's label.

B. Storage: All products shall be carefully stored on wood blocking in an area that is protected from the elements and in a manner recommended by the product manufacturer. Storage shall be in a manner that will prevent damage to the material or marring of its finish.

C. Protection of Glass and Glazing: Protect glass and glazing materials during delivery, storage and handling to comply with manufacturer's directions and as required to prevent edge damage to glass, and damage to glass and glazing materials from effects of moisture including condensation, of temperature changes, of direct exposure to sun, and from other causes. Where insulating glass units will be exposed to substantial altitude changes, hermetic seal ruptures shall be avoided by complying with insulating glass fabricator's recommendations for venting and sealing.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Manufacturer's Standards: Glass and caulking materials shall be in accordance with the manufacturer's published literature and specifications for the products indicated.

B. General Requirements: The CONTRACTOR shall provide glass and glazing that has been produced, fabricated and installed to withstand normal thermal movement, wind loading, and impact loading (where applicable), without failure including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glass and glazing materials and other defects in the Work.

1. Normal thermal movement shall be defined as that resulting from an ambient temperature range of 120 degrees F and from a consequent temperature range within glass and glass framing members of 180 degrees F.

2.2 GLAZING MATERIALS

A. Glass Specifications:

1. Primary Glass Standard: Primary glass shall be provided which complies with ASTM C 1036, including those indicated by type, class, quality, and, if applicable, form, finish, mesh and pattern.

2. Glass shall conform to ASTM C 1036.

3. Heat-Treated Glass Standard: Heat-treated glass shall be provided which complies with ASTM C 1048 requirements, including those indicated by reference to kind, condition, type, quality, class, and, if applicable, form, finish, and pattern.

4. Tempered glass shall also conform to ASTM C 1048.

B. Single Source Responsibility for Glass: Materials shall be provided which are produced by a single manufacturer or fabricator for each kind and condition of glass indicated. Primary glass shall be obtained from a single source for each type and class required.

C. Sizes: Glass shall be fabricated to sizes required for glazing openings indicated, with edge clearances and tolerances complying with recommendations of glass manufacturer. Thicknesses shall be provided as indicated or, if not otherwise indicated, as recommended by the glass manufacturer for the application indicated.

D. Glazing Thickness: Thicknesses of glass indicated are minimum thicknesses. Thicker glass shall be provided when required by applicable Building Code requirements.

E. Labeling: Glass shall be factory-labeled. Nonlabeled glass will be rejected.

2.3 GLASS TYPES

A. General Requirements: All glass shall conform to the following requirements:

1. Type D - Clear, Fully Tempered Float Glass: Conform to ASTM C 1048, minimum thickness 3-inch. Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select). Manufacture heat-treated glass by horizontal (roller hearth) process with roll wave distortion parallel with bottom edge of glass as installed, unless otherwise indicated.
2. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 for window assemblies.

   a. Laminated Ceramic Glazing: Laminated glass made from 2 plies of clear, ceramic flat glass, 5/16-inch total nominal thicknes; complying with testing requirements in 16 CFR 1201 for Category II Materials.

   b. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F (not a requirement of this Project), and the fire resistance rating in minutes.

2.4 ELASTOMERIC GLAZING SEALANTS AND PREFORMED GLAZING TAPES

A. General: Products shall be provided of type indicated and complying with the following requirements:

1. Compatibility: Glazing sealants and tapes shall be selected which are of proven compatibility with other materials with which they will come into contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.

2. Suitability: Recommendations of sealant and glass manufacturers shall be complied with for selection of glazing sealants and tapes which have performance characteristics suitable for applications indicated and conditions at time of installation.

3. Elastomeric Sealant Standard: Manufacturer's standard chemically curing, elastomeric sealant shall be provided of base polymer indicated which complies with ASTM C 920, Specification for Elastomeric Joint Sealant requirements, including those for type, grade, class, and uses.

4. Colors: Color of exposed sealants shall be provided as indicated or, if not otherwise indicated, as selected by RESIDENT ENGINEER from manufacturer's standard colors.

B. Two Part Polysulfide Glazing Sealant: Type M; Grade NS; Glass 25; Uses NT, M, G, A, and, as applicable to uses indicated, O.

C. One-Part Non-Acid-Curing Silicone Glazing Sealant: Type S; Grade NS, Class 25; Uses NT, G, A, and, as applicable to uses indicated, O; conforming to Federal Specifications TT-S-001543A - Sealing Compound, Silicone Rubber Base (for Caulking, Sealing and Glazing in Buildings and Other Structures.), nonsag type, and complying with the following requirements for modulus and additional joint movement capability.

1. Low Modulus: Tensile strength of 45 psi or less at 100 percent elongation when tested per ASTM D 412, after 14 days at 77 degrees F and 50 percent relative humidity.

D. Preformed Butyl-Polyisobutylene Glazing Tape: Manufacturer's standard solvent-free butyl-polyisobutylene formulation shall be provided with a solids content of 100 percent; complying with AAMA A 804.1; in extruded tape form; nonstaining and nonmigrating in contact with nonporous surfaces; packaged on rolls with a release paper on one side; with or without continuous spacer or as recommended by manufacturers of tape and glass for application indicated.

E. View Window Gaskets: Glazing gaskets for view windows in hydraulic structures shall be black neoprene having a 75 (+5) shore "A" Durometer hardness, and be chemically compatible with the sealant used.

F. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

2.5 MISCELLANEOUS GLAZING MATERIALS

A. Compatibility: Materials shall be provided with proven record of compatibility with surfaces contacted with installation.

B. Cleaners, Primers and Sealers: Types shall be recommended by sealant or gasket manufacturer.

C. Setting Blocks: Neoprene, EPDM or silicone blocks shall be provided as required for compatibility with glazing sealants, 80 to 90 Shore A durometer hardness.

D. Spacers: Neoprene, EPDM or silicone blocks, or continuous extrusions, shall be provided as required for compatibility with glazing sealant, of size, shape, and hardness recommended by glass and sealant manufacturers for application indicated.

E. Edge Blocks: Neoprene, EPDM or silicone blocks shall be provided as required for compatibility with glazing sealant, of size and hardness required to limit lateral movement (side-walking) of glass.

F. Compressible Filler Rods: Closed-cell or waterproof-jacketed rod stock of synthetic rubber or plastic foam, flexible and resilient, with 5- to 10-psi compression strength for 25 percent deflection.

G. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.6 MANUFACTURERS

A. Products shall be from the following manufacturers, or equal.

1. Glazing Accessory Products:

a. Two-Part Polysulfide Glazing Sealant:

(1) "Chem-Calk 200"; Bostik Construction Products Division.
(2) "Synthacalk GC-5"; Pecora Corp.

2. One-Part Non-Acid Curing Medium-Modulus Silicone Glazing Sealant:

a. "Dow Corning 795"; Dow Corning Corp.
b. "Silpruf"; General Electric Corp.
c. "Gesil"; General Electric Corp.
d. "Spectrum 2"; Tremco, Inc.

3. Preformed Butyl-Polysiobutylene Glazing Tape Without Spacer Rod:

   a. "Chem-Tape 40"; Bostik Construction Products Division.
   b. "Extru-Seal"; Pecora Corp.
   c. "PTI 303" Glazing Tape; Protective Treatments, Inc.
   d. "Tremco 440 Tape"; Tremco, Inc.

4 Heat-Treated Glass:

   a. AFG Industries, Inc.
   b. Cardinal IG
   c. Environmental Glass Products
   d. Falconer Glass Industries
   e. Ford Glass Division
   f. Guardian Industries Corp.
   g. Hordis Brothers, Inc.
   h. LOF Glass, Inc.
   i. PPG Industries, Inc.
   j. Saint-Gobain/Euroglass
   k. Spectrum Glass Prod. Division., H.H. Robertson Co.
   l. Viracon, Inc.

5. Fire-Protection-Rated Glass:

   a. Nippon Electric Glass Co., Ltd. (distributed by Technical Glass Products); FireLite Plus.

   b. Schott North America, Inc.; Laminated Pyran Crystal

   c. Vetrotech Saint Gobain; SGG Keralite FR-L

PART 3 -- EXECUTION

3.1 GENERAL

A. Reference Standard: Glazier shall comply with combined printed recommendations of glass manufacturers and of manufacturers of sealants, gaskets and other glazing materials, including those of referenced glazing standards, except where more stringent requirements. are indicated herein.

B. Complete System: Glass and glazing system shall be installed complete with all stops, blocks, channels, beads, sealants, and glass to form a completely installed, watertight installation.

C. Glazing channel dimensions as indicated in details are intended to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Glazier shall adjust as required by job conditions at time of installation.

D. Pre-Inspection: The CONTRACTOR shall require the glazier to inspect the work of the glass framing erector for compliance with manufacturing and installation tolerances, including those for size, squareness, offsets at corners; for the presence and functioning of weep system; for the existence of minimum required face or edge clearances; and for effective sealing of joinery. The CONTRACTOR shall obtain the glazier's written report listing conditions detrimental to performance of glazing Work. The RESIDENT ENGINEER will not allow glazing Work to proceed until unsatisfactory conditions have been corrected.

E. Starting of glazing installation shall be construed as acceptance of substrates as appropriate to successful completion of Work of this Section.

3.2 GLAZING APPLICATION SCHEDULE

A. Glass types for the various locations shall conform to the following schedule:

1. Interior View windows: Fire-protection-rated glass.

2. Unit skylights: As described in Section 08620 Unit Skylights.

3.3 PREPARATION

A. Preparation work such as priming and cleaning shall be done with materials and procedures specified in the printed recommendations of the manufacturer. Surfaces shall be dry and free from dust, dirt, and film. All priming shall be completed and thoroughly dried before glazing.

B. Glazing channels and other framing members shall be thoroughly cleaned to receive glass, immediately before glazing. Coatings which are not firmly bonded to substrates shall be removed. Lacquer shall be removed from metal surfaces where elastomeric sealants are indicated for use.

3.4 INSTALLATION

A. Protection: Glass shall be protected from edge damage during handling and installation; a rolling block shall be used in rotating glass units to prevent damage to glass corners. Glass shall not be impacted against metal framing. Suction cups shall be used to shift glass units within openings; pry bar shall not be used to raise or drift glass. Glass shall be rotated with flares or bevels along one horizontal edge which would occur in vicinity of setting blocks so that these are located at top of opening.

B. Edges: Concealed edges of glass shall be clean, straight cut, and free from chips and fissures. All glass shall be shop-cut, with proper allowances of size for installed lite. Maximum grip shall be allowed on all edges. Glass shall be set with equal bearing on entire width of pane. Nipping glass on the job site will not be allowed. Glass units shall be removed from the project site and disposed of if they are discovered to contain edge damage or other imperfections of the kind that, when installed, weaken the glass and impair its performance and appearance.

C. Weather and Temperature Limitations: No Work of this Section shall be performed in damp, foggy, or rainy weather. Work shall not proceed unless temperatures are within manufacturer's printed recommendations.

D. Setting Glass Units: Units of glass shall be set in each series with conformity of pattern, draw, bow, and similar characteristics.

E. Glazing Beads: Glass in glazing beads or channels shall be in accordance with manufacturer's printed installation instructions. Materials shall not be stretched.

F. Metal Glazing Beads: Where metal glazing beads or stops occur and where vinyl glazing beads are not used, the glass shall be set on setting blocks and be completely bedded in glazing compound. Metal glazing beads furnished by the manufacturer shall be installed in accordance with manufacturer's printed instructions. Compound shall be trimmed flush to sight line.

G. Gasket Glazing: Glass set in reglet with gasket glazing shall be set on glazing tape. All voids around perimeter and between glass and stop shall be filled with glazing compound to provide completely watertight installation. Tape and compound shall be trimmed flush to sight line.

H. Sealant Application: Sealant shall be applied on inside glass surface below glazing bead. The void below vinyl to bottom of glazing reglet shall be filled to maintain weather tight seal.

1. Compressible filler rods or equivalent back-up material, shall be provided as recommended by the sealant and glass manufacturers to prevent sealant from extruding into glass channel weep systems and from adhering to joint's back surface as well as to control depth of sealant for optimum performance, unless otherwise indicated.

2. Sealants shall be forced into glazing channels to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.

3. Exposed surfaces of sealants shall be tooled to provide a substantial "wash" away from glass. Pressurized tapes and gaskets shall be installed to protrude slightly out of channel, so as to eliminate dirt and moisture pockets.

I. Setting Blocks: Setting blocks of proper size shall be installed in sill rabbet, located one quarter of glass width from each corner, but with edge nearest corner not closer than 6" from corner, unless otherwise required. Blocks shall be set in a thin course of sealant which is acceptable for heel bead use.

J. Spacers: Spacers shall be provided, inside and out, of correct size and spacing to preserve required face clearances, for glass sizes larger than 50 united inches (length plus height), except where gaskets or glazing tapes with continuous spacer rods are used for glazing, 1/8-inch minimum bite of spacers shall be provided on glass and thickness equal to sealant width shall be used, except with sealant tape, thickness shall be employed which is slightly less than final compressed thickness of tape.

K. Edge Blocking: Edge blocking shall be provided to comply with requirements of referenced glazing standard, except where otherwise required by glass unit manufacturer.

L. Anchorage: Where edge-shaped gaskets are driven into one side of channel to pressurized sealant or gasket on opposite side, adequate anchorage shall be provided to ensure that gasket will not "walk" out when installation is subjected to movement.

M. Gaskets: Wedge-shaped gasket shall be miter-cut at corners and gaskets shall be installed in manner recommended by gasket manufacturer to prevent pull-away at corners; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

N. Safety Markings: Glass, glazing panels, and glazing shall be protected by markings or devices which clearly indicate the presence of glass to other workers and material handlers. Taping or marking which would cause a permanent stain on the glass shall not be used. Labels shall remain on glass until final cleaning.

3.5 TESTING

A. Leak Testing: After installation is complete, all exterior glazing, except for aluminum entrance doors, shall be given a leak test by flooding the glazing from bottom to top using 3/4-inch minimum hose with nozzle.

3.6 ACCEPTANCE AND CLEANING

A. Contamination: Glass shall be protected from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, they shall be removed immediately by method recommended by glass manufacturer.

B. Examination of Glass Surfaces: Glass surfaces adjacent to or below exterior concrete and other masonry surfaces shall be examined at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkali deposits or staining. When examination reveals presence of these forms of residue, they shall be removed by method recommended by glass manufacturer.

C. Damaged Glass: Glass which is broken, chipped, cracked, abraded, or damaged in other ways during construction period, shall be removed, and replaced.

D. Label Removal and Cleaning: Not more than 4 days prior to final acceptance of the Work, nonpermanent labels shall be removed from glass surfaces and the surfaces shall be cleaned. Glass shall be washed on both faces by methods recommended by glass manufacturer.

*** END OF SECTION ***

SECTION 09511

ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The CONTRACTOR shall provide material and installation of acoustical panel ceiling systems in accordance with Contract Documents.

B. Work included in this Section includes acoustical panels and exposed suspension systems for ceilings.

1.2 SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 6 inches (150 mm) in size.

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Panel: Set of 6-inch-square Samples of each type, color, pattern, and texture.

2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch-long Samples of each type, finish, and color.

D. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

E. Maintenance Data: For finishes to include in maintenance manuals.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.

2.2 ACOUSTICAL PANELS, GENERAL

A. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.

2. Suspension System: Obtain each type from single source from single manufacturer.

B. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.

C. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

2.3 ACOUSTICAL PANELS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc., Dune Square Lay-in, or comparable product by one of the following:

1. CertainTeed Corp.

2. Chicago Metallic Corporation.

3. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:

1. Type and Form: Type III, mineral base with factory applied painted finish; Form 2, water felted.

2. Pattern: As indicated by manufacturer's designation.

C. Color: White.

D. LR: Not less than 0.80

E. NRC: Not less than 0.50.

F. CAC: Not less than 30.

G. Edge/Joint Detail: Square.

H. Thickness: 5/8 inch.

I. Modular Size: 24 by 48 inches.

J. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.

B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch-diameter wire.

D. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

E. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

F. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in place.

G. Seismic Beam End Retaining Clips: Manufacturer's standard clips to join main beam or cross tee to wall molding and web of grid with no visible pop rivets.

2.5 METAL SUSPENSION SYSTEM

A. Suspension System for Acoustical Panel Ceiling: Provide acoustical panel ceiling suspension system complying with the following:

1. Products: Provide one of the following:

a. Armstrong Prelude XL Heavy Duty System

1) Main Runner: Prelude XL 7301 Heavy Duty
2) Cross Runner: Prelude XL 7341

b. USG Corporation Donn DX Heavy Duty System

1) Main Runner: DX-26 Heavy Duty
2) Cross Runner: DX-424

c. Chicago Metallic Series 1200

1) Main Runner: 200 Heavy Duty
2) Cross Runner: 1214

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.

3. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

4. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.

5. Do not attach hangers to steel deck tabs.

6. Do not attach hangers to steel roof deck. Attach hangers to structural members.

7. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.

8. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.

2. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

*** END OF SECTION ***

SECTION 09800

PROTECTIVE COATING

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide protective coatings and follow safety and health procedures as listed herein to provide the minimum level of protection for materials against physical, environmental and corrosive damage. The CONTRACTOR shall develop protective coating measures in accordance with these guidelines and other design criteria referenced in the CONTRACT DOCUMENTS to ensure all systems are protected.

B. Architectural coatings are specified in Section 09900

C. Definitions:

1. The term "paint," "coatings," or "finishes" as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, and all other protective coatings, excepting galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat.

2. The term "DFT" means minimum dry film thickness.

D. The following surfaces shall not be protective coated unless specifically indicated in other Sections or on the Drawings.

1. Concrete.

2. Stainless steel.

3. Machined surfaces.

4. Grease fittings.

5. Glass.

6. Equipment nameplates.

7. Platform gratings, stair treads, door thresholds, and other walking surfaces.

8. Plastic and fiberglass surfaces

9. Embedded steel in concrete.

10. Factory pre-finished surfaces with baked-on enamel, porcelain, polyvinyldiene fluoride or other similar heat-applied factory finish.

11. Submerged or intermittently submerged concrete unless otherwise specified.

12. Internal components of valves or pumps if the factory supplied coating meets or exceeds any applicable standard specified in the equipment section of these specifications.

B. The coating system schedules summarize the surfaces to be coated, the required surface preparation, and the coating systems to be applied. Coating notes on the Drawings are used to show exceptions to the schedules, to show or extend the limits of coating systems, or to clarify or show details for application of the coating systems.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the Work of this Section:

1. References herein to "SSPC Specifications" or "SSPC" shall mean the published standards of SSPC, the Society for Protective Coatings.

2. References herein to "NACE" shall mean the published standards of the National Association of Corrosion Engineers.

3. References herein to "ANSI/AWWA" shall mean the published standards of the American Water Works Association including:

a.	ANSI/AWWA C205	Cement-Mortar Protective Lining and Coating for Steel Water Pipe B 4 in. (100mm) and Larger - Shop Applied
b.	ANSI/AWWA C209	Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
c.	ANSI/AWWA C210	Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
d.	ANSI/AWWA C213	Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
e.	ANSI/AWWA C214	Tape Coating Systems for the Exterior of Steel Water Pipelines
f.	ANSI/AWWA C217	Cold-Applied Petrolatum Tape and Petroleum Wax Tape Coatings for Exterior of Special Sections, Connections, and Fittings for Buried Steel Water Pipelines

4. Federal Specifications:

OSHA 1910.144	Safety Color Code for Marking Physical Hazards

5. National Sanitation Foundation "NSF," Standard 61 for Contact with Drinking Water.

6. ASTM Standards:

   a. C-309 Liquid Membrane-Forming Compounds for Curing Concrete

7. Regulatory Agency Requirements: Coatings for surfaces in contact with raw or potable water shall impart no taste or odor to the water nor result in any organic or inorganic content in excess of the maximum contaminant level established by applicable laws or regulations including NSF Standards. All coatings shall be approved by the San Diego Air Pollution Control District. The CONTRACTOR shall revise painting systems specified herein to provide manufacturer's regulatory agency approved coating system where required. All painting systems shall be VOC. compliant.

B. The Work of this Section shall comply with the current edition of the Uniform Building Code as adopted by the City of San Diego.

C. Inspection and test records of shop or field-applied coatings and linings for buried or submerged items shall be submitted within 15 days after the work has been accepted.

1.3 SUBMITTALS

A. General: Submittals shall be furnished in accordance with Section 01300 - Submittals unless indicated otherwise below.

B. Submittals shall include the following information and be submitted at least 30 days before protective coating work:

1. Coating Materials List: Eight copies of a coating materials list showing the Manufacturer and the coating number, keyed to the coating systems herein. The list shall be submitted before or at the time of submittal of samples.

2. Paint Manufacturer's Information: For each coating system to be used, the following data:

   a. Paint manufacturer's data sheet for each product proposed, including statements on the suitability of the material for the intended use.

   b. Technical and performance information that demonstrates compliance with the system performance and material requirements,

   c. Paint manufacturer's instructions and recommendations on surface preparation and application.

   d. Proposed application techniques including proof of the acceptability of the proposed technique for each coating.

   e. Colors available for each product (where applicable).

f. Compatibility of shop and field applied coatings (where applicable).

g. Material Safety Data Sheet for each product used.

1.4 SPECIAL CORRECTION OF DEFECTS REQUIREMENTS

A. Warranty Inspection: A warranty inspection may be conducted during the eleventh month following completion of all coating and painting work. The CONTRACTOR and a representative of the coating material manufacturer shall attend this inspection. All defective work shall be repaired in accordance with these Specifications and to the satisfaction of the Owner. The Owner may, by written notice to the CONTRACTOR, reschedule the warranty inspection to another date within the 2-year correction period, or may cancel the warranty inspection altogether. If a warranty inspection is not held, the CONTRACTOR is not relieved of its responsibilities under the Contract Documents.

1.6 SAFETY AND HEALTH REGULATIONS

A. General: In accordance with the requirements of OSHA Safety and Health Standards for Construction (29CFR1926) and the applicable requirements of regulatory agencies having jurisdiction, as well as manufacturer's printed instructions and appropriate technical bulletins and manuals, the CONTRACTOR shall provide and require use of personnel protective lifesaving equipment for persons working in or about the project site.

B. Head and Face Protection and Respiratory Devices: Equipment shall include protective helmets which shall be worn by all persons while in the vicinity of the Work. In addition, workers engaged in or near the work during sandblasting shall wear OSHA approved eye and face protection devices and air purifying, halfmask or mouthpiece respirators. Barrier creams shall be used on any exposed areas of skin.

C. Ventilation: Where ventilation is used to control hazardous exposure, all equipment shall be explosion-proof. Forced air ventilation shall be provided to reduce the concentration of air contaminant to a safe limit. Air circulation and exhausting of solvent vapors shall be continued until coatings have fully cured.

D. Sound Levels: Whenever the occupational noise exposure exceeds maximum allowable sound levels, the CONTRACTOR shall implement furnish and require the use of approved ear protective devices.

E. Illumination: Adequate illumination shall be provided while Work is in progress, which may include explosion-proof lights, scaffolding and electrical equipment. Whenever required by the Engineer, the CONTRACTOR shall provide additional illumination to cover all areas to be inspected. The level of illumination for inspection purposes shall be determined by the Engineer.

F. Temporary Ladders and Scaffolding: All temporary ladders and scaffolding shall conform to applicable safety requirements. They shall be erected where requested by the Engineer to facilitate inspection and shall be moved by the CONTRACTOR to locations as requested by the Engineer.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Suitability: Use suitable coating materials as recommended by the Manufacturer.

B. Compatibility: In any coating system only compatible materials from a single Manufacturer shall be used in the Work. Particular attention shall be directed to compatibility of primers and finish coats. If necessary, a barrier coat shall be applied between existing prime coat and subsequent field coats to ensure compatibility.

C. Containers: Coating materials shall be sealed in containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, and name of manufacturer, all of which shall be plainly legible at the time of use.

D. Colors: All colors and shades of colors of all coats of paint shall be as indicated or selected by the Engineer and specified in Section 15030. Each coat shall be of a slightly different shade, to facilitate inspection of surface coverage of each coat. Finish colors shall be as selected from the manufacturer's standard color samples by the Engineer.

E. Substitute or "Or-Equal" Products:

1. To establish equality, the CONTRACTOR shall furnish satisfactory documentation from the manufacturer of the proposed substitute or "or-equal" product that the material meets the indicated requirements and is equivalent or better in the following properties:

   a. Quality.
   b. Durability.
   c. Resistance to abrasion and physical damage.
   d. Life expectancy.
   e. Ability to recoat in future.
   f. Solids content by volume.
   g. Dry film thickness per coat.
   h. Compatibility with other coatings.
   i. Suitability for the intended service.
   j. Resistance to chemical attack.
   k. Temperature limitations in service and during application.
   l. Type and quality of recommended undercoats and topcoats.
   m. Ease of application.
   n. Ease of repairing damaged areas.
   o. Stability of colors.

2. Protective Coating Materials shall be standard products produced by recognized manufacturers who are regularly engaged in production of such materials for essentially identical service conditions. Where requested, provide the Engineer with the names of not less than 10 successful applications of the proposed manufacturer's products which comply with these requirements.

3. The cost of all testing and analyzing proposed substitute products which may be required by the Engineer shall be paid by the CONTRACTOR at no additional cost to the City. If a proposed substitution requires changes in the Work, bear all such costs involved and the costs of allied trades affected by the substitution at no additional cost to the City.

2.2 INDUSTRIAL COATING SYSTEMS

A. Material Sources: Each of the following manufacturers is capable of supplying many of the industrial coating materials indicated herein. Where manufacturers and paint numbers are listed, it is to show the type and quality of coatings that are required. Proposed substitute materials will be considered as indicated above. All industrial coating materials shall be materials that have a record of satisfactory performance in industrial plants, manufacturing facilities, and water and wastewater treatment plants.

1. Ameron International.
2. Carboline Coatings Company.
3. ICI Devoe Coatings Company.
4. Glidden Coatings and Resins.
5. Inorganic Coatings, Inc.
6. International Protective Coatings.
7. Tnemec Company.

2.3 COLORS AND FINISHES

A. Surface treatments and finishes are shown under "Coating Systems" below. All substrates scheduled under "Coating Systems" shall be coated whether or not shown on the Drawings or in the Coating System Schedule, unless an item is specifically scheduled as not requiring one of the coating systems described in this Section.

B. Color Selection

1. In general, all color coding of piping, ducts and equipment shall comply with applicable standards of ANSI A13.1 and OSHA 1910.144. Piping colors shall conform to the standards listed in the City's design guidelines.

2. The CONTRACTOR shall develop a color selection chart for all protective coatings and provide as a sumbittal in accordance with Section 01300.

C. Color Pigments: Color pigments shall be pure, nonfading, applicable types to suit the substrates and service indicated. Lead content shall not exceed amount permitted by federal, state and local government laws and regulations.

2.4 COATING SYSTEMS

A. Interior and Exterior Systems

1. System No. 1 - Aliphatic Polyurethane: Two component aliphatic acrylic polyurethane coating material shall provide superior color and gloss retention, resistance to splash from acid and alkaline chemicals, resistance to chemical fumes and severe weathering and with a minimum solids content of 58 percent

by volume. Primer shall be a rust inhibitive two-component epoxy coating with a minimum solids content of 68 percent by volume.

a. Prime coat DFT = 4 mils, Ameron 385, Carboline 893, Tnemec 69, or equal.

b. Finish coat (1 or more, DFT = 3 mils), Ameron Amershield, Carboline 134 HS, Tnemec 74, or equal.

c. Total system DFT = 7 mils.

d. More than one finish coat shall be applied as necessary to produce a finish with uniform color and texture.

2. System No. 2 - Epoxy, Equipment and Piping: Two-component, rust inhibitive polyamide cured epoxy coating material shall provide a recoatable finish that is available in a wide selection of colors. The coating material shall have a minimum solids content of 66 percent by volume and be resistant to service conditions of condensing moisture, splash and spillage of lubricating oils, and frequent washdown and cleaning.

a. Prime coat DFT = 3 mils, Ameron 385, Tnemec 69, or equal.

b. Prime coat, where shop applied. (DFT = 3 mils), universal primer, Ameron 185 HS, Tnemec 50-330 or 161, or equal.

c. Finish coats (2 or more, DFT = 6 mils), Ameron 385, Tnemec 69, or equal.

d. Total system DFT = 9 mils.

B. Submerged and Severe Service Coating Systems

1. Materials Sources: The manufacturers' products listed in this paragraph are materials which satisfy the material descriptions of this paragraph and have a documented successful record for long term submerged or severe service conditions. Proposed substitute products will be considered as indicated above.

2. System No. 3 - Amine-Cured Epoxy: High build, amine-cured, epoxy resin shall have a solids content of at least 80% by volume, and shall be suitable for long-term immersion service in potable water. For potable water service, the coating material shall be listed by the NSF International as in compliance with NSF Standard 61 - Drinking Water System Components - Health Effects.

a. Prime coat and finish coats (3 or more, DFT = 16 miles), Ameron 395, Tnemec 139, or equal.

b. For coating of valves and nonsubmerged equipment, DFT = 12 mils.

3. System No. 4 - Cold-Applied Tape: Tape coating materials and procedures shall be in accordance with ANSI/AWWA C209. The system shall consist of a primer layer, inner layer tape (35 mils), and an outer layer tape (35 mils). Total system DFT = 70 mils. Prefabricated tape shall be Type II for fittings and ANSI/AWWA C214 tape for piping.

4. System No. 5 - Polyamide-Cured Epoxy: High build, polyamide epoxy resin shall have a solids content of at least 56% by volume, and shall be suitable for long-term immersion in potable water. For potable water service, the coating material shall be listed by NSF International as in compliance with NSF Standard 61.

   a. Prime coat and finish coats (3 or more, DFT = 12 mils), Tnemec 20, Ameron 83HS, or equal.

5. System No. 6 - Fusion Bonded Epoxy: The coating material shall be a 100% powder epoxy applied in accordance with the ANSI/AWWA C213 - Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines, except that the surface preparation shall be as specified in the coating system schedule of this Section. The coating shall be applied using the fluidized bed process.

   a. Liquid Epoxy: For field repairs, the use of a liquid epoxy will be permitted, applied in not less than three coats to provide a DFT of 15 mils. The liquid epoxy shall be a 100 percent solids epoxy recommended by the powder epoxy manufacturer and per AWWA C210.

      (1) Coating DFT = 16 mils, Scotchkote 134 or 206N, or equal.
      (2) Total system DFT = 16 mils.
      (3) For coating of valves, DFT = 12 mils.

6. System No. 7 - Epoxy, Concrete: The coating material shall be an amine-cured epoxy material suitable for long-term immersion in water and for service where subjected to occasional splash and spillage of water treatment chemicals. The finish coating material shall have a minimum solids content of 80% by volume. If used for potable water service the finish coating material shall be listed by the NSF International as in compliance with NSF Standard 61, and shall conform with state and local health regulations and policies for service in potable water. The filler-sealer shall be a 100 percent solids amine-cured epoxy material with silica and inert fillers. A 100 percent solids epoxy surface shall be used to fillholes and patch the concrete surface after abrasive blasting.

   a. Prime coat (filler-sealer), applied in two coats to the entire surface using a squeegee to achieve a smooth, void-free surface, Tnemec 63-1500, Ameron Nu-Klad 105A followed by Nu-Klad 114A (two coats) or equal.

   b. Finish coats (2 or more, DFT = 12 mils), Tnemec Series 139 Ameron 395, or equal. On walking surfaces, use a nonskid additive such as Ameron 886 in the final coat.

C. Special Coating Systems:

1. System No. 8 - Cold-applied petrolatum/wax tape coating materials and procedures shall be in accordance with ANSI/AWWA C217. The system shall consist of a primer (DFT = 3 mils) and a tape layer (40 mils minimum thickness).

2. System No. 9 - Rich Portland Cement Mortar: Rich Portland cement mortar coating shall have a minimum thickness of 1/8 inch, followed by enclosure in an 8-mil thick polyethylene sheet with all joints and edges lapped and sealed with tape.

3. System No. 10 - Cement Mortar Coating: Cement mortar coating materials and procedures shall conform to the requirements of ANSI/AWWA C205. A 1-1/4-inch minimum thickness mortar coating shall be provided. The mortar coating shall be reinforced with wire fabric. The cement mortar shall contain no less than one part Type V cement to three parts sand. The cement mortar shall be cured by a curing compound meeting the requirements of "Liquid Membrane Forming Compounds for Curing Concrete," ASTM C 309, Type II, white pigmented, or by enclosure in an 8-mil thick polyethylene sheet with all edges and joints lapped by at least 6 inches. Sheeting shall be removed before backfilling.

4. System No. 11 - Tape and Cement Mortar Coating: A flexible pipe dielectric coating system (polyethylene tape) and cement mortar protective overcoat (rock shield) shall be provided. Polyethylene tape requirements shall conform to the requirements of ANSI/AWWA C214. A 3/4-inch minimum thickness mortar coating (rock shield) shall be provided and shall be reinforced with welded wire fabric conforming to the requirements of ANSI/AWWA C205. Cement mortar shall conform to the requirements of ANSI/AWWA C205, and cement for mortar shall be Type V.

5. System No. 13 - Acrylic Latex Coating for Exposed PVC Piping: Exterior surfaces of PVC piping exposed to sunlight shall be completely coated with a single component, water-based acrylic latex with a fungicide additive. Exposed PVC piping in interior, nonsubmerged applications shall be color-coded in accordance with Section 15030 - Pipe Identification Systems using a single component, water-based acrylic latex. The acrylic latex shall have a minimum solids content of 35 percent by volume. The prime coat shall be as recommended by the manufacturer. The coating material shall be available in ANSI safety colors. The system shall include a prime coat (DFT = 2 mils) as recommended by the manufacturer. The system shall include two or more finish coats (DFT = 6 mils) of Amerguard 220, Carboline 3300, or equal. The total system DFT = 8 mils.

2.5 COATING SYSTEM SCHEDULE:

A. The CONTRACTOR shall provide protective coatings in accordance with the schedule below. Proposed modifications shall be presented individually in writing to the City for consideration during the design phase and upon acceptance by the City shall be included in the Construction Documents.

Item	Surface Prep.	System No.
All ferrous surfaces indoors and outdoors, exposed or covered, except those included below.	Commercial blast cleaning SSPC-SP6	(1) aliphatic polyurethane
Surfaces of piping and equipment and ferrous surfaces submerged or intermittently submerged in potable water and all surfaces inside enclosed hydraulic structures and vents (excluding shop-coated valves, couplings, pumps).	White metal blast cleaning SSPC-SP5	(3) amine-cured epoxy
Buried steel pipe 3-inch diameter and smaller.	Removal of dirt, grease, oil	(4) cold applied tape
Where indicated, ferrous surfaces in water passages of all valves 4-inch diameter and larger, exterior surfaces of submerged or buried valves.	White metal blast cleaning SSPC-SP5	(5) polyamide-cured epoxy
Where indicated, ferrous surfaces in water passages and submerged surfaces of all pumps which have discharge diameter of 4 inches or larger.	White metal blast cleaning SSPC-SP5	(3) amine-cured epoxy
Ferrous surfaces of sleeve-couplings and exposed piping inside buildings/vaults.	White metal blast cleaning SSPC-SP5	(6) fusion-bonded epoxy
Buried surfaces that are not indicated to be coated elsewhere.	Removal of dirt, grease, oil	(4) cold applied tape
Above-grade or below-grade concrete, submerged and non-submerged	Per paragraph 3.7	(7) epoxy, concrete
Below-grade concrete, submerged, potable water	Per paragraph 3.7	(7) epoxy, concrete
Galvanized surfaces where indicated	Sweep blast cleaning SSPC-SP7	(2) epoxy
Buried pipe couplings, valves, and flanged joints, including epoxy-coated surfaces	As specified by reference specification	(8) petrolatum/wax tape
Buried plastic pipe couplings, valves, fittings, and flanged joints (where piping is plastic)	Removal of dirt, grease, oil	(9) rich Portland cement mortar
Buried steel pipe and fittings	As specified by reference specification	(11) tape and cement mortar

Item	Surface Prep.	System No.
Buried ductile or cast iron pipe and fittings	As specified by manufacturer for polyurethane coating; as specified by reference specification for epoxy coatings	(8) petrolatum/wax tape

PART 3 -- EXECUTION

3.1 WORKMANSHIP

A. Skilled craftsmen and experienced supervision shall be used on all Work.

B. Coating shall be done in a workmanlike manner so as to produce an even film of uniform thickness. Edges, corners, crevices, and joints shall receive special attention to insure thorough cleaning and an adequate thickness of coating material. The finished surfaces shall be free from runs, drops, ridges, waves, laps, brush marks, and variations in color, texture, and finish. The hiding shall be so complete that the addition of another coat would not increase the hiding. Special attention shall be given to insure that edges, corners, crevices, welds, and similar areas receive a film thickness equivalent to adjacent areas, and installations shall be protected by the use of drop cloths or other precautionary measures.

C. All damage to surfaces resulting from the Work shall be cleaned, repaired, and refinished to original condition.

3.2 STORAGE, MIXING, AND THINNING OF MATERIALS

A. Manufacturer's Recommendations: Unless otherwise indicated, the coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for all other procedures relative to coating shall be strictly observed.

B. All protective coating materials shall be used within the manufacturer's recommended shelf life.

C. Storage and Mixing: Coating materials shall be stored under the conditions recommended by the Material Safety Data Sheets, and shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Coatings of different manufacturers shall not be mixed together.

3.3 PREPARATION FOR COATING

A. General: All surfaces to receive protective coatings shall be cleaned as indicated before application of coatings. Examine all surfaces to be coated, and correct surface defects before application of any coating material. All marred or abraded spots on shop-primed and on factory-finished surfaces shall receive touch-up restoration before any coating application. Surfaces to be coated shall be dry and free of visible dust.

B. Protection of Surfaces Not to be Coated: Surfaces which are not to receive protective coatings shall be protected during surface preparation, cleaning, and coating operations.

C. All hardware, lighting fixtures, switchplates, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not to be painted shall be removed, masked or otherwise protected. Drop cloths shall be provided to prevent coating materials from falling on or marring adjacent surfaces. The working parts of all mechanical and electrical equipment shall be protected from damage during surface preparation and coating operations. Openings in motors, including moisture weep holes, shall be masked to prevent entry of coating or other materials.

D. Care shall be exercised not to damage adjacent work during blast cleaning operations. Spray painting shall be conducted under carefully controlled conditions. The DESIGN/BUILDER shall be fully responsible for and shall promptly repair any and all damage to adjacent work or adjoining property occurring from blast cleaning or coating operations.

E. Protection of Painted Surfaces: Cleaning and coating shall be coordinated so that dust and other contaminants from the cleaning process will not fall on wet, newly coated surfaces.

3.4 SURFACE PREPARATION STANDARDS

A. The following referenced surface preparation specifications of SSPC: The Society for Protective Coatings shall form a part of this specification:

1 Solvent Cleaning (SSPC-SP1): Removal of oil, grease, soil, salts, and other soluble contaminants by cleaning with solvent, vapor, alkali, emulsion, or steam.

2 Hand Tool Cleaning (SSPC-SP2): Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by hand chipping, scraping, sanding, and wire brushing.

3 Power Tool Cleaning (SSPC-SP3): Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by power tool chipping, descaling, sanding, wire brushing, and grinding.

4 White Metal Blast Cleaning (SSPC-SP5): Removal of all visible rust, oil, grease, soil, dust, mill scale, paint, oxides, corrosion products and foreign matter by blast cleaning.

5 Commercial Blast Cleaning (SSPC-SP6): Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 33 percent of each square inch of surface area.

6 Brush-Off Blast Cleaning (SSPC-SP7): Removal of all visible oil, grease, soil, dust, loose mill scale, loose rust, and loose paint.

7 Near-White Blast Cleaning (SSPC-SP10): Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 5 percent of each square inch of surface area.

8 Surface Preparation of Concrete (SSPC-SP13): Concrete surface shall be free of contaminants, laitance, loosely adhering concrete and dust, and should provide a sound, uniform substrate suitable for the application of protective coating or lining systems.

3.5 METAL SURFACE PREPARATION (UNGALVANIZED)

A. The minimum abrasive blasting surface preparation shall be as indicated in the coating system schedules included at the end of this Section. Where there is a conflict between these Specifications and the coating manufacturer's printed recommendations for the intended service, the higher degree of cleaning shall apply.

B. Workmanship for metal surface preparation shall be in conformance with the current SSPC Standards and this Section. Blast cleaned surfaces shall match the standard samples available from the National Association of Corrosion Engineers, NACE Standard TM-01-70 - Visual Standard for Surfaces of New Steel Airblast Cleaned with Sand Abrasive and TM-01-75 - Visual Standard for Surfaces of New Steel Centrifugally Blast Cleaned with Steel Grit.

C. All oil, grease, welding fluxes, and other surface contaminants shall be removed by solvent cleaning per SSPC-SP1 - Solvent Cleaning before blast cleaning.

D. All sharp edges shall be rounded or chamfered and all burrs, and surface defects and weld splatter shall be ground smooth before blast cleaning.

E. The type and size of abrasive shall be selected to produce a surface profile that meets the coating manufacturer's recommendation for the particular coating and service conditions. Abrasives for submerged and severe service coating systems shall be clean, hard, sharp cutting crushed slag. Automated blasting systems shall not be used for surfaces that will be in submerged service. Metal shot or grit shall not be used for surfaces that will be in submerged service, even if subsequent abrasive blasting is planned to be one with hard, sharp cutting crushed slag.

F. The abrasive shall not be reused unless an automated blasting system is used for surfaces that will be in nonsubmerged service. For automated blasting systems, clean oil-free abrasives shall be maintained. The abrasive mix shall include at least 50 percent grit.

G. Comply with the applicable federal, state, and local air pollution control regulations for blast cleaning.

H. Compressed air for air blast cleaning shall be supplied at adequate pressure from well maintained compressors equipped with oil and moisture separators which remove at least 95% of the contaminants.

I. Surfaces shall be cleaned of all dust and residual particles of the cleaning operation by dry air blast cleaning, vacuuming, or another approved method before painting.

J. Enclosed areas and other areas where dust settling is a problem shall be vacuum cleaned and wiped with a tack cloth.

K. Damaged or defective coating shall be removed by the specified blast cleaning to meet the clean surface requirements before recoating.

L. If the specified abrasive blast cleaning will damage adjacent work, the area to be cleaned is less than 100 square feet, and the coated surface will not be submerged in service, then SSPC-SP2 - Hand Tool Cleaning or SSPC-SP3 - Power Tool Cleaning, may be used.

M. Shop-applied coatings of unknown composition shall be completely removed before the indicated coatings are applied. Valves, castings, ductile or cast iron pipe, and fabricated pipe or equipment shall be examined for the presence of shop-applied temporary coatings. Temporary coatings shall be completely removed by solvent cleaning per SSPC-SP1 before the abrasive blast cleaning work has been started.

N. Shop primed equipment shall be solvent cleaned in the field before finish coats are applied.

3.6 SURFACE PREPARATION FOR GALVANIZED FERROUS METAL

A Galvanized ferrous metal shall be alkaline cleaned per SSPC-SP1 to remove oil, grease, and other contaminants detrimental to adhesion of the protective coating system to be used.

B Pretreatment coatings of surfaces shall be in accordance with the printed recommendations of the coating manufacturer.

3.7 SURFACE PREPARATION FOR CONCRETE SURFACES

A. Prepare surfaces of concrete to be painted by removing all efflorescence, chalk, dust, dirt, grease, oils, with soap and water.

B. Determine the alkalinity and moisture content of the surfaces to be painted by performing appropriate tests in accordance with SSPC-SP13. If the surfaces are found to be sufficiently alkaline to cause blistering and burning of the finish paint, correct this condition before application of paint in accordance with the coating manufacturer's recommendations. Provide suitable testing materials and carry out alkalinity and moisture tests.

C. Do not paint over surfaces where the moisture content exceeds 8%, unless otherwise permitted in the manufacturer's printed directions.

D. Surface preparation and acceptance criteria shall be in accordance with methods described in SSPC-SP13, except acid etching and flame cleaning will not be permitted.

3.8 SHOP COATING REQUIREMENTS

A. Unless otherwise indicated, all items of equipment, or parts of equipment which are not submerged or buried in service, shall be shop primed and then finish coated in the field after installation with the indicated or selected color. The methods, materials, application equipment and all other details of shop painting shall comply with this Section. If the shop primer requires topcoating within a specified period of time, the equipment shall be finish coated in the shop and then touchup painted after installation.

B. All items of equipment or parts and surfaces of equipment which are submerged or inside an enclosed hydraulic structure when in service, with the exception of pumps and valves, shall have all surface preparation and coating work performed in the field.

C. The interior surfaces of steel water reservoirs, except for Part A surfaces, shall have all surface preparation and coating work performed in the field.

D. For certain pieces of equipment it may be undesirable or impractical to apply finish coatings in the field. Such equipment may include engine generator sets, equipment such as electrical control panels, switchgear or main control boards, submerged parts of pumps, ferrous metal passages in valves, or other items where it is not possible to obtain the indicated quality in the field. Such equipment shall be primed and finish coated in the shop and touched up in the field with the identical material after installation. The DESIGN/BUILDER shall require the manufacturer of each such piece of equipment to certify as part of its shop drawings that the surface preparation is in accordance with these Specifications. The coating material data sheet shall be submitted with the shop drawings for the equipment.

3.9 APPLICATION OF COATINGS

A. The application of protective coatings to steel substrates shall be in accordance with SSPC-PA1 - Paint Application Specification No. 1.

B. Cleaned surfaces and all coats shall be inspected before each succeeding coat. Schedule such inspection with the RESIDENT ENGINEER in advance.

C. Blast cleaned ferrous metal surfaces shall be painted before any rusting or other deterioration of the surface occurs. Blast cleaning shall be limited to only those surfaces that can be coated in the same working day.

D. Coatings shall be applied in accordance with the manufacturer's instructions and recommendations, and this Section, whichever has the most stringent requirements.

E. Special attention shall be given to edges, angles, weld seams, flanges, nuts and bolts, and other places where insufficient film thicknesses are likely to be present. Use stripe painting for these areas.

F. Special attention shall be given to materials which will be joined so closely that proper surface preparation and application are not possible. Such contact surfaces shall be coated before assembly or installation.

G. Finish coats, including touch-up and damage repair coats shall be applied in a manner which will present a uniform texture and color matched appearance.

H. Coatings shall not be applied under the following conditions:

1 Temperature exceeding the manufacturer's recommended maximum and minimum allowable.

2 Dust or smoke laden atmosphere.

3 Damp or humid weather.

4 When the substrate or air temperature is less than 5 degrees F above dewpoint.

5 When air temperature is expected to drop below 40 degrees F or less than 5 degrees F above the dewpoint within 8 hours after application of coating.

6 When wind conditions are not calm.

I. Dewpoint shall be determined by use of a sling psychrometer in conjunction with U.S. Department of Commerce, Weather Bureau psychometric tables.

J. Unburied steel piping shall be abrasive blast cleaned and primed before installation.

3.10 CURING OF COATINGS

A. Maintain curing conditions in accordance with the conditions recommended by the coating material manufacturer or by this Section, whichever is the most stringent, before placing the completed coating system into service.

B. In the case of enclosed areas, forced air ventilation, using heated air if necessary, may be required until the coatings have fully cured.

3.11 SHOP AND FIELD INSPECTION AND TESTING

A. General: Furnish the RESIDENT ENGINEER a minimum of 3 days' advance notice of the start of any field surface preparation work or coating application work, and a minimum of 7 days' advance notice of the start of any shop surface preparation work.

B. All inspection, testing, and operation of inspection tools for field-applied coatings and linings shall be performed only in the presence of the RESIDENT ENGINEER, unless the RESIDENT ENGINEER has granted prior approval to perform such Work in its absence.

C. Inspection by the RESIDENT ENGINEER, or the waiver of inspection of any particular portion of the Work, shall not relieve the DESIGN/BUILDER of its responsibility to perform the Work in accordance with these Specifications.

D. For external or internal application of lining or coating materials for buried or submerged piping systems, the DESIGN/BUILDER shall supply inspection procedures for use by the RESIDENT ENGINEER. Procedures shall be supplied in advance of starting work.

E. Inspection Devices: Furnish, until final acceptance of such coatings, inspection devices in good working condition for the detection of holidays and measurement of dry-film thicknesses of protective coatings. Dry-film thickness gauges shall be made available for the RESIDENT ENGINEER's use at all times while coating is being done, until final acceptance of such coatings. Furnish the services of a trained operator of the holiday detection devices until the final acceptance of such coatings. Holiday detection devices shall be operated only in the presence of the RESIDENT ENGINEER.

F. Holiday Testing: Holiday test all coated ferrous surfaces inside a steel reservoir, other surfaces which will be submerged in water or other liquids, or surfaces which are enclosed in a vapor space in such structures and surfaces coated with any of the submerged and severe service coating systems. Areas which contain holidays shall be marked and repaired or recoated in accordance with the coating manufacturer's printed instructions and then retested. Electrical inspection for linings and coatings shall be in accordance with applicable NACE standards RPO 188 and/or RPS 274.

1 Coatings With Thickness Exceeding 20 Mils: For surfaces having a total dry film coating thickness exceeding 20 mils: pulse-type holiday detector such as Tinker & Rasor Model AP-W, D.E. Stearns Co. Model 14/20, or equal shall be used. The unit shall be adjusted to operate at the voltage required to cause a spark jump across an air gap equal to twice the specified coating thickness.

2 Coatings With Thickness of 20 Mils or Less: For surfaces having a total dry film coating thickness of 20 mils or less: Tinker & Rasor Model M1 nondestructive type holiday detector, K-D Bird Dog, or equal shall be used. The unit shall operate at less than 75 V. For thicknesses between 10 and 20 mils, a nonsudsing type wetting agent, such as Kodak Photo-Flo, or equal, shall be added to the water before wetting the detector sponge.

G. Film Thickness Testing: On ferrous metals, the dry film coating thickness shall be measured in accordance with the SSPC "Paint Application Specification No. 2" using a magnetic-type dry film thickness gauge such as Mikrotest model FM, Elcometer model 111/1EZ, or equal. Each coat shall be tested for the correct thickness. No measurements shall be made until at least 8 hours after application of the coating. On nonferrous metals and other substrates, the coating thicknesses shall be measured at the time of application using a wet film gauge.

H. Surface Preparation: Evaluation of blast cleaned surface preparation work will be based upon comparison of the blasted surfaces with the standard samples available from the NACE, using NACE standards TM-01-70 and TM-01-75.

3.12 PROTECTION

A. Protect work of other trades, whether to be painted or not, against damage by the painting and finishing Work. Leave all such work undamaged. Correct all damages by cleaning, repairing or replacing, and repainting, as acceptable to the RESIDENT ENGINEER.

B. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove all temporary protective wrappings provided for protection of this Contract and other contracts after completion of painting operations.

3.13 CLEAN-UP

A. During the progress of Work, remove from the site all discarded paint materials, rubbish, cans and rags at the end of each work day.

B. Upon completion of painting Work, clean window glass and all other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

C. At the completion of Work of other trades, touch up and restore all damaged or defaced painted surfaces as determined by the RESIDENT ENGINEER.

*** END OF SECTION ***

SECTION 09900

ARCHITECTURAL PAINT FINISHES

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide painted surfaces such as wood, drywall and plaster, complete in accordance with the Contract Documents.

B. Materials not to be painted hereunder shall include the following:

1. Work having complete factory finish other than prime coat.

2. Work painted under Section 09800 - Protective Coating

3. Surfaces whose coatings are for the specific purpose of protection from abrasion, wear and tear, or from corrosion, oxidation, decomposition, or other effects of exposure.

4. Stainless steel, aluminum brass, bronze, and plated finished metals (excluding zinc and cadmium).

5. Finish hardware except prime-coated items, and fusible links, UL labels, nameplates, numbers, and identifying data.

6. Walking surfaces.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 08710 Finish Hardware
2. Section 09800 Protective Coating

B. This section is for coatings of wood, masonry, surfaces. All other surfaces of buildings shall be coated in accordance with Section 09800 - Protective Coating.

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the Work of this Section:

1. References herein to "SSPC Specifications" or "SSPC" shall mean the published standards of SSPC: The Society for Protective Coatings, 4400 Fifth Avenue, Pittsburgh, PA 15213.

2. References herein to "NACE" shall mean the published standards of the National Association of Corrosion Engineers, P.O. Box 986, Katy, TX 77450.

3. Commercial Standards:

ANSI A13.1	Scheme for Identification of Piping Systems

4. Federal Specifications:

OSHA 1910.144 Safety Color Code for Marking Physical Hazards

5. Regulatory Agency Requirements: Coatings for surfaces in contact with raw or potable water shall impart no taste or odor to the water nor result in any organic or inorganic content in excess of the maximum contaminant level established by applicable laws or regulations including National Sanitation Foundation (NSF) Standards. All coatings shall be approved by the applicable regulatory agency. The CONTRACTOR shall revise painting systems specified herein to provide manufacturer's regulatory agency approved coating system where required. All painting systems shall be VOC compliant.

1.4 CONTRACTOR SUBMITTALS

A. General: Submittals shall be in accordance with Section 01300 - Submittals and Section 09800 - Protective Coating.

B. List of Paint Materials: Before submittal of color and gloss samples, the CONTRACTOR shall submit a complete list of all paint materials proposed for use, identifying each material by the manufacturer's name, product name, and number. The list shall include all primers, thinners, and coloring agents, together with manufacturer's catalog data fully describing each material as to contents, recommended usage, and preparation and application methods. The CONTRACTOR shall identify surfaces to receive various paint materials and make no deviations from the accepted list. The list shall be submitted within 60 days after execution of the agreement.

C. Color samples: Color samples and stain samples shall be submitted as required by the RESIDENT ENGINEER.

1. Samples of each color and paint finish shall be submitted, using the same substrate materials indicated in the Specifications or shown on the Drawings.

2. Colors, sheens and texture shall be illustrated.

3. Size of each sample shall be 8-1/2 inches by 11 inches.

4. For transparent and stained finishes, samples shall be prepared on the same species and quality of wood indicated in the Specifications or shown on the Drawings, and shall employ the same system of application as specified.

D. Extra Stock: Upon completion of the project, the CONTRACTOR shall furnish 1 gallon or quart of each type and color of paint, depending on quantity used for the Work.

1.5 QUALITY ASSURANCE

A. The CONTRACTOR shall verify with the authorities having jurisdiction over air pollution control, the use of any materials containing organic chemical compounds of which use at the date of installation may be prohibited or restricted by any regulations then in effect.

B. Materials are subject to such tests as the RESIDENT ENGINEER may direct.

C. The number of coats indicated shall be the minimum number acceptable. If full coverage is not obtained with the minimum number of coats, installer shall apply such additional coats as are necessary to produce the required finish, at no extra cost to the OWNER.

D. The installer shall employ coats and undercoats for all types of finishes in strict accordance with the recommendations of the paint manufacturer unless otherwise indicated in this Section. In case of conflict, comply with the most stringent.

E. Testing shall conform to the requirements of Section 09800 - Protective Coating.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. The paint materials shall be delivered to the job site in the manufacturer's unopened containers and a list of all batch numbers shall be furnished to the RESIDENT ENGINEER before the start of work.

B. Stored paints and liquids shall be kept covered, and precautions shall be taken for the prevention of fire. Empty containers and paint-soiled or oily rags shall be removed from the site at the end of each day's work. Paint thinner shall not be stored in a room scheduled to receive resilient flooring.

1.7 PROJECT CONDITIONS

A. Finish Coat Coordination: Finish coats shall be provided which are compatible with prime paints used. The CONTRACTOR shall thoroughly review other Sections under which prime coats are to be provided, to ensure compatibility of total coating systems for various substrates. Coordinate communication between the various trades to ensure that each has complete information on characteristics of finish materials proposed for use. Before starting painting, the installer shall notify the CONTRACTOR and the RESIDENT ENGINEER in writing of any anticipated problems in use of specified coating systems with substrates primed by others.

B. No coating shall be applied: (1) when the surrounding air temperature or the temperature of the surface to be coated is below 40 degrees F; (2) to wet or damp surfaces or in rain, fog or mist; (3) when the temperature is less than 5 degrees F above the dewpoint; or (4) when it is expected the air temperature will drop below 40 degrees F, or less than 5 degrees F above the dewpoint within 8 hours after application of coating. Dewpoint shall be measured by use of a sling psychrometer in conjunction with U.S. Department of Commerce Weather Bureau psychrometric tables.

1.8 SAFETY AND HEALTH REGULATIONS

A. General: In accordance with requirements of OSHA Safety and Health Standards for Construction (29CFR1926) and the applicable requirements of regulatory agencies having jurisdiction, as well as manufacturer's printed instructions and appropriate technical bulletins and manuals, the CONTRACTOR shall provide and require use of personnel protective lifesaving equipment for persons working in or about the project site.

B. Head and Face Protection and Respiratory Devices: Equipment shall include protective helmets which shall be worn by all persons while in the vicinity of the Work. In addition, workers engaged in or near the work during sandblasting shall wear OSHA approved eye and face protection devices and air purifying, halfmask or mouthpiece respirators. Barrier creams shall be used on any exposed areas of skin.

C. Ventilation: Where ventilation is used to control hazardous exposure, all equipment shall be explosion-proof. Forced air ventilation shall be provided to reduce the concentration of air contaminant to a safe limit. Air circulation and exhausting of solvent vapors shall be continued until coatings have fully cured.

D. Sound Levels: Whenever the occupational noise exposure exceeds maximum allowable sound levels, the CONTRACTOR shall implement furnish and require the use of approved ear protective devices.

E. Illumination: Adequate illumination shall be provided while Work is in progress, which may include explosion-proof lights and electrical equipment. Whenever required by the RESIDENT ENGINEER, the CONTRACTOR shall provide additional illumination to cover all areas to be inspected. The level of illumination for inspection purposes shall be determined by the RESIDENT ENGINEER.

F. Temporary Ladders and Scaffolding: All temporary ladders and scaffolding shall conform to applicable safety requirements. They shall be erected where requested by the RESIDENT ENGINEER to facilitate inspection and shall be moved by the CONTRACTOR to locations as requested by the RESIDENT ENGINEER.

1.9 CLEANUP

A. Upon completion of the Work, all staging, scaffolding and containers shall be removed from the site or destroyed in a manner approved by the RESIDENT ENGINEER. Coating spots and oil or stain upon adjacent surfaces shall be removed and the job site cleaned. All damage to adjacent surfaces or facilities resulting from the Work shall be cleaned, repaired or refinished to the satisfaction of the RESIDENT ENGINEER at no additional cost to the OWNER.

1.10 WARRANTY INSPECTION

A. A warranty inspection shall be conducted during the eleventh month following completion of all coating and painting work. The CONTRACTOR or its authorized representative shall attend this inspection. All defective work shall be repaired in accordance with the requirements of the Contract Documents and to the satisfaction of the OWNER or RESIDENT ENGINEER. The OWNER may, by written notice to the CONTRACTOR, reschedule the warranty inspection within the contract guarantee period, or may cancel the warranty inspection altogether.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Where alternative painting systems are indicated, selection from among those alternatives shall be the CONTRACTOR 's option.

B. Substitutions: While architectural paint finishes and related materials are specified herein through the use of proprietary names of specific manufacturers, such reference shall not be construed as intending to limit competition, but rather to establish a minimum standard for kind, quality and function.

1. Alternative finish systems of competing manufacturers shall be considered by the RESIDENT ENGINEER for acceptance as substitutions when submitted by the CONTRACTOR, in conformance with procedures and requirements established in Section 01600 - Materials and Equipment.

2. To be approved as an acceptable substitution, the CONTRACTOR's submittal must prove, to the satisfaction of the RESIDENT ENGINEER, equivalent or superior quality in components, durability, color, and quality of final appearance.

C. In proposing a substitution, the CONTRACTOR shall bear the burden of proof of equivalence in material, durability, color, quality and compatibility with related materials. Final judgment of equivalency and approval of a substitution shall be solely the prerogative of the RESIDENT ENGINEER.

D. Unless otherwise approved by the RESIDENT ENGINEER in writing, all coatings applied under a single paint system shall be the products of a single manufacturer.

2.2 FACTORY MIXING

A. To the maximum extent practicable and, unless otherwise approved by the RESIDENT ENGINEER, each paint shall be factory-mixed to the specified color, gloss, and consistency required for application.

2.3 MATERIALS LIST

A. All paint materials shall be of the following grades or brands, or equals, in each case:

PRIMERS

Symbol	Generic Group	Trade Name
P1	Masonry Prime Coat (Exterior Waterproofing)	Tamms Industries Co., "Chemstop, H.D. Rainguard products Co., "Rainguard HD"
P2	Masonry, Concrete Sealer (Graffiti Control System)	US Specialty Coatings, Monopole Elastoseal Dunn Edwards, Oxon Masonry Sealer
P3	Masonry, Prime Coat (Interior)	Dunn Edwards, Carboguard 1340 Vista 9800 Protec AE Semi-gloss
P4	Metal Prime Coat	Dunn Edwards, Carbomastic 15 Vista 9600 Protec AE Metal Primer
P5	Masonry Block Filler	Dunn Edwards, Smooth Blocfil Select SBS 100 Smooth Block filler MPI #4 Vista 040 Block Kote Acrylic Block Filler

FINISH COATS

Symbol	Generic Group	Trade Name
F1	Graffiti Control System	US Specialty Coatings, Monopole Perma Shield Dunn Edwards, Oxon Ultrashield Clear Poly-Urethane Enamel
F2	Masonry Paint	Dunn Edwards, Carboguard 890 Vista 9800 Protec 9800 AE Semi-gloss
F3	Metal Paint	Dunn Edwards Carbothane 134 VOC Vista 9800 Protec AE Semi-gloss
F4	Concrete Floor Sealer	Dunn Edwards Carboguard 1340 Vista Monopole Monochem W20

2.4 PAINTING SCHEDULE

A. All painting shall conform to the following schedule of finishes, number of coats, and pretreatment requirements. All paint materials listed are keyed to the identifying numbers listed under the Materials List herein.

INTERIOR & EXTERIOR WORK

System Number:	Substrate Material:	1st Coat:	2nd Coat:	3rd Coat:	4th Coat:
E-1	Exterior Concrete Block Masonry, Waterproofing	P1	P1	--	--
E-2	Exterior Concrete and Block Masonry, Graffiti Control System	P2	F1	F1	F1
E-3	Exterior Metal Doors, Frames, Fascia	P4	F3	F3	--
I-1	Interior Masonry	P5/P3	F2	F2	--
I-2	Interior Metal	P4	F3	F3	--
I-3	Interior Concrete	F4	F4	--	--

PART 3 -- EXECUTION

3.1 INSPECTION

A. The CONTRACTOR's applicator shall thoroughly examine all surfaces scheduled to receive architectural paint finishes, for conditions that will adversely affect execution, permanence and quality of Work.

B. Starting of application Work shall be construed as applicator's acceptance of substrates, surfaces and conditions within any particular area as appropriate to the successful execution of the Work of this Section.

3.2 GENERAL REQUIREMENTS

A. Workmanship: Unless otherwise indicated, all paint materials shall be applied by brush or roller in strict accordance with the manufacturer's printed instructions. Spray painting is not allowed without specific approval in each case. Each coat shall be applied at proper consistence, and shall be free of brush or roller marks, sags, runs or any other evidence of poor workmanship. The splattering of paint on glass, hardware, tile, trim, and other surfaces not to be painted shall be avoided. Masking tape shall be applied as required. Sand between each enamel coat.

B. Coverage Rates: In no case shall paint application exceed the paint manufacturer's published coverage rate based upon unthinned material. In the event that paint has been extended beyond the recommended coverage, or the "hide" produced is inadequate, as determined by the RESIDENT ENGINEER, apply one or more additional coats as determined by the RESIDENT ENGINEER at no additional cost to OWNER. The manufacturer's recommended amount of thinner shall not be exceeded. Unless otherwise approved, finish coat material shall be applied as taken from manufacturer's container.

C. Protection: Floors, fixtures, equipment, and similar surfaces shall be protected with impervious protective covers or drop cloths.

D. Removal of Finish Hardware: Finish hardware shall be removed prior to painting and finishing and re-installed as indicated in Section 08710 - Finish Hardware.

E. Contrasting Colors: Where painting is to be executed in contrasting colors, edges shall be cut to meet true lines. Holidays and restrikes in painted surfaces shall be sufficient cause for necessitating recoating the entire surface involved. More than one color may be used in any one room.

F. Barricades: Maintain barricades and wet paint signs for duration of period needed.

G. Scaffolds: Provide and transfer scaffolds, staging, and planking as necessary for proper performance of Work.

3.3 PREPARATION

A. General: Prepare surfaces to receive finishes as indicated.

B. Woodwork: The preparation of the surfaces of woodwork to receive paint shall conform to the following requirements:

1. Painted Surfaces shall be sanded smooth and dusted clean. Nail holes, cracks, or other defects shall be carefully puttied after prime coat using putty which matches the color of the paint. Knots and sappy areas shall be covered with shellac or accepted knot sealer.

2. Putty work shall be knifed; thumb puttying is not allowed. On painted and enameled work, exposed end grain shall be putty-glazed smooth and flush, and shall be allowed to dry before the next coat.

C. Masonry and Concrete to be Painted: Surfaces of masonry and concrete to be painted shall be dry and free of dust, dirt, grease, oil, and other foreign matter such as loose or granular material. Holes, cracks, joints and any surface defects shall be repaired and filled out flush and smooth with appropriate products, except where a priming coat may be recommended first by the manufacturer of the paint. Glaze and loose particles shall be removed by wire brushing. No evidence of curing compounds, release agents and the like will be acceptable.

D. Ferrous and galvanized metal surfaces shall be prepared in accordance with the requirements of Section 09800 - Protective Coating.

3.4 APPLICATION

A. General: Paint shall not be applied in extreme heat, nor in dust or smoke laden air, nor in damp or humid weather.

B. Drying times shall be not less than called for in manufacturer's printed instructions.

C. Drop cloths shall be placed where required to protect floors and equipment from splatter and droppings.

D. Spray painting, where allowed, shall be conducted under controlled conditions, and the CONTRACTOR shall be fully responsible for any damage to adjacent work or adjoining property occurring from spray painting.

E. Each coat will be inspected by the RESIDENT ENGINEER prior to application of the next coat. Areas found to contain runs, overspray, roughness, or other signs of improper application shall be recoated in accordance with the RESIDENT ENGINEER's instructions.

F. The CONTRACTOR shall apply complete paint system required for exposed surfaces behind permanent cabinets, cases, counters, and similar work before such items are installed.

G. Coats and Colors: Each coat shall be tinted a sufficiently different shade of finish color to permit identification, in accordance with accepted samples.

3.5 OUTLINE OF PAINTING AND FINISHING WORK

A. Exterior: In general, all exposed exterior surfaces of the building shall be painted and finished in accordance with the requirements herein. Exposed surfaces of miscellaneous metal, sheet metal items, mechanical equipment, and all other items, as required, shall be painted with the required primers and coats of paint.

B. Interior: In general, exposed surfaces of the building shall be painted and finished in accordance with the requirements herein.

1 Metal items in partitions and ceilings such as registers, grilles, and similar items shall be painted to match finish of room or area in which they occur, unless directed otherwise by the RESIDENT ENGINEER.

2 Painted doors opening into rooms or spaces having different finishes or colors shall have the edges finished as directed by the RESIDENT ENGINEER. Closet and

storage room doors shall be finished on both sides to match the room into which they open.

C. Except as noted below, mechanical and electrical products requiring painting shall conform to the requirements of Section 09800 - Protective Coating. Exposed surfaces, not factory finished, of areas behind grilles, baffles, ventilators, and louvers, that are visible from inside and outside of the building, shall be painted with appropriate primers and one coat of black semi-gloss (low sheen) enamel paint to conceal such areas and spaces when viewed from the floor and ground levels.

3.6 ADJUSTMENT AND CLEANING

A. General: Make a detailed inspection of paint finishes after painting work has been completed, and carefully remove splatterings of paint material from adjoining work of others (particularly plumbing fixtures, trim, tile, and finish metal surfaces), and make good any damage thereto that may be caused by such cleaning operations. Carefully touch-up all abraded, stained, or otherwise disfigured painting work and leave the entire painting work in first-class condition.

B. Cleanup and Disposal: During and upon completion of work, remove unused tools and equipment, surplus materials, rubbish, debris, dust and shall leave areas affected by work of this Section in clean approved condition in accordance with the requirements of Section 01700 - Contract Closeout.

3.7 TESTING

A. Testing shall be in accordance with the requirements of paragraph 3.11 of Section 09800 B Protective Coating.

3.8 EXTRA MATERIAL

A. Upon completion of the Work, and as a condition of final acceptance, the CONTRACTOR shall furnish the specified stock of maintenance painting materials to the OWNER. Maintenance painting materials shall be from the same manufacture and color-mixed lots as the materials which are installed. Maintenance materials shall be enclosed in protective packaging with appropriate identifying labels.

*** END OF SECTION ***

SECTION 10210

OUTSIDE SOUND BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Furnish and install of sound barrier wall system including:

2. Acoustical barrier wall panels.

3. Structural steel framing.

1.2 REFERENCES SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated, the current editions of the following standards apply to the work of this Section:

1. American Society for Testing and Materials (ASTM):

ASTM E90	Laboratory Measurements of Airborne Sound Transmission Loss of Building Partitions.
ASTM C423	Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
ASTM B117	Standard Practice for Operating Salt Spray (Fog) Apparatus
ADTM G23	Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials
ASTM D4214	Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D2244	Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Colored Coordinates
ASTM A924	Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM A653	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process

ASTM A123	Standard Specification for Zinc (Hot-Dipped Galvanized) Coating or Iron and Steel Products
ASTM A992	Standard Specification for Structural Steel Shapes
ASTM A36	Standard Specification for Carbon Structural Steel

1.3 DEFINITIONS

A. Sound Transmission Class (STC): Single number quantifier used to rate partitions, doors and windows for their effectiveness in blocking sound per ASTM E90.

B. Noise Reduction Coefficient (NRC): Single number quantifier used to rate materials for their effectiveness in absorbing sound per ASTM C423.

1.4 CONTRACTOR SUBMITTALS

A. General: Provide listed submittals in accordance with Section 01300 Contractor Submittals.

B. Product Data:

1. Submit manufacture's certification of compliance with this specification, standard details, certified product test results, installation instructions and general recommendations as applicable to materials and finishes for each component.

2. Prior to shop drawing preparation and fabrication of panels, field measurements shall be taken of structure and substrates to receive panel system. Incorporate measurements and show adjustments so that panels may accommodate actual site conditions. Submit detailed design calculations, construction drawings and layout of sound barrier wall construction. Calculations and drawings shall be prepared and sealed by a Professional Engineer licensed in California.

3. Detailed layout plan of the panels showing distances between support posts, angles, post construction, method of supporting the panels, and elevation view of each panel section indicating approximate finished grade.

C. Maintenance Information: The CONTRACTOR shall submit information on pumps in accordance with the requirements of Section 01730- Operations and Maintenance Information.

1.5 QUALITY ASSURANCE

A. Installer's Qualifications: Installer shall be thoroughly trained and experienced in the necessary crafts and familiar with the methods needed for proper performance of this section.

1.6 DELIVERY, STORAGE & HANDLING

A. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

B. Storage and Protection: Store and handle materials in accordance with manufacturer's recommendations. Use all means necessary to protect materials from damage before, during and after installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers shall be IAC Acoustics Noishield Barrier Wall System, or equal.

B. IAC Acoustics, 1160 Commerce Avenue, Bronx, NY 10462; Telephone: (718) 931-8000; Web site: www.iac-acoustics.com/us/.

C. Performance Requirements

1. FS/A (alum. const.) Sound Transmission Loss (dB) per ASTM E90 & Sound Transmission Class (STC) per E413:

1/3 Octave Band Center Frequency (Hz)	125	250	500	1K	2K	4K	8K	STC
Noishield FS/A (aluminum construction)	21	32	37	30	37	28	30	31

2. FS/A (aluminum construction) Sound Absorption Coefficients per ASTM C423:

1/3 Octave Band Center Frequency (Hz)	125	250	500	1K	2K	4K	8K	NRC
Noishield FS/A (aluminum construction)	1.12	1.12	1.10	1.01	0.89	0.76	0.57	1.05

D. Structural: Aluminum panels shall be designed to withstand a wind pressure of 39.7 PSF at a span of twelve (12) feet without reinforcement.

E. Corrosion Testing: Modules shall prove testing for corrosion resistance in accordance with ASTM B117. After 2,400 hours of exposure, the coating system shall not fail due to blistering, loss of adhesion or corrosion along the score lines.

F. Weather Testing: Modules shall prove testing for accelerated weathering in accordance with ASTM G23. After 2,400 hours of testing, module samples shall not exhibit chalking greater than No. 8 per ASTM D4214 or a color change greater than 5 NBS units per ASTM D2244.

2.2 COMPONENTS

A. Standard Panel Construction:

1. Individual panels shall be two feet high x five inches thick x up to twelve feet in length.

2. Panels shall be constructed of galvanized steel manufactured in accordance with ASTM A924 and ASTM A653.

3. Panel components shall meet the following structural requirements:

   a. Perforated face sheet shall be minimum 20 gauge steel.

   b. Solid face sheet shall be minimum 14 gauge steel.

   c. Solid end caps shall be minimum18 gauge steel.

B. Acoustic Fill:

1. Fiberglass, non-corrosive, resistant to attack by fungus, vermin proof and non-hygroscopic.

2. Free draining, self-supporting and shall retain physical and sound absorptive characteristics after long term exposure to the elements.

3. Class A Fire Rating with a Flame Spread not greater than 25.

C. Bearing Blocks shall be:

1. Used to support the bottom panel of the wall system

2. 1 inch thick x 2.25 inch wide x 4 inch long

3. 65 durometer EPDM, neoprene or rubber.

D. Steel columns:

1. Fabricated structural steel members to [be hot-dipped galvanized after fabrication per ASTM A123] [receive three-step epoxy paint coating].

2. Steel for wide flange shapes and built-up column members shall conform to ASTM A992. All other structural steel base plates and braces shall conform to ASTM A36.

3. Anchor Bolts: ASTM A36 galvanized.

E. Post Footing: Refer to Section 03 30 0.

2.3 FABRICATION

A. Perforated and solid sheets shall be roll-formed in lengths up to twenty (20) feet.

B. Panel shall be assembled to form a free-draining module.

C. Spot welds or mechanical fasteners shall not be acceptable to join the solid inner and perforated outer panel sheets together. Internal reinforcement shall not be acceptable.

D. Fabricate panels to be rigid, neat in appearance and free from defects.

E. Panel assembly shall such so as to compress and hold the fill materials in place under severe conditions of vibration such as encountered in shipment and installation. Any voids in the panel will be unacceptable.

F. Panel manufacturer, where required, shall provide openings for any large known penetrations. Pipe and conduit penetrations shall be located and cut in the field and sealed in accordance with manufacturer's instructions.

2.4 FINISH

A. Panels shall be finished with a factory-applied polyester powder coating system.

B. Finish coating shall have a dry film thickness of three (3) mils (+/- 0.5 mils).

C. Powder colors shall be selected from manufacturer's list of available colors.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in strict accordance with manufacturer's published instructions for specific installation conditions.

B. Install wall to provide rigid structure.

3.2 SITE TOLERANCES

A. Maximum variation from plumb: 1/4 inch.

B. Maximum Offset from True Position: 1 inch.

END OF SECTION

SECTION 10400

IDENTIFYING DEVICES

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing all signs and other identifying devices and all appurtenant work.

1.2 CODES

A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

1. California Building Code

1.3 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 01300:

1. Shop Drawings: Submit shop drawings for fabrication and erection of identification device. Include plans, elevations, and large scale details of sign wording and lettering layout. Show fasteners, mountings, anchorages and accessory items.

a. Furnish location template drawings for supported or anchored to permanent construction.

b. Style and colors of lettering shall be as selected by the RESIDENT ENGINEER from manufacturer's standards.

2. Product Data: Manufacturer's technical data and installation instructions shall be submitted for each type of sign required.

3. Samples: The CONTRACTOR shall submit to the RESIDENT ENGINEER for approval, samples of all the materials and colors he proposes to use on the WORK. The samples shall be clearly marked to show the manufacturer's name and product identification. Accepted sample units may be installed as part of the WORK, with the RESIDENT ENGINEER'S permission.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Wording on all identification devices shall be as per schedule.

B. Uniformity of Manufacturer: The CONTRACTOR shall furnish products of a single manufacturer for each sign type and graphic image process indicated.

2.2 NAMEPLATES

A. Nameplates shall be of colored 1/8-inch acrylic plastic plates with matte finish. Lettering shall be white, 1/2-inch high and fused by heat and pressure to a depth of approximately 0.005-inch. Plates shall be installed in an extruded aluminum frame, medium bronze or dark anodized finish, and plate color and letter style shall be as selected by the RESIDENT ENGINEER.

B. Nameplate schedule shall be as indicated on drawings.

2.3 SIGNS

A. General: Signs or warnings shall be painted. Paint materials shall be baked enamel on aluminum.

1. Signs shall conform to OSHA Standards and directions. Locations, sizes, and colors shall be as reviewed by the RESIDENT ENGINEER.

2. The lettering sizes shall be 3-inch in height unless shown or specified otherwise.

3. Each sign shall be in both English and Spanish as defined below.

B. Doors: The following sign shall be painted on doors as indicated on drawings:

EXIT SALIDA

2.4 METAL LETTERS AND NUMBERS

A. Metal letters and numbers shall be provided in compliance with the requirements indicated for the manufacturing process, materials, finish, style, size and message content.

B. Letters and numbers shall be formed by casting aluminum to produce characters with smooth, flat faces, sharp corners, precisely-formed lines and profiles, free from pits, scale, sand holes, or other defects. Cast lugs into the back of the characters and tap to receive threaded mounting studs.

C. Baked Enamel Finish: Finish shall be AA-M4xC12C42R1x, manufacturer's standard non-directional mechanical finish including sanding and filing, cleaning with inhibited chemicals, conversion coating with an acid-chromate-fluoride-phosphate treatment and painting with manufacturer's standard organic thermosetting enamel system consisting of a prime coat and a finish coat.

2.5 MISCELLANEOUS LETTERS AND NUMBERS

A. Plastic: Plastic letters shall be Helvetica Medium lower case cut from 1/4-inch thick acrylic plastic, size as indicated, finished with auto paint coating of color selected by the RESIDENT ENGINEER.

B. Wording: The lettering shall read as indicated. Number shall be verified before ordering.

2.6 MANUFACTURERS

A. Products shall be of the following manufacture and type (or equal):

1. Nameplates:

Builders Brass Works, "460 Series"
Desk and Door Nameplate Co., "Elite Sign System"
Vomar Products, Inc., "ES100 Series"

2. Metal letters:

A.R.K. Ramos
James H. Matthews and Co.
Metal Arts

PART 3 -- EXECUTION

3.1 GENERAL

A. Identifying devices shall be installed where directed by the RESIDENT ENGINEER.

B. All installations of identifying devices shall be vandal-resistant. Fasteners shall be concealed, non-corrosive fasteners appropriate for materials being fastened and as required.

C. Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.

D. Install sign units level, plumb and at the height indicated, with sign surfaces free from distortion or other defects in appearance.

3.2 METAL LETTERS AND NUMBERS

A. Metal letters and numbers shall be mounted using standard fastening methods recommended by the manufacturer for the letter form, type of mounting, wall construction and condition of exposure indicated. Provide heavy paper template to establish letter spacing and to locate holes for fasteners.

1. Flush Mounting: Letters shall be mounted with backs in contact with the wall surface.

*** END OF SECTION ***

SECTION 10520

FIRE EXTINGUISHERS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide material and installation of fire extinguishers in accordance with the Contract Documents.

B. The WORK of this Section includes providing fire protection equipment, cabinets, and appurtenant work, complete.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 04232 Reinforced Concrete Block Masonry

1.3 CODES

A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

1. California Building Code
2. California Fire Code

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

1. Trade Standards:

National Fire Protection Association, Standard No. 10, "Portable Fire Extinguishers"

Underwriter's Laboratory, Fire Protection Equipment List

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 01300:

1. Manufacturer's catalogue containing technical data, installation instructions, and details

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials: Fire extinguishers and appurtenant materials shall be delivered in original unbroken packages or containers, bearing the manufacturer's label with manufacturer's name, product description, and rating.

B. Storage: All materials shall be carefully stored in an area which is protected from deleterious elements as recommended by the material manufacturer. Storage shall be in a manner that will prevent damage to the material and its finish.

PART 2 -- PRODUCTS

2.1 GENERAL

A. All fire protection equipment shall be from the same manufacturer and shall meet the requirements of NFPA Standard No. 10, "Portable Fire Extinguishers"

2.2 FIRE EXTINGUISHERS

A. Extinguisher shall be 14 lb minimum capacity, CleanGuard 14 Model CA-1481 with minimum UL rating of 2-A:10-B:C, in enameled seamless steel container, for Class A, Class B, and Class C fires.

2.3 BRACKETS AND OTHER MATERIALS

A. Mounting brackets shall be specially designed for extinguishers.

B. All other materials, not specifically described, but required for a complete and proper installation of fire fighting devices shall be as selected by the DESIGN/BUILDER.

2.4 MANUFACTURERS

A. Fire protection equipment shall be manufactured by one of the following (or equal):

1. General Fire Extinguisher Corp.
2. J.L. Industries
3. Potter-Roemer
4. Standard Fire Equipment (Division of Zurn Co.)
5. Walter Kidde and Co.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Brackets: All fire extinguishers shall be provided with and installed on brackets or brackets within cabinets. Block and reinforce the wall area as necessary to support the fire extinguishers.

B. Locations: Fire protection equipment locations shall be verified with the RESIDENT ENGINEER and Fire Marshal before installation and shall be installed, where directed, per NFPA Standard No. 10, "Portable Fire Extinguishers."

*** END OF SECTION ***

SECTION 11000

EQUIPMENT GENERAL PROVISIONS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide all tools, supplies, materials, equipment, and all labor necessary for the furnishing, construction, installation, testing, and operation of all equipment and appurtenant Work, complete and operable, in accordance with the Contract Documents.

B. The provisions of this Section shall apply to all equipment specified and where referred to, except where otherwise indicated.

C. This faciltiy is classified as an essential facility.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 05500 Miscellaneous Metals
2. Section 09800 Protective Coating
3. Section 11033 Variable Frequency Drives
4. Section 11175 Pumps, General
5. Section 13334 Pressure Measuring Systems
6. Section 15000 Piping Components
7. Section 15020 Pipe Supports
8. Section 15050 Vibration Isolation
9. Section 16040 Electric Motors
10. Section 16050 Basic Electrical Materials and Methods
11. Section 16480 Motor Control Center

1.3 REFERENCE SPECIFICATIONS AND STANDARDS

A. Commercial Standards: All equipment, products, and their installation shall be in accordance with the following standards, as applicable, and as indicated in each Section:

1. American Society for Testing and Materials (ASTM)

2. American Public Health Association (APHA)

3. American National Standards Institute (ANSI)

4. American Society of Mechanical Engineers (ASME)

5. American Water Works Association (AWWA)

6. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)

7. American Welding Society (AWS)

8. American Gear Manufacturers Association (AGMA)

9. American Iron and Steel Institute (AISI)

10. National Fire Protection Association (NFPA)

11. Federal Specifications (FS)

12. National Electrical Manufacturers Association (NEMA)

13. Antifriction Bearing Manufacturers Association (AFBMA)

14. Mechanical Power Transmission Association (MPTA)

15. Rubber Manufacturers Association (RMA)

16. Sheet Metal and Air Conditioning CONTRACTOR's National Association (SMACNA)

17. Hydraulic Institute Standards (HYI)

18. Institute of Electrical and Electronic Engineers (IEEE)

19. Instrument Society of America (ISA)

20. Manufacturer's published recommendations and specifications

21. General Industry Safety Orders (CAL OSHA)

B. The following standards have been referred to in this Section:

1.	ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250, and 800
2.	ANSI B16.5	Pipe Flanges and Flanged Fittings, NPS 2 through NPS 24
3.	ANSI B46.1	Surface Texture (Surface Roughness, Waviness, and Lay)
4.	ANSI S12.6	Methods for Measuring the Real-Ear Attenuation of Hearing Protectors
5.	ANSI/ASME B1.20.1	General Purpose Pipe Threads (Inch)

6.	ANSI/ASME B31.1	Power Piping
7.	ANSI/AWWA D100	Welded Steel Tanks for Water Storage
8.	AWWA C206	Field Welding of Steel Water Pipe
9.	ASTM A 48	Specification for Gray Iron Castings
10.	ASTM A 108	Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality

1.4 CODES

A. The Work of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

1. Uniform Mechanical Code
2. Uniform Plumbing Code
3. Uniform Fire Code
4. National Electrical Code
5. Uniform Building Code

1.5 CONTRACTOR SUBMITTALS

A. Shop Drawings: The CONTRACTOR shall furnish complete shop drawings for all equipment specified in other Sections, together with all materials, fabrication, assembly, foundation, and installation drawings in accordance with Section 01300 - Submittals.

B. Tools: The CONTRACTOR shall obtain from the manufacturer a list of special wrenches and other special tools necessary for the assembly, adjustment, and dismantling of the equipment. All tools shall be of best quality hardened steel forgings with bright finish. Wrench heads shall have work faces dressed to fit nuts. All tools shall be suitable for professional work and manufactured by a recognized supplier of professional tools such as Snap On, Crescent, Stanley, or equal. After approval, CONTRACTOR shall furnish such tools neatly mounted in a labeled tool box of suitable design provided with a hinged cover.

C. Spare Parts: In accordance with Section 01750 - Spare Parts and Maintenance Materials, the CONTRACTOR shall obtain from the manufacturer and submit to the RESIDENT ENGINEER a list of suggested spare parts for each piece of equipment. After approval, the CONTRACTOR shall furnish such spare parts suitably packaged, identified with the equipment number, and labeled. CONTRACTOR shall also furnish the name, address, and telephone number of the nearest distributor for each piece of equipment. All spare parts are intended for use by the OWNER, only, after expiration of the correction period.

D. Operation and Maintenance Information: The CONTRACTOR shall submit operations and maintenance information for each piece of equipment. The following shall be included in compliance with Section 01300 - Submittals:

1. Manufacturer's catalog including installation instructions.

2. Manufacturer's operating and maintenance procedures including lubricating instructions.

3. Manufacturer's certification that products comply with the indicated requirements.

4. Certification that products have been factory-tested.

5. Certification that the equipment has been field-tested and the equipment complies with the indicated requirements.

6. Equipment tolerances and required clearances.

7. Electrical data including control and wiring diagrams.

8. Warranty information, address and telephone number of local service representative.

E. Torsional Analysis:

1. The CONTRACTOR shall submit to the RESIDENT ENGINEER a torsional and lateral vibration analysis of the following equipment, in accordance with Section 01300 - Submittals. The analysis has to be performed by a State of California Registered Professional Mechanical Engineer experienced in this type of Work and approved by the RESIDENT ENGINEER.

   a. All engine drives.
   b. All blowers and compressors with drives of 100 horsepower and over.
   c. All vertical pumps with universal joints and extended shafts.
   d. All synchronous motor driven trains.
   e. All electric motor with variable frequency drive (VFD) trains.
   f. All other equipment where indicated.

2. Excitation of the following frequencies shall be evaluated:

a.	Train with gear	1 and 2 x RPM of either shaft
b.	Engine drive	n x RPM
c.	Synchronous motor	n x slip frequency, 1 and 2 x line frequency
d.	VFD	n x RPM, 1 and 2 line frequency

where:

RPM = Rotor speed
N = an integer determined by the drive manufacturer
- for engines: derived from the number of power strokes per revolution
- for motors: derived from the number of poles

Note: The excitation frequencies for motor drives shall include transient and steady state conditions.

F. The undamped torsional natural frequencies of the complete train shall be at least 10 percent above or 10 percent below any possible (steady state) excitation frequency within the specified operating speed range (from minimum to maximum continuous speed). The manufacturer shall furnish a detailed report of the analysis including the following:

1. A description of the method used to calculate the natural frequencies.

2. A diagram of the mass elastic system.

3. A table of the mass moment and torsional stiffness of each element of the mass elastic system.

4. A Campbell diagram.

5. A mode shape diagram with peak stresses shown for each resonant frequency.

G. Vibration Analysis: In his bid price the CONTRACTOR shall include at least two site visits of a vibration specialist, during construction and testing of the equipment, to analyze and measure the amount of equipment vibration and make his written recommendation for keeping the vibration at a safe limit.

H. Earthquake Design and Restraint:

1. All manufactured equipment supplied under this contract shall be designed, constructed and attached to resist stresses produced by seismic forces specified in this Section. Equipment that does not vibrate during normal operation shall be rigidly attached. Equipment that vibrates during normal operation shall be attached by means of isolators with mechanical stops that limit movement in all directions, unless it can be demonstrated by calculations that such stops are not required.
2. Equipment or portions of equipment that move during normal operation shall be restrained with mechanical devices that prevent displacement unless it can be demonstrated by calculations that such restraints are not required.

3. Work Included. The requirements specified in this Article apply to all machinery, mechanical and electrical equipment, instrumentation panels, and electrical panels, including but not limited to:

   a. All pumps.
   b. All compressors.
   c. All tanks.
   d. Engine generators.
   e. Heat exchangers.
   f. Water treatment systems
   g. HVAC equipment.
   h. Engine cooling equipment.
   i. All electrical equipment and panels, including battery racks
   j. All instrumentation panels.

4. Minimum Earthquake Forces. Except as provided herein, the minimum design earthquake forces shall be those prescribed for Essential Facilities by the latest edition of the Uniform Building Code as published by the International Conference of Building Officials, 5360 South Workman Mill Road, Whittier, California, 90601.

5. Submit shop drawings, details and data required in this Section.

6. Installation Certificate Report in accordance with Subsection 11100-3.8B.

1.6 QUALITY ASSURANCE

A. Inspection, Startup, and Field Adjustment: The CONTRACTOR shall demonstrate that all equipment meets the specified performance requirements. CONTRACTOR shall provide the services of an experienced, competent, and authorized service representative of the manufacturer of each item of major equipment who shall visit the site to perform the following tasks:

1. Assist the CONTRACTOR in the installation of the equipment.

2. To inspect, check, adjust if necessary and approve the equipment installation.

3. To start-up and field-test the equipment for proper operation, efficiency, and capacity.

4. To perform necessary field adjustments during the test period until the equipment installation and operation are satisfactory to the RESIDENT ENGINEER.
5. To instruct the OWNER's personnel in the operation and maintenance of the equipment. Instruction shall include step-by-step trouble shooting procedures with all necessary test equipment.

B. Costs: The costs of all inspection, startup, testing, adjustment, and instruction Work performed by said factory-trained representatives shall be borne by the CONTRACTOR. The OWNER will pay for costs of power and water. When available, the OWNER'S operating personnel will provide assistance in the field testing.

C. Public Inspection: It shall be the responsibility of the CONTRACTOR to inform the local authorities, such as building and plumbing inspectors, Fire Marshall, OSHA inspectors, and others, to witness all required tests for piping, plumbing, fire protection systems, pressure vessels, and safety systems to obtain all required permits and certificates, and pay all fees.

D. Tolerances: Tolerances and clearances shall be as shown on the shop drawings and shall be closely adhered to. Machine Work shall in all cases be of high-grade workmanship and finish, with due consideration to the special nature or function of the parts. Members without milled ends and which are to be framed to other steel parts of the structure may have a variation in the detailed length of not greater than 1/16-inch for members 30 feet or less in length, and not greater than 1/8-inch for members over 30 feet in length.

E. Machine Finish: The type of finish shall be the most suitable for the application and shall be shown in micro-inches in accordance with ANSI B46.1. The following finishes shall be used:

1. Surface roughness not greater than 63 micro-inches shall be required for all surfaces in sliding contact.

2. Surface roughness not greater than 250 micro-inches shall be required for surfaces in contact where a tight joint is not required.

3. Surface roughness not greater than 500 micro-inches shall be required for other machined surfaces.

4. Contact surfaces of shafts and stems which pass through stuffing boxes and contact surfaces of bearings shall be finished to not greater than 32 micro-inches.

F. Manufacturer's Experience: Unless otherwise directed by the RESIDENT ENGINEER, all equipment furnished shall have a record of at least 5 years of successful, trouble free operation in similar applications, from the same manufacturer.

G. Warranty: Unless otherwise specified, all equipment shall have a minimum of one year full parts and service warranty.

1.7 UNIT RESPONSIBILITY:

A. The Contractor shall cause equipment assemblies made up of two or more components to be provided as a working unit by the unit responsibility manufacturer, where specified. The unit responsibility manufacturer shall coordinate selection, coordinate design, and shall provide all mechanical equipment assembly components such that all equipment components furnished under the specification for the equipment assembly, and all equipment components specified elsewhere but referenced in the equipment assembly specification, is compatible and operates reliably and properly to achieve the specified performance requirements. Unless otherwise specified, the unit responsibility manufacturer shall be the manufacturer of the driven component equipment in the equipment assembly. The unit responsibility manufacturer is designated in the individual equipment specifications found elsewhere in this project manual. Agents, representatives or other entities that are not a direct division of the driven equipment manufacturing corporation shall not be accepted as a substitute for the driven equipment manufacturer in meeting this requirement. The requirement for unit responsibility shall in no way relieve the Contractor of his responsibility to the Owner for performance of all systems.

B. The Contractor shall ensure that all equipment assemblies provided for the project are products for which unit responsibility has been accepted by the unit responsibility manufacturer(s), where specified. Unit responsibility for related components in a mechanical equipment assembly does not require or obligate the unit responsibility manufacturer to warranty the workmanship or quality of component products not manufactured by them. Where an individual specification requires the Contractor to furnish a certificate from a unit responsibility manufacturer, such certificate shall conform to the content, form and style of Form 11000-C specified in Section 01999, shall be signed by an officer of the unit responsibility manufacturer's corporation and shall be notarized. No other submittal material will be processed until a Certificate of Unit Responsibility has been received and has been

found to be satisfactory. Failure to provide acceptable proof that the unit responsibility requirement has been satisfied will result in withholding approval of progress payments for the subject equipment *even though the equipment may have been installed in the work.*

PART 2 -- PRODUCTS

2.1 GENERAL REQUIREMENTS

A. General: Only products meeting the indicated requirements shall be provided.

B. Essential Facility: The pumping station and auxilliary equipment is classified as an Essential Facility per UBC and only equipment certified for use in this classification shall be provided.

B. Manufacturers: Products shall be new, of current manufacture, and shall be the products of reputable manufacturers specializing in the manufacture of such products.

C. Products: Materials shall be suitable for the intended purpose and free of defects and shall be recommended by the manufacturer for the application indicated.

D. High Noise Level Locations: The CONTRACTOR shall provide one personal hearing protection station, as indicated herein, at each high noise level location. Said locations are defined as follows:

1. Outdoor Location: Any single equipment item or any group of equipment items that produce noise exceeding OSHA noise level requirements for a 2-hour exposure. Where such equipment is separated by a distance of more than 20-feet, measured between edges of footings, each group of equipment shall be provided with a separate hearing protection station.

2. Indoor Location:

   a. Any single equipment item, or any group of equipment items, located within a single room not normally occupied, that produces noise exceeding OSHA noise level requirements for a 2-hour exposure.

   b. Any single equipment item, or any group of equipment items, located within a single room normally occupied by workers, that produces noise exceeding OSHA noise level requirements for an 8-hour exposure.

3. Personal Hearing Protection Station: At each station, the CONTRACTOR shall supply, in their original unopened packaging, three pairs of high attenuation hearing protectors. The ear protectors shall be capable of meeting the requirements of ANSI S12.6 and shall produce a noise level reduction of 25-dBA at a frequency of 500-Hz. The hearing protectors shall have fluid filled ear cushions and an adjustable, padded headband. The protectors shall be stored in a weatherproof, labeled, steel cabinet, furnished by the CONTRACTOR and mounted in an approved location near the noise protection station.

E. Service Factors: Service factors shall be applied in the selection or design of mechanical power transmission components. Unless otherwise calculated, the minimum service factor shall be 1.25. Unless otherwise indicated, the following load classifications shall apply in calculating service factors:

Type of Equipment	Load Classification
Blower:	
Centrifugal or vane	Uniform
Lobe	Moderate Shock
Reciprocating Air Compressor:	
Multi-Cylinder	Moderate Shock
Single-Cylinder	Heavy Shock
Pump:	
Centrifugal or Rotary	Uniform
Reciprocating	Moderate Shock
Mixer:	
Constant Density	Uniform
Variable Density	Moderate Shock
Fan/Blower	Moderate Shock
Crane or Hoist	Moderate Shock

F. For service factors of electric motors, see Section 16040 - Electric Motors. Where load classifications are not indicated, best modern practice shall be used.

G. Welding: Unless otherwise indicated, all welding shall conform to the following:

1. Latest revision of ANSI/AWWA D100.

2. Latest revision of AWWA C206.

3. All composite fabricated steel assemblies which are to be erected or installed inside a hydraulic structure, including any fixed or movable structural components of mechanical equipment, shall have continuous seal welds to prevent entrance of air or moisture.

4. All welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards governing same.

5. In assembly and during welding, the component parts shall be adequately clamped, supported, and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as specified by the AWS code. Upon completion of welding, all weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions. All sharp corners of material which is to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

H. Protective Coating: All equipment shall be painted or coated in accordance with Section 09800 - Protective Coating, unless otherwise indicated. Nonferrous metal and corrosion-resisting steel surfaces shall be coated with grease or lubricating oil. Coated surfaces shall be protected from abrasion or other damage during handling, testing, storing, assembly, and shipping.

I. Protection of Equipment: All equipment shall be boxed, crated, or otherwise protected from damage and moisture during shipment, handling, and storage. All equipment shall be protected from exposure to corrosive fumes and shall be kept thoroughly dry at all times. Fans, blowers, pumps, motors, drives, electrical equipment, and other equipment having anti-friction or sleeve bearings shall be stored in weathertight storage facilities before installation. For extended storage periods, plastic equipment wrappers should be avoided, to prevent accumulation of condensate in gears and bearings.

J. Identification of Equipment Items: Each item of equipment shipped shall have a legible identifying mark corresponding to the equipment number indicated for the particular item.

K. Vibration Level: All reciprocating equipment shall be provided with restrained spring-type vibration isolators or pads per manufacturer's written recommendations.

L. Shop Fabrication: Shop fabrication shall be performed in accordance with the Contract Documents and the approved shop drawings.

2.2 EQUIPMENT SUPPORTS AND FOUNDATIONS

A. Equipment Supports: All equipment supports, anchors, and restrainers shall be adequately designed for static, dynamic, wind, and seismic loads. The design horizontal seismic force shall be the greater of: that noted in the general structural notes or as required by the governing building code, or 10 percent of gravity. Submitted design calculations for equipment supports must bear the signature and seal of an engineer registered in California.

B. Provide a heavy cast-iron or welded steel base shall be provided for each item of equipment which is to be installed on a concrete foundation.

1. Mount equipment assemblies, unless otherwise specified, or shown on the Drawings on a single, heavy-cast-iron or welded steel bedplate.

2. Provide bases and bedplates with machined support pads, tapered dowels for alignment of mating, or adjacent items, adequate openings to facilitate grouting, and openings for electrical conduits.

3. All seams and contact edges between steel plates and shapes shall be continuously welded and ground smooth.
4. The plates shall have a minimum thickness of 3-inch.

5. Include a drip lip and provision for directing accumulated gland leakage to a single disposal drain point.

C. Pipe all accumulated gland and seal water leakage and spent cooling water to a floor drain provided by CONTRACTOR adjacent to each piece of equipment.

1. A single floor drain may be provided for more than one piece of equipment provided the equipment drain line does not create a safety or tripping hazard.

2. If drain piping creates a hazard, provide an additional floor drain adjacent to the equipment at no additional cost to the OWNER.

D. Equipment Foundations: Equipment foundations shall be as per manufacturer's written recommendations. All mechanical equipment, tanks, and control cabinets shall be mounted on concrete bases as shown on standard structural details.

E. Shop Drawings:

1. Shop drawings shall be submitted to the RESIDENT ENGINEER for review in accordance with the requirements of Section 01300 - Submittals.

2. Shop drawings will be considered incomplete unless clear, concise calculations are presented showing equipment anchorage forces and the capacities of the anchorage elements provided by the CONTRACTOR.

2.3 PIPE HANGERS, SUPPORTS, AND GUIDES

A. All pipe connections to equipment shall be supported, anchored, and guided to avoid stresses and loads on equipment flanges and equipment. Supports and hangers shall be in accordance with the requirements of Section 15020 - Pipe Supports.

2.4 FLANGES AND PIPE THREADS

A. All flanges on equipment and appurtenances provided under this Section shall conform to ANSI B16.1, Class 125; or B16.5, Class 150, unless otherwise indicated. All pipe threads shall be in accordance with ANSI/ASME B1.20.1, and with requirements of Section 15000 - Piping Components.

2.5 BOLTS AND FASTENERS FOR PIPING

A. Bolts and pipe fasteners for exposed ferrous piping shall conform with Section 15000 - Piping Components. Concrete anchor bolts shall conform to Section 05220 - Concrete Bolts.

2.6 FLEXIBLE COUPLINGS

A. Flexible element couplings shall be provided between the driver and the driven equipment to accommodate slight angular misalignment, parallel misalignment, end float, and to cushion shock loads. Where required for vertical shafts driven by solid shaft drivers, the coupling shall be a spacer type. The spacer shall be of sufficient length to permit seal replacement without removal of the driver.

B. The CONTRACTOR shall have the equipment manufacturer select or recommend the size and type of coupling required to suit each specific application.

C. Couplings shall be keyed to the shaft. Keys, keyways, and fits shall conform to ISO/R773. Flexible couplings with cylindrical bores shall have interference fits as specified in ISO/R286. Coupling hubs shall be furnished with tapped puller holes.

D. Where universal type couplings are specified, they shall be of the needle bearing type construction, equipped with commercial type grease fittings.

E. Jacking Screws and Anchor Bolts

1. Provide jacking screws in the equipment bases and bedplates to aid in leveling before grouting.

2. Equipment suppliers shall furnish anchor bolts, nuts, washers and sleeves of adequate design as required for proper anchorage of the bases and bedplates to the concrete bases.

a. Sleeves shall be a minimum of 12 times the diameter of the anchor bolts.

b. Unless otherwise shown or specified, anchor bolts for items of equipment mounted on baseplates shall be long enough to permit 1-inch of grout beneath the baseplate and to provide adequate anchorage into structural concrete.

c. Anchor bolts, together with templates or setting drawings, shall be delivered sufficiently early to permit setting the anchor bolts when the structural concrete is placed.

d. Anchor bolts shall be 316 stainless steel for all equipment except for pumps which will be Type 416 stainless steel which conform to ASTM A167 and ASTM A276.

F. Anchoring of Pump Cans: Anchoring shall be as indicated on the drawings and further specified in Section 11175 - Pumps, General and Section 11214 – Vertical Turbine pumps..

2.7 ELECTRIC MOTOR DRIVES

A. All electric motors supplied under this Contract shall conform to all requirements specified in Section 16040 - Electric Motors. Additional or superseding requisites for certain motors may be found in Divisions 11, 14, 15, and 16 wherein electric motor driven equipment is specified.

B. CONTRACTOR must coordinate the work of all trades and the national safety code requirements for each installation in order to comply with these specifications.

2.8 SHAFTING

A. General: All shafting up to ten feet in length shall be continuous between bearings and shall be sized to transmit the power required. Keyways shall be accurately cut in line. Shafting shall not be turned down at the ends to accommodate bearings or sprockets whose bore is less than the diameter of the shaft. All shafts shall rotate in the end bearings and shall be turned and polished, straight, and true.

B. Materials: Shafting materials shall be appropriate for the type of service and torque transmitted. Environmental elements such as corrosive gases, moisture, and fluids shall be taken into consideration. Materials shall be as indicated unless furnished as part of an equipment assembly.

1 Cold-rolled steel shafting shall conform to AISI 4140 (A434 CL BB).

2 Corrosion-resistant shafting shall be AISI grade Type 316 stainless steel or Monel, whichever is most suitable for the intended service.

C. Differential Settlement: Where differential settlement between the driver and the driven equipment may be expected, a shaft of sufficient length with two sets of universal type couplings shall be provided.

2.9 BEARINGS

A. General Rotating Element Type: Bearings shall conform to the standards of the Anti-Friction Bearing Manufacturers Association, Inc. (AFBMA).

B. To assure satisfactory bearing application, fitting practice, mounting, lubrication, sealing, static rating, housing strength, and other important factors shall be considered in bearing selection.

C. All re-lubricatable type bearings shall be equipped with a hydraulic grease fitting in an accessible location and shall have sufficient grease capacity in the bearing chamber.

D. All lubricated-for-life bearings shall be factory-lubricated with the manufacturer's recommended grease to insure maximum bearing life and best performance.

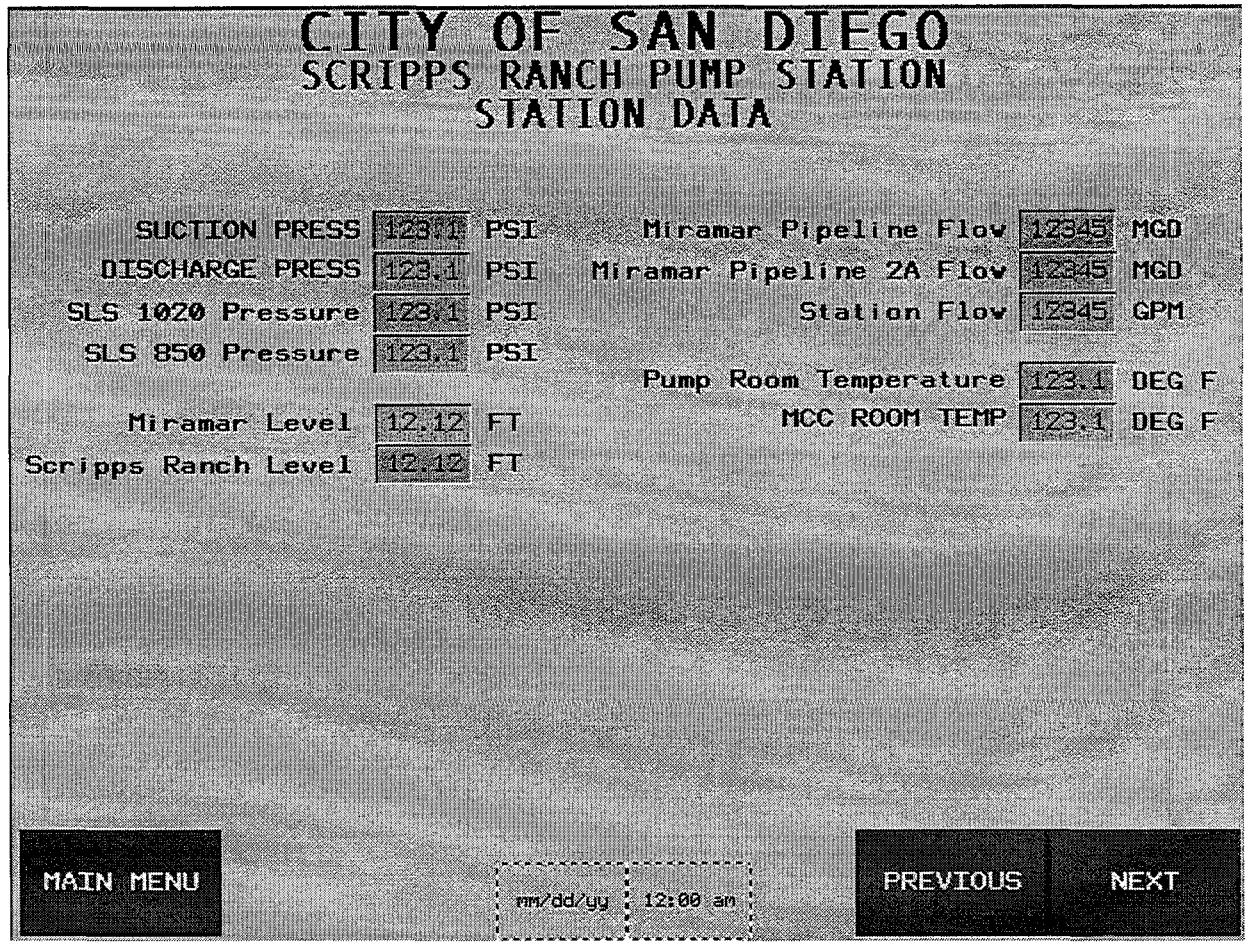
E. Bearing Life: Except where otherwise indicated, all bearings shall have a minimum L-10 life expectancy of 10 years or 100,000 hours, whichever occurs first.

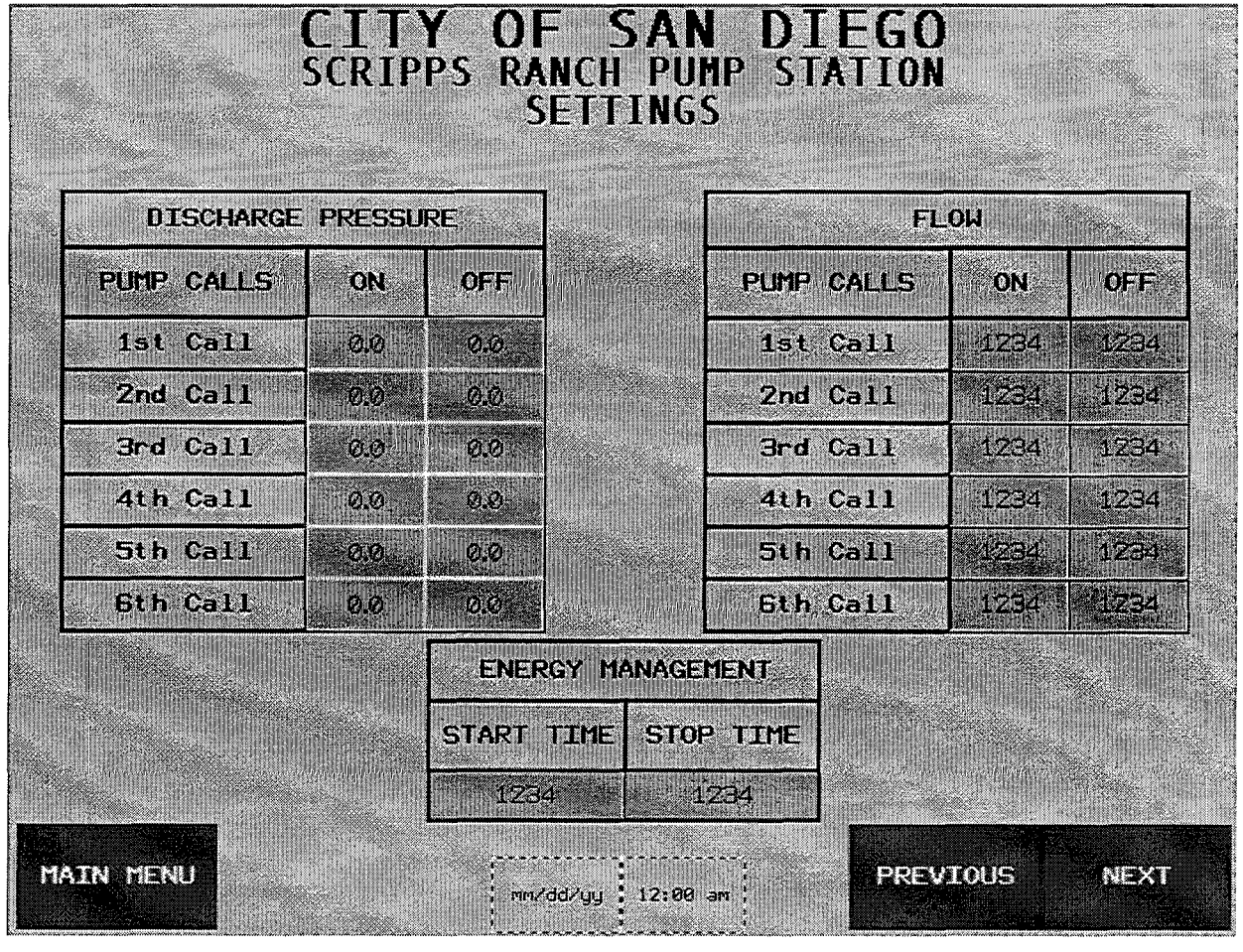
F. Bearing housings shall be of cast iron, ductile iron, or steel and bearing mounting arrangement shall be as indicated, or as recommended in the published standards of the manufacturer if not indicated. Split-type housings may be used to facilitate installation, inspection, and disassembly.

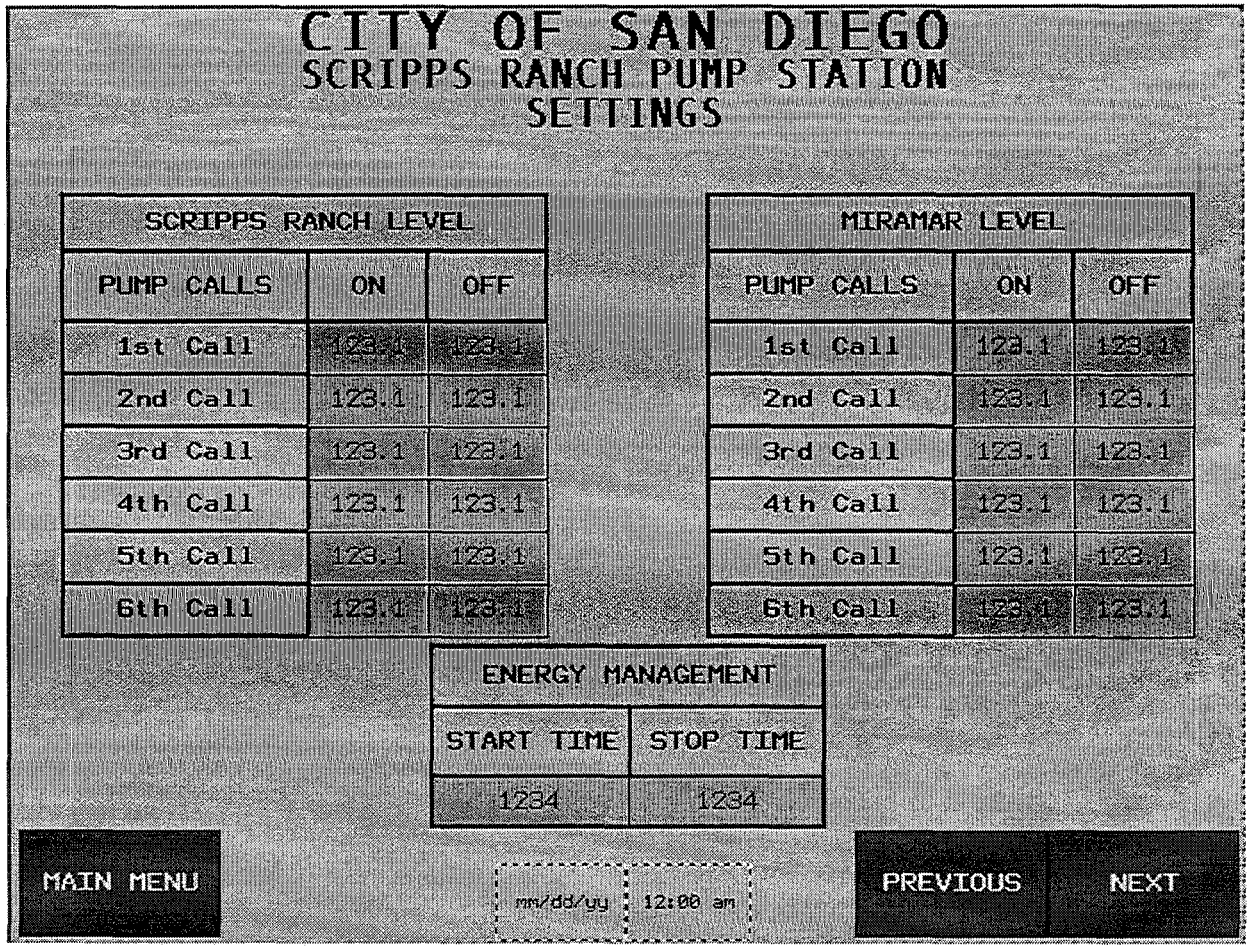
G. Sleeve-type bearings shall have a Babbitt or bronze liner.

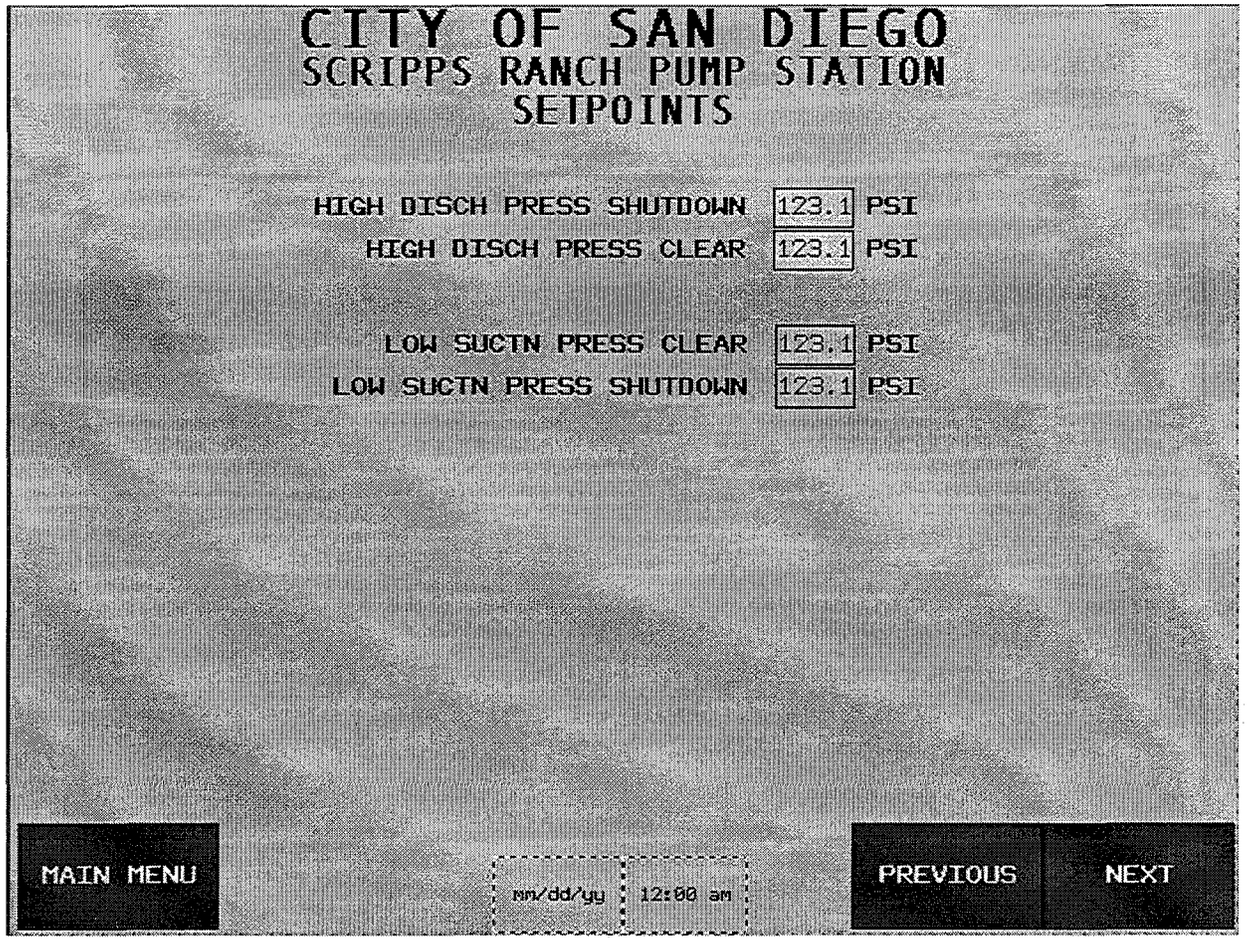
Tag #	Loop #	Description	P&ID	Spec	Instrument/ Calibrated Range	Process Range	Setpoint	Units	Notes
LSL	600	P-302 Level Switch Low (Stop)	I-9	13325			9	inch	Float Switch, Meter Vault sump
LSH	600	P-302 Level Switch High (Start-Lead)	I-9	13325			24	inch	Float Switch, Meter Vault sump
LSHH	600	P-302 Level Switch High High (Start-Lag, Alarm)	I-9	13325			30	inch	Float Switch, Meter Vault sump
FIT	124	Zone 752 Flow Transmitter	I-9	13314	0-6000	200-4500		Gpm	
FIT	224	Zone 900 Flow Transmitter	I-9	13314	0-3000	125-2500		Gpm	
TIT	510	Pump Room Temperature Transmitter	I-10	13344	0-135	0-135		°F	
TIT	511	MCC Room Temperature Transmitter	I-10	13344	0-135	0-135		°F	
LSH	09A	Pump Room Flood Switch (trench level)	I-10	13325			6 AFF	inch	Cap Switch
LSH	09B	Pump Room Flood Switch (pump room level)	I-10	13325			1"AFF	inch	Cap Switch

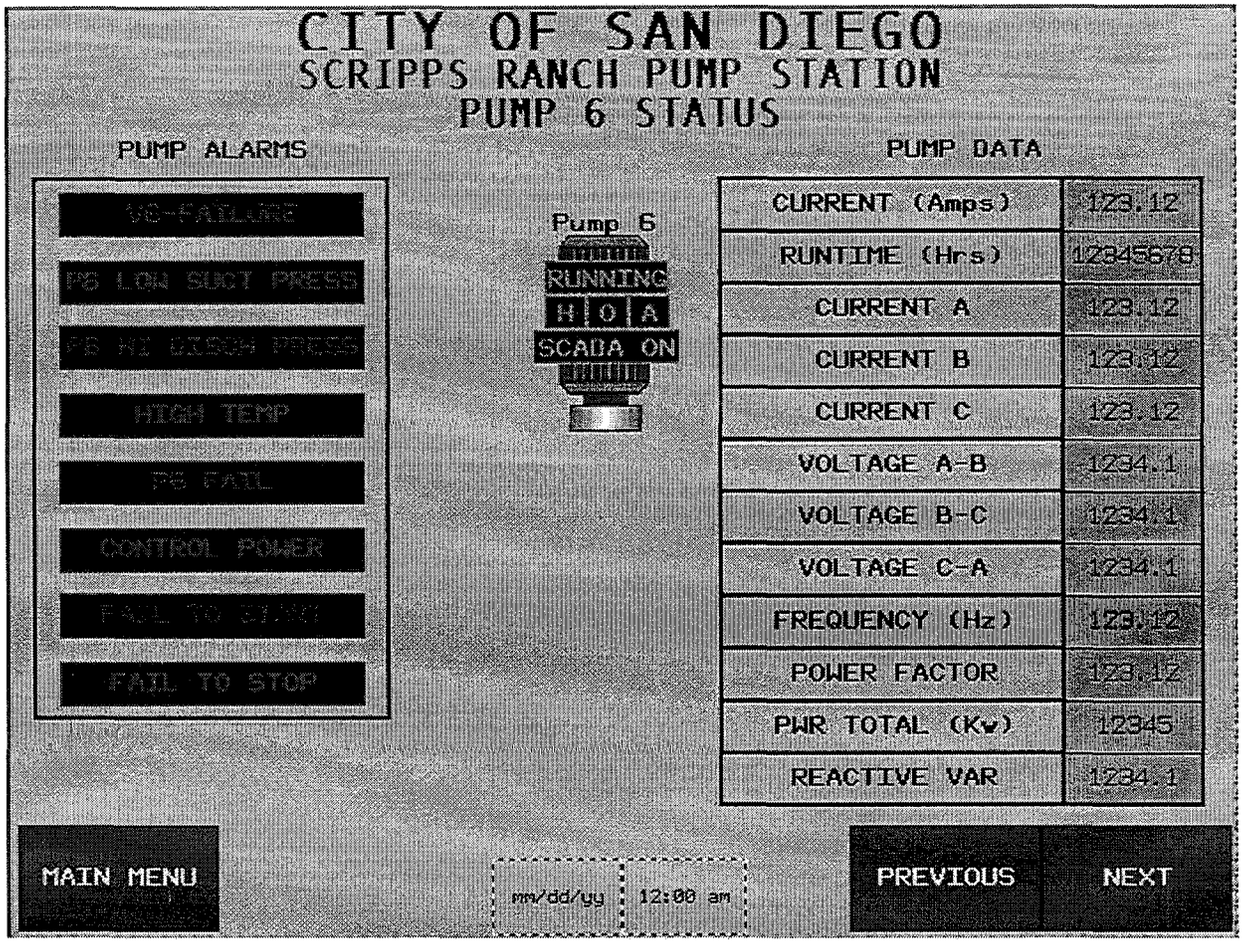
3.16 SAMPLE SCREEN SHOTS

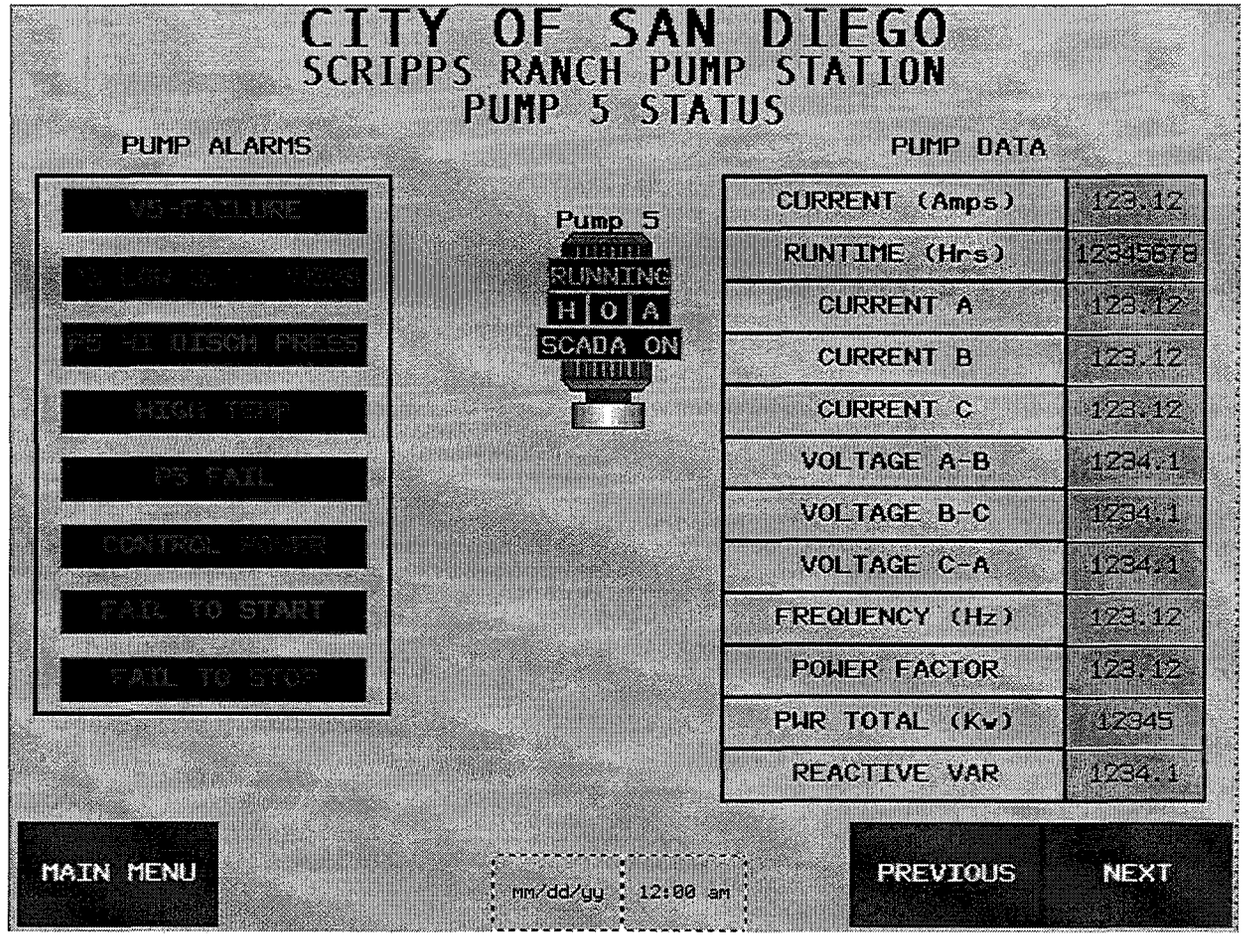


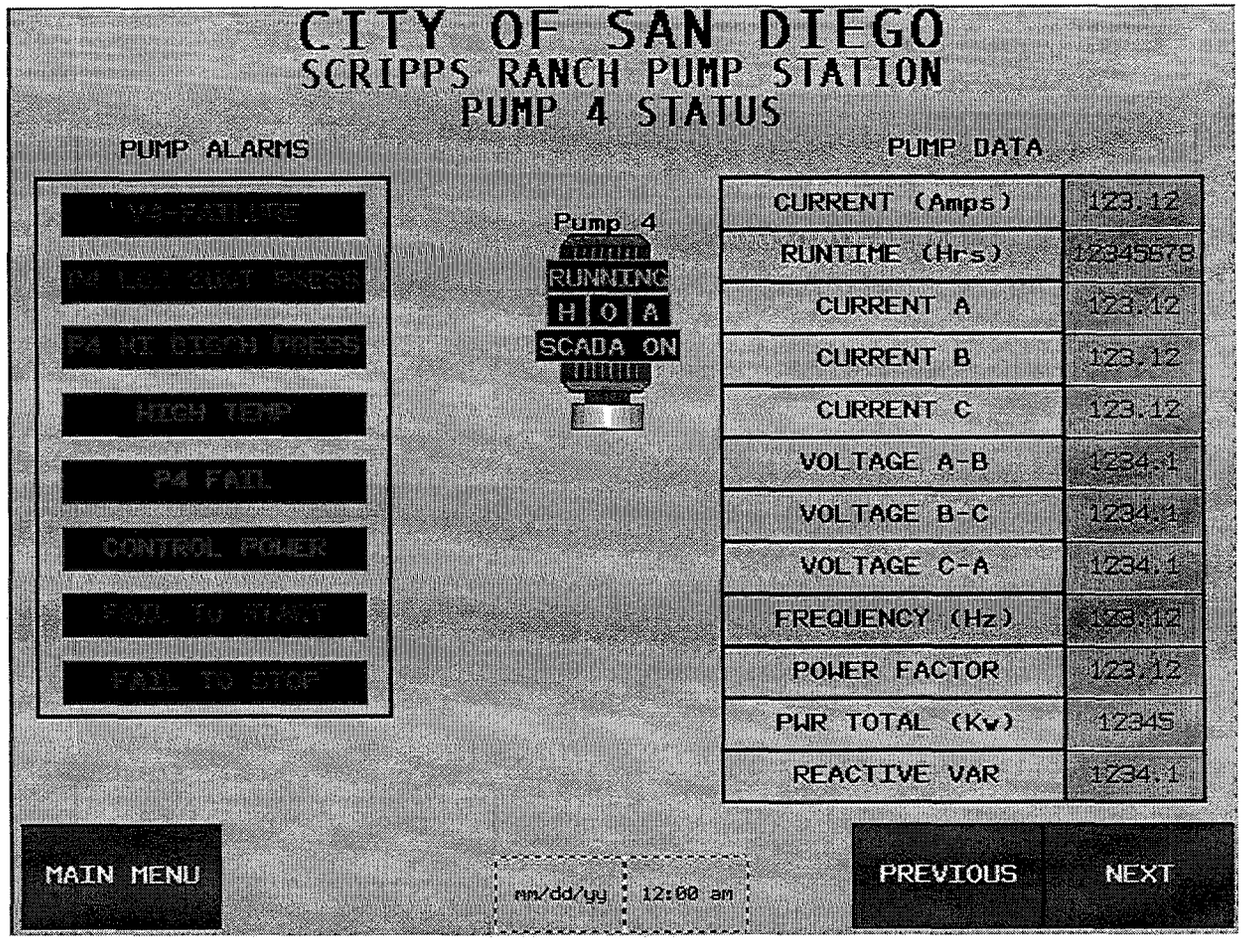

CITY OF SAN DIEGO
SCRIPPS RANCH PUMP STATION
SETTINGS
DISCHARGE PRESSURE
PUMP CALLS
ON
OFF
1st Call
2nd Call
3rd Call
4th Call
5th Call
6th Call
0.0
FLOW
PUMP CALLS
ON
OFF
1234
ENERGY MANAGEMENT
START TIME
STOP TIME
1234
MAIN MENU
mm/dd/yy
12:00 am
PREVIOUS
NEXT

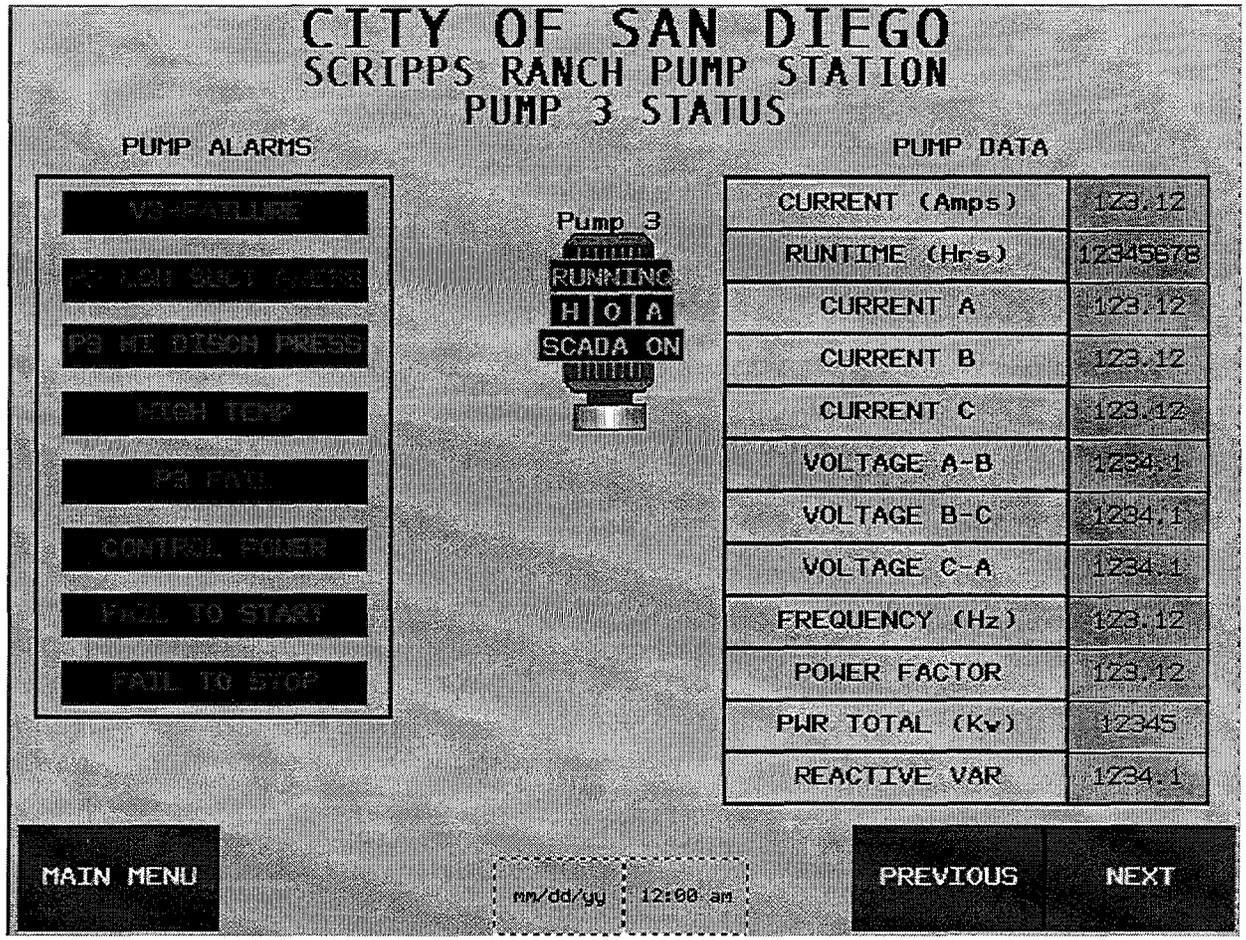

CITY OF SAN DIEGO
SCRIPPS RANCH PUMP STATION
SETTINGS
SCRIPPS RANCH LEVEL
PUMP CALLS
ON
OFF
1st Call
2nd Call
3rd Call
4th Call
5th Call
6th Call
123.1
MIRAMAR LEVEL
PUMP CALLS
ON
OFF
1st Call
2nd Call
3rd Call
4th Call
5th Call
6th Call
123.1
ENERGY MANAGEMENT
START TIME
STOP TIME
1234
1234
MAIN MENU
mm/dd/yy
12:00 am
PREVIOUS
NEXT

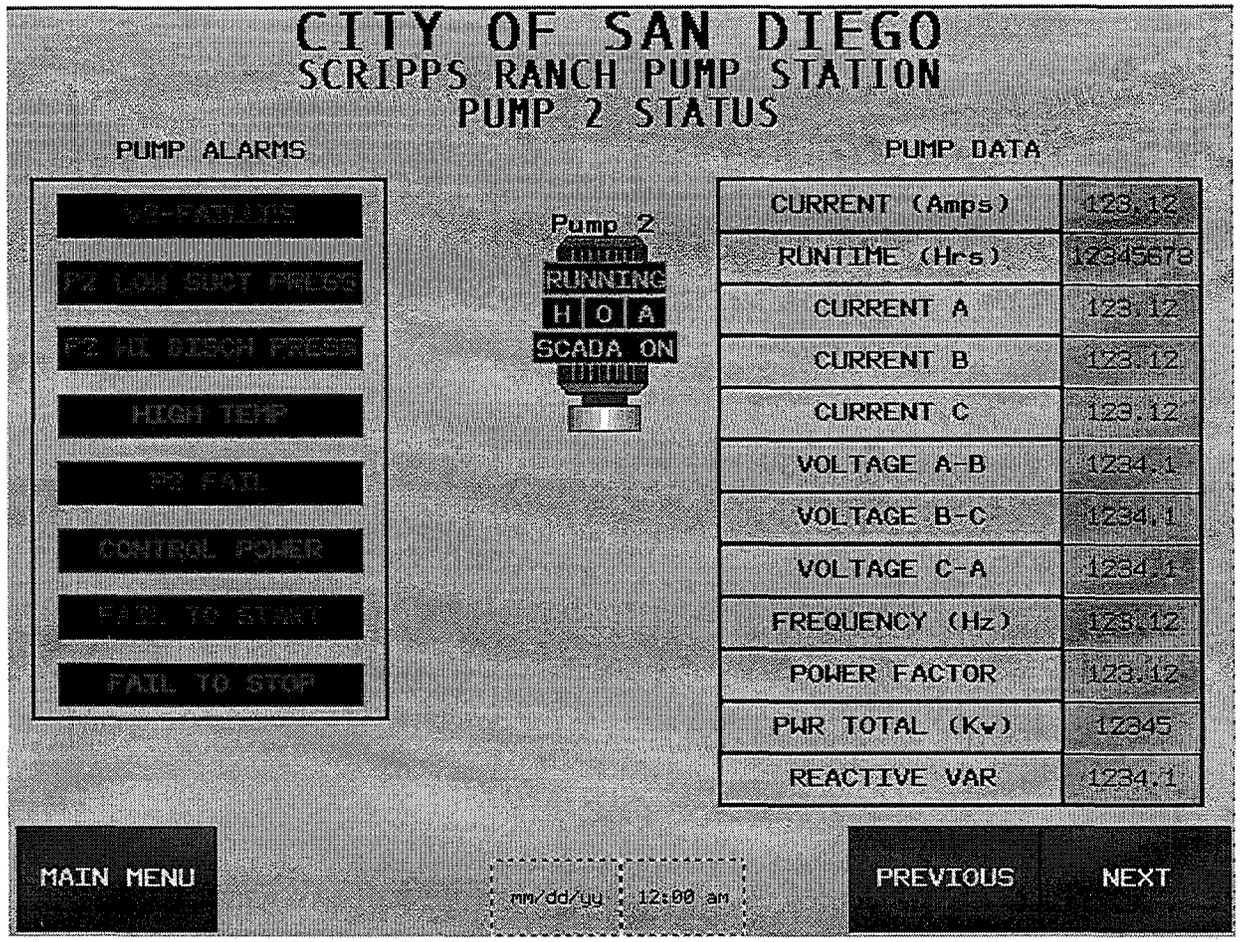

CITY OF SAN DIEGO
SCRIPPS RANCH PUMP STATION
SETPOINTS
HIGH DISCH PRESS SHUTDOWN 123.1 PSI
HIGH DISCH PRESS CLEAR 123.1 PSI
LOW SUCTN PRESS CLEAR 123.1 PSI
LOW SUCTN PRESS SHUTDOWN 123.1 PSI
MAIN MENU
mm/dd/yy
12:00 am
PREVIOUS
NEXT

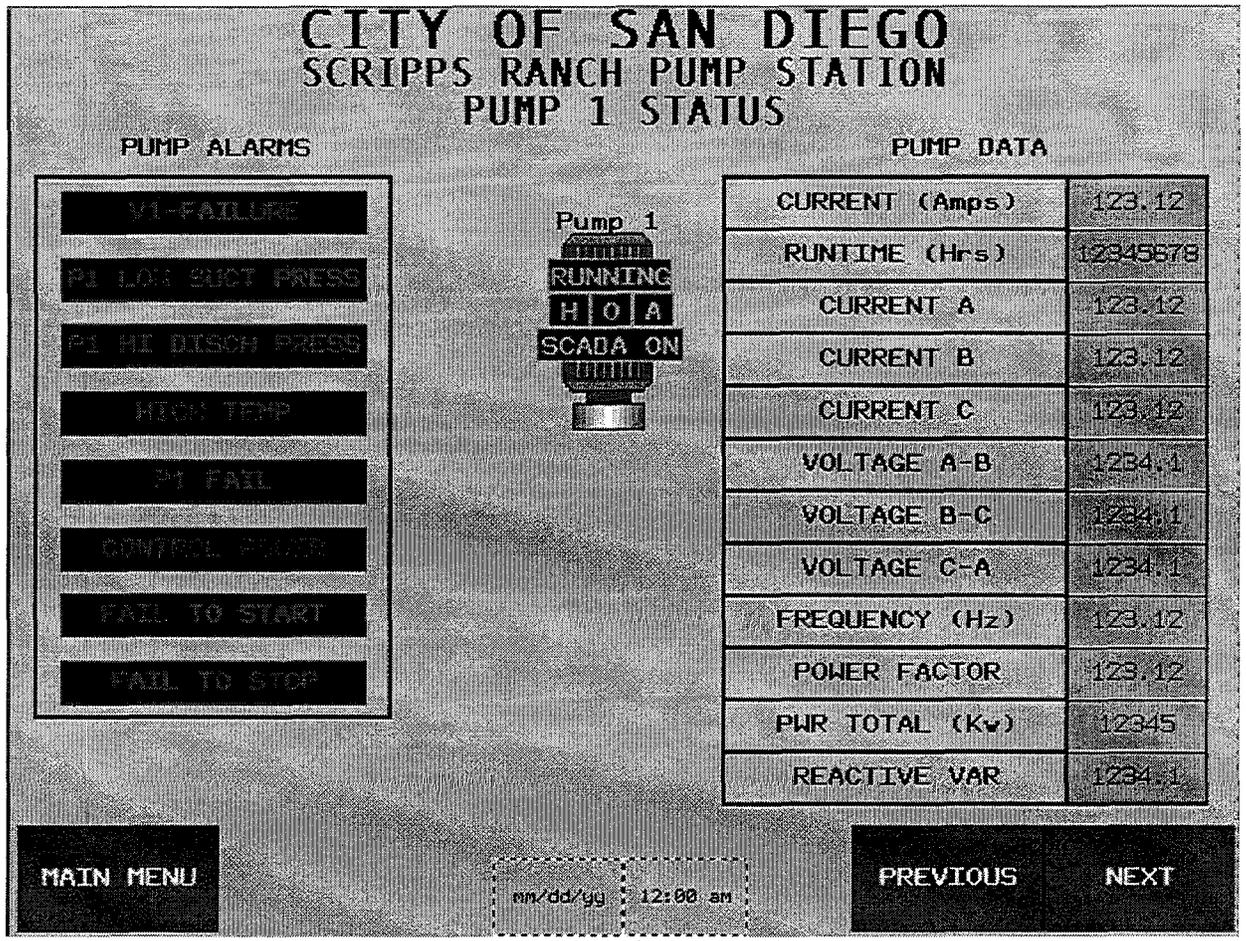

CITY OF SAN DIEGO
SCRIPPS RANCH PUMP STATION
PUMP 6 STATUS
PUMP ALARMS
VS-FAILURE
PS LOW SUCT PRESS
PS HI DISCH PRESS
HIGH TEMP
PS FAIL
CONTROL POWER
FAIL TO START
FAIL TO STOP
Pump 6
RUNNING
H O A
SCADA ON
PUMP DATA
CURRENT (Amps) 123.12
RUNTIME (Hrs) 12345678
CURRENT A 123.12
CURRENT B 123.12
CURRENT C 123.12
VOLTAGE A-B 1234.1
VOLTAGE B-C 1234.1
VOLTAGE C-A 1234.1
FREQUENCY (Hz) 123.12
POWER FACTOR 123.12
PWR TOTAL (Kw) 12345
REACTIVE VAR 1234.1
MAIN MENU
mm/dd/yy 12:00 am
PREVIOUS
NEXT

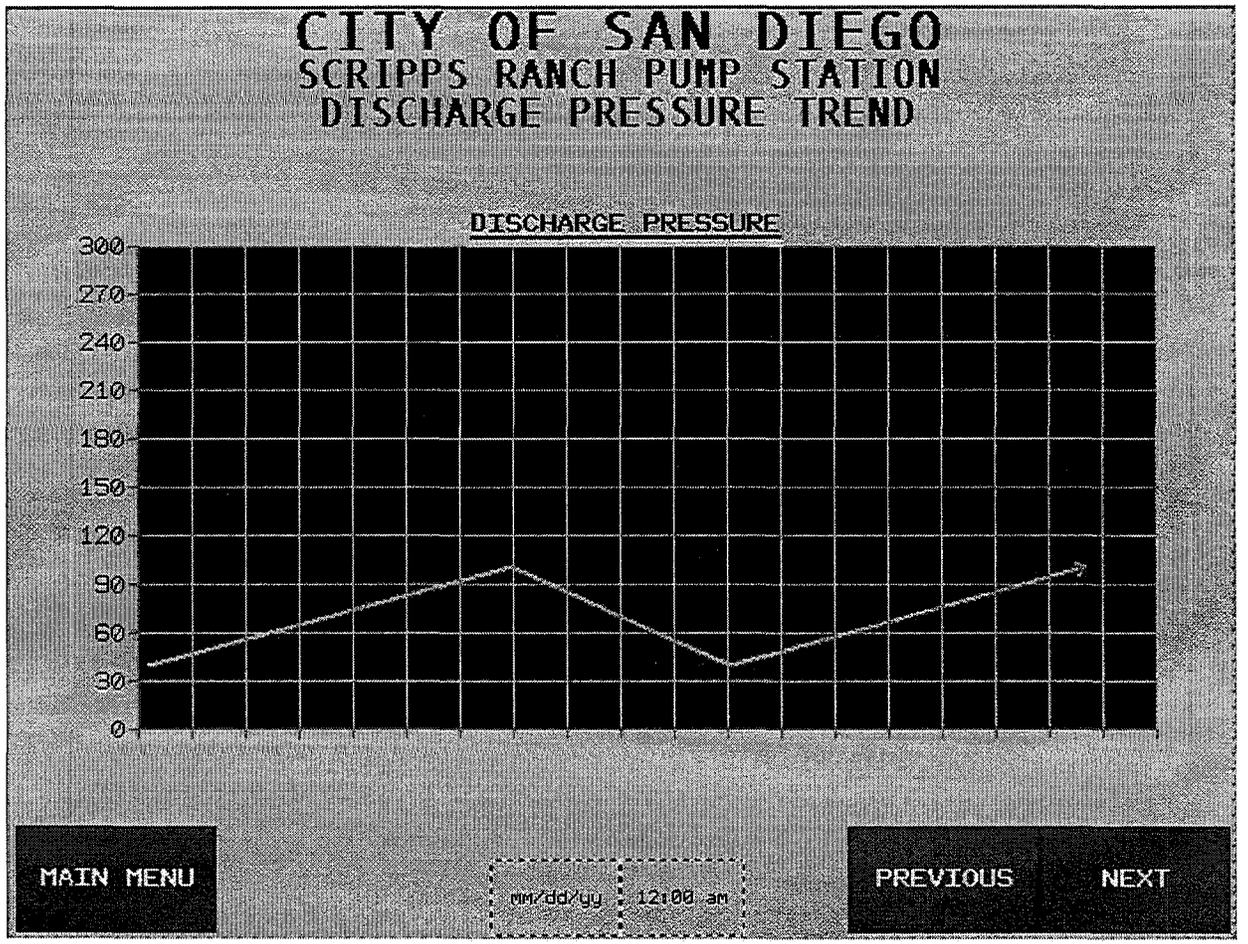

CITY OF SAN DIEGO
SCRIPPS RANCH PUMP STATION
PUMP 5 STATUS
PUMP ALARMS
VS-FAILURE
P5 HI DISCH PRESS
HIGH TEMP
P5 FAIL
CONTROL POWER
FAIL TO START
FAIL TO STOP
Pump 5
RUNNING
H O A
SCADA ON
PUMP DATA
CURRENT (Amps) 123.12
RUNTIME (Hrs) 12345678
CURRENT A 123.12
CURRENT B 123.12
CURRENT C 123.12
VOLTAGE A-B 1234.1
VOLTAGE B-C 1234.1
VOLTAGE C-A 1234.1
FREQUENCY (Hz) 123.12
POWER FACTOR 123.12
PWR TOTAL (Kw) 12345
REACTIVE VAR 1234.1
MAIN MENU
mm/dd/yy 12:00 am
PREVIOUS
NEXT

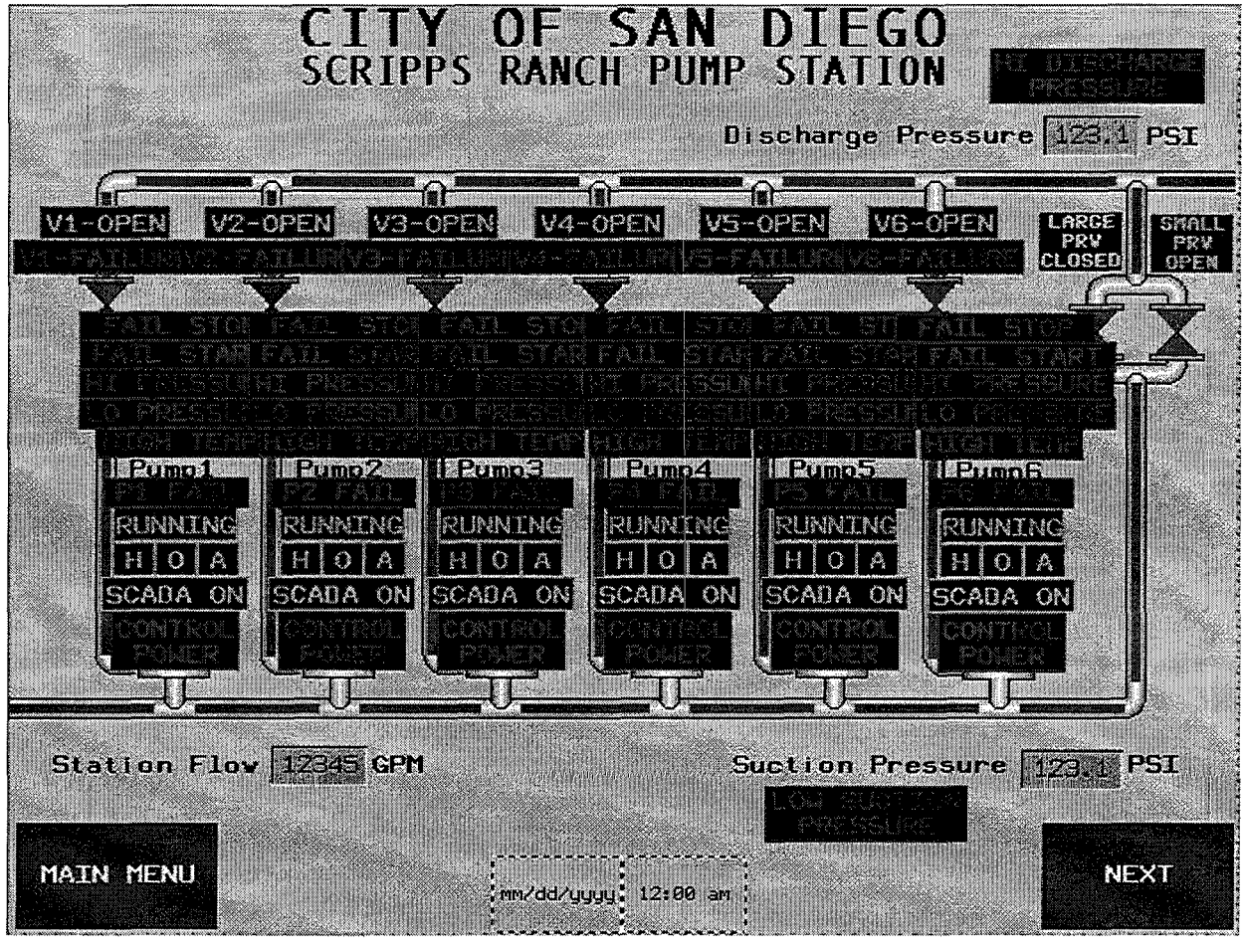

CITY OF SAN DIEGO
SCRIPPS RANCH PUMP STATION
PUMP 4 STATUS
PUMP ALARMS
PUMP DATA
Pump 4
RUNNING
H O A
SCADA ON
CURRENT (Amps) 123.12
RUNTIME (Hrs) 12345678
CURRENT A 123.12
CURRENT B 123.12
CURRENT C 123.12
VOLTAGE A-B 1234.1
VOLTAGE B-C 1234.1
VOLTAGE C-A 1234.1
FREQUENCY (Hz) 123.12
POWER FACTOR 123.12
PWR TOTAL (Kw) 12345
REACTIVE VAR 1234.1
MAIN MENU
mm/dd/yy 12:00 am
PREVIOUS
NEXT

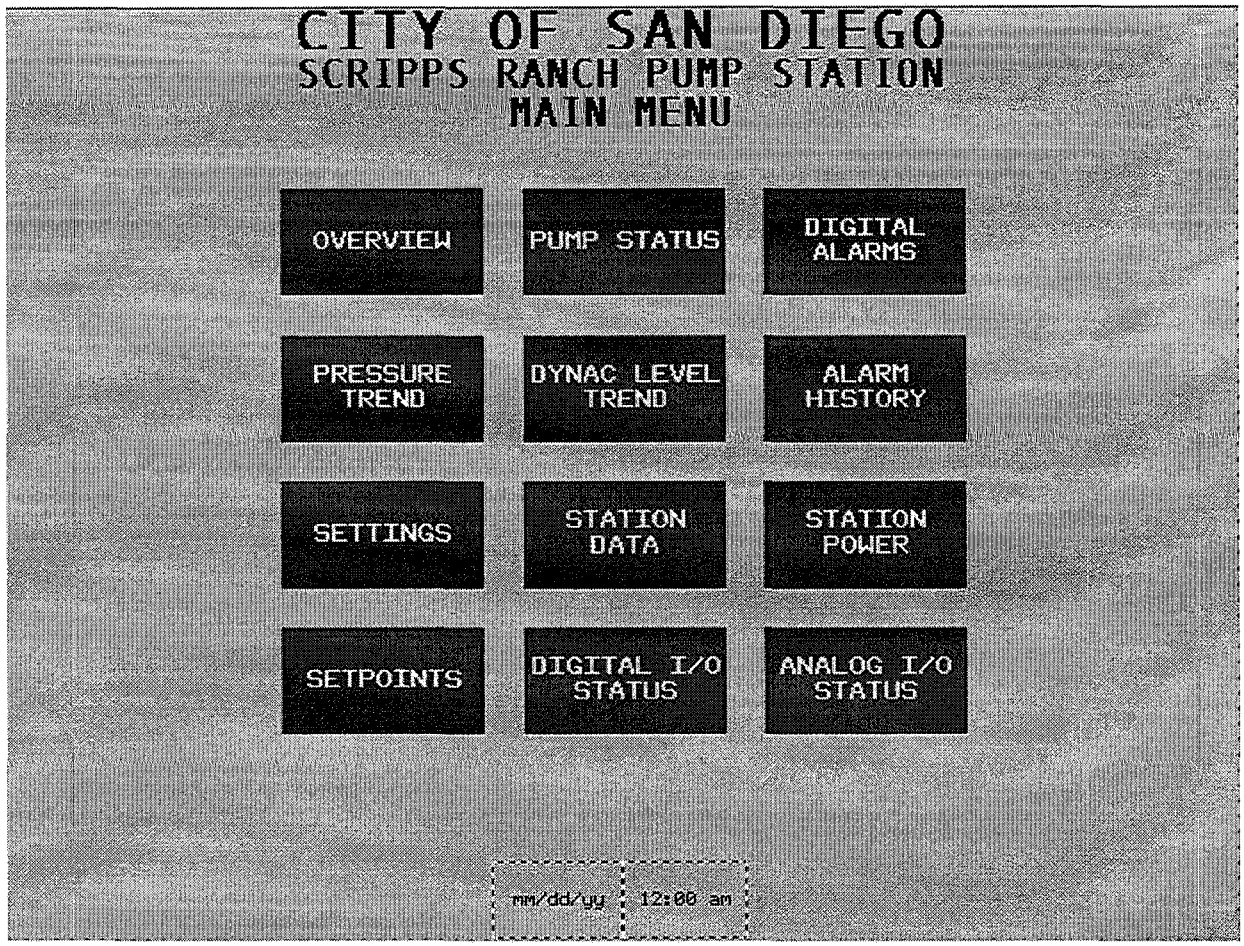

CITY OF SAN DIEGO
SCRIPPS RANCH PUMP STATION
PUMP 3 STATUS
PUMP ALARMS
VS-FAILURE
P3 HI DISCH PRESS
HIGH TEMP
P3 FAIL
CONTROL POWER
FAIL TO START
FAIL TO STOP
Pump 3
RUNNING
H O A
SCADA ON
PUMP DATA
CURRENT (Amps) 123.12
RUNTIME (Hrs) 12345678
CURRENT A 123.12
CURRENT B 123.12
CURRENT C 123.12
VOLTAGE A-B 1234.1
VOLTAGE B-C 1234.1
VOLTAGE C-A 1234.1
FREQUENCY (Hz) 123.12
POWER FACTOR 123.12
PWR TOTAL (Kw) 12345
REACTIVE VAR 1234.1
MAIN MENU
mm/dd/yy
12:00 am
PREVIOUS
NEXT

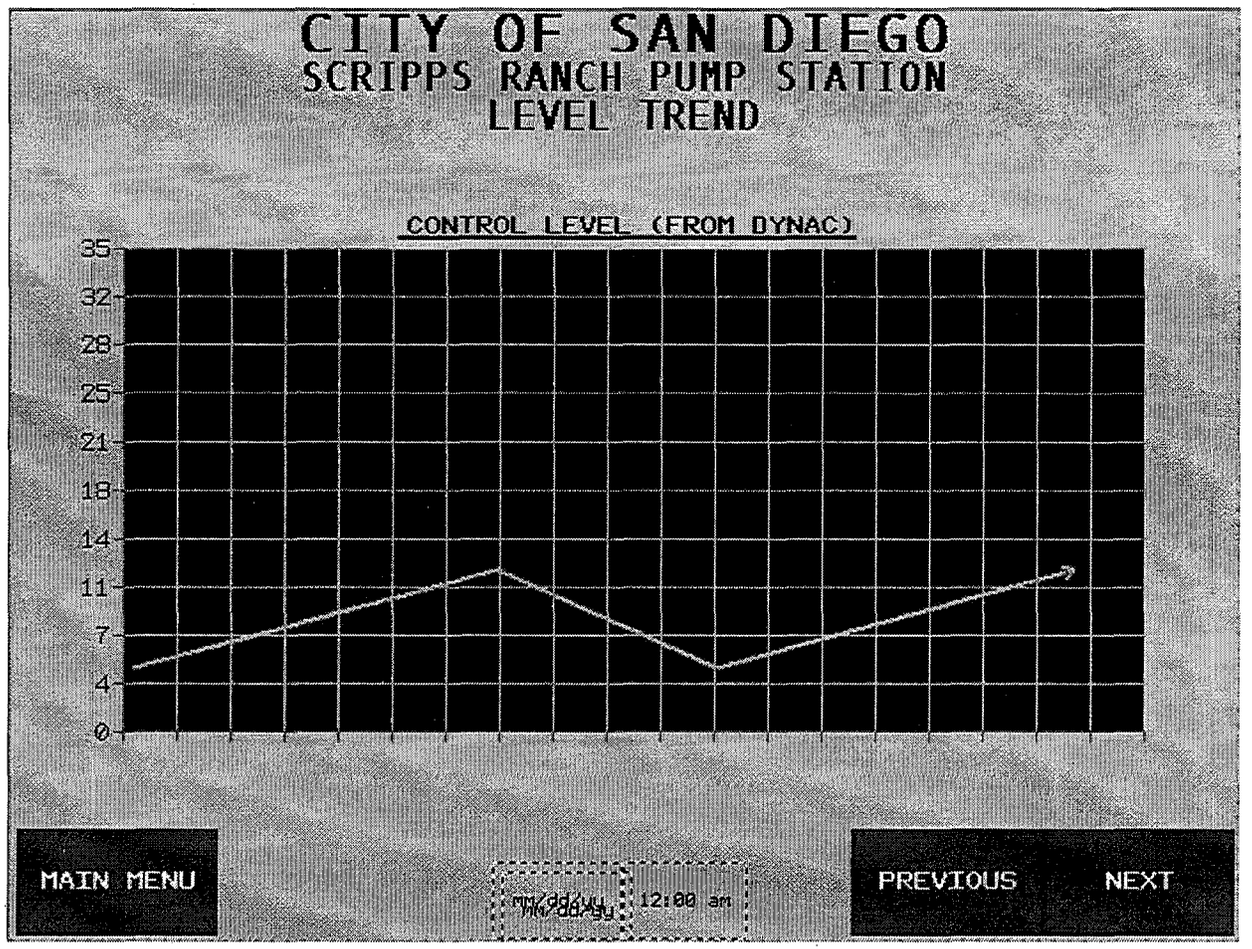

CITY OF SAN DIEGO
SCRIPPS RANCH PUMP STATION
PUMP 2 STATUS
PUMP ALARMS
PUMP DATA
Pump 2
RUNNING
H O A
SCADA ON
CURRENT (Amps) 123.12
RUNTIME (Hrs) 12345678
CURRENT A 123.12
CURRENT B 123.12
CURRENT C 123.12
VOLTAGE A-B 1234.1
VOLTAGE B-C 1234.1
VOLTAGE C-A 1234.1
FREQUENCY (Hz) 123.12
POWER FACTOR 123.12
PWR TOTAL (Kw) 12345
REACTIVE VAR 1234.1
MAIN MENU
mm/dd/yy 12:00 am
PREVIOUS
NEXT

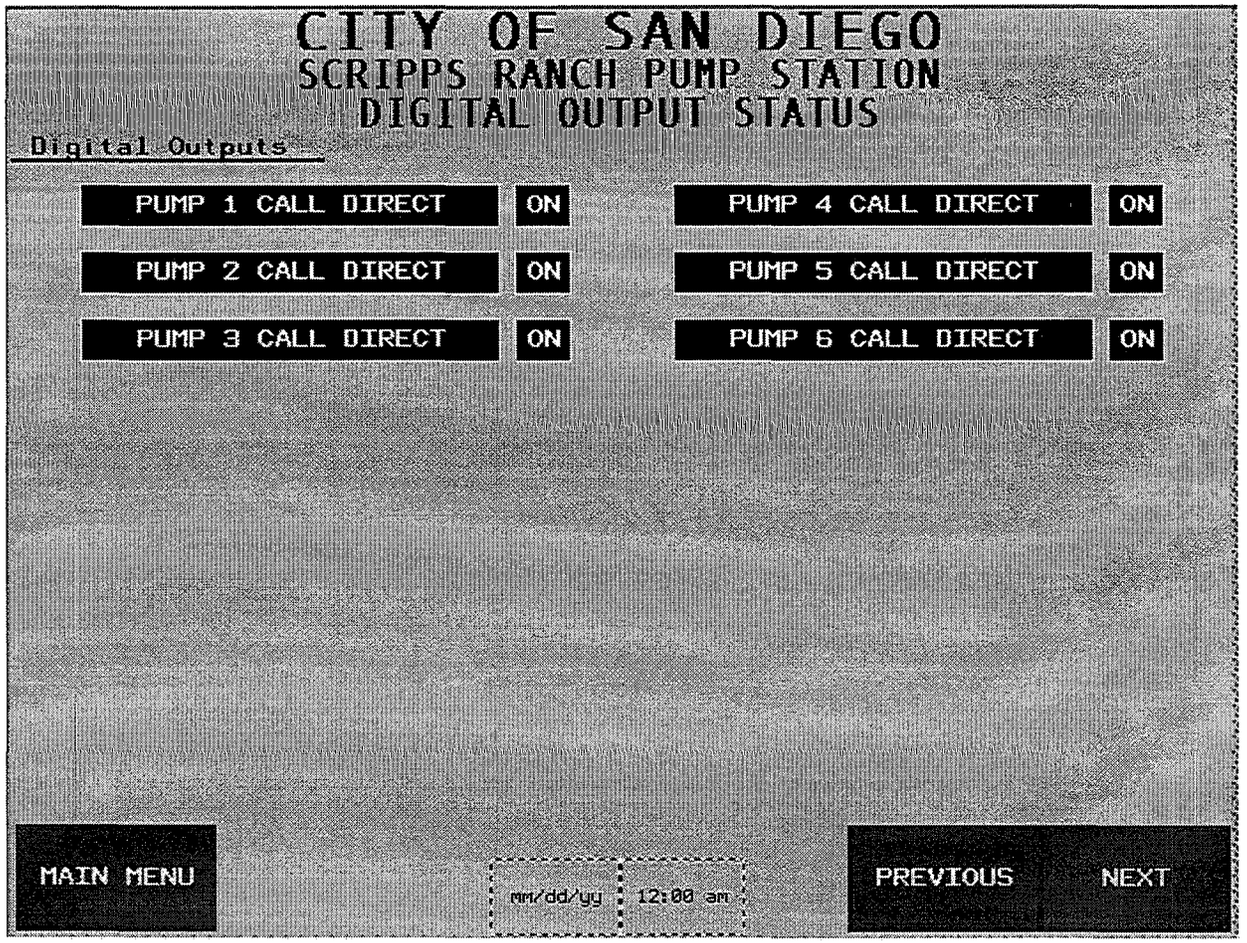

CITY OF SAN DIEGO
SCRIPPS RANCH PUMP STATION
PUMP 1 STATUS
PUMP ALARMS
V1-FAILURE
P1 LOW SUCT PRESS
P1 HI DISCH PRESS
HIGH TEMP
P1 FAIL
CONTROL POWER
FAIL TO START
FAIL TO STOP
Pump 1
RUNNING
H O A
SCADA ON
PUMP DATA
CURRENT (Amps) 123.12
RUNTIME (Hrs) 12345678
CURRENT A 123.12
CURRENT B 123.12
CURRENT C 123.12
VOLTAGE A-B 1234.1
VOLTAGE B-C 1234.1
VOLTAGE C-A 1234.1
FREQUENCY (Hz) 123.12
POWER FACTOR 123.12
PWR TOTAL (Kw) 12345
REACTIVE VAR 1234.1
MAIN MENU
mm/dd/yy 12:00 am
PREVIOUS
NEXT

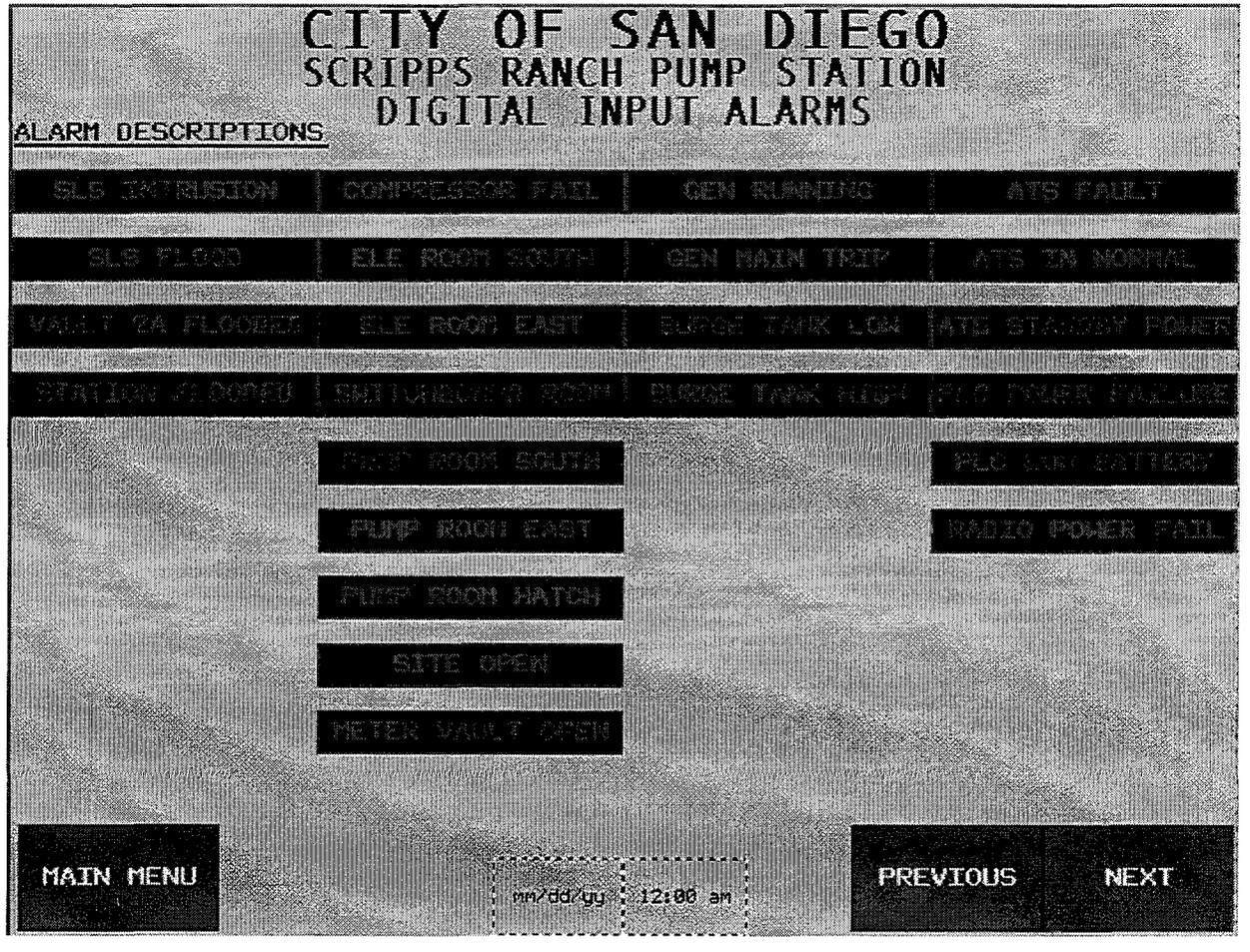

CITY OF SAN DIEGO
SCRIPPS RANCH PUMP STATION
DISCHARGE PRESSURE TREND
DISCHARGE PRESSURE
300
270
240
210
180
150
120
90
60
30
0
MAIN MENU
mm/dd/yy
12:00 am
PREVIOUS
NEXT

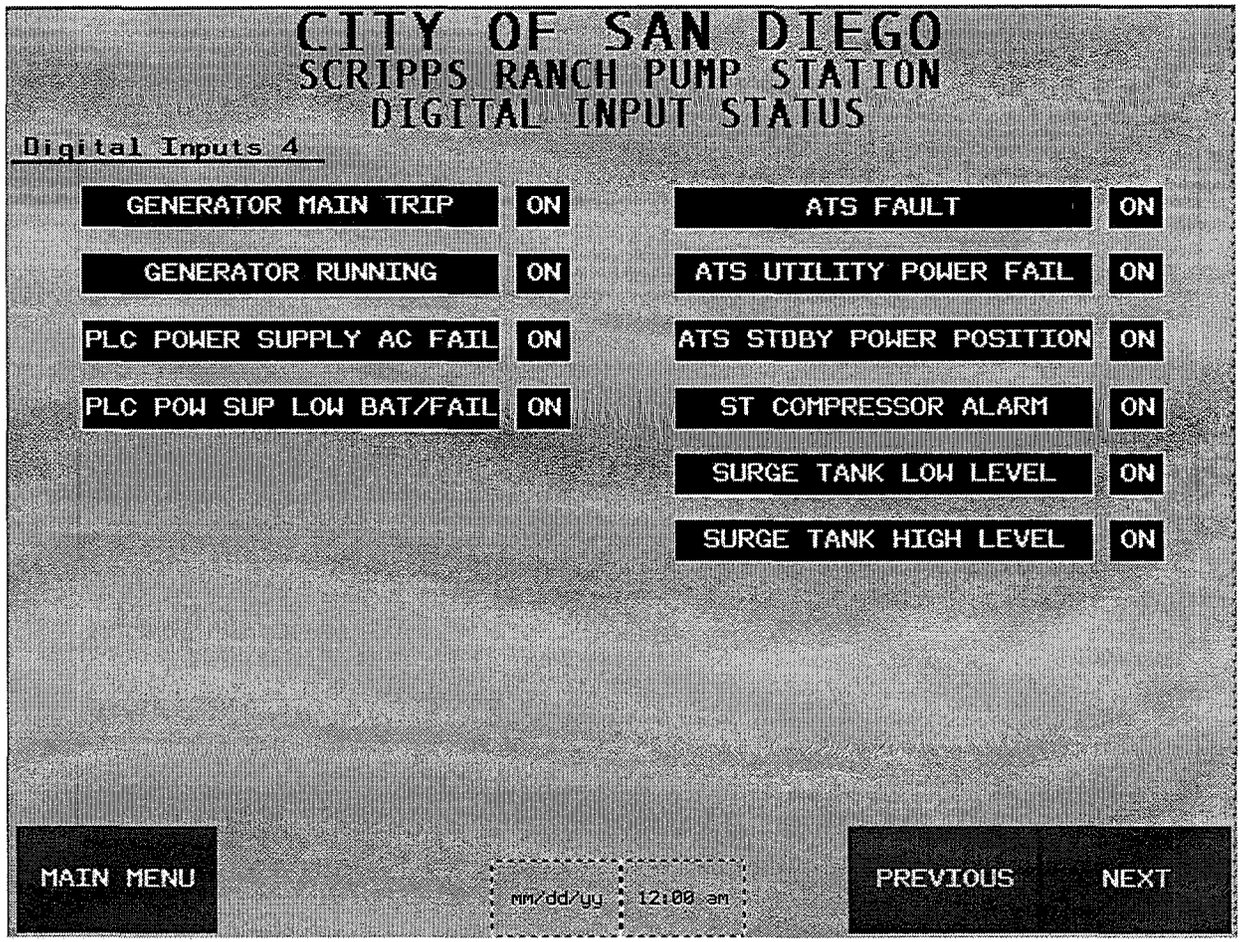

CITY OF SAN DIEGO
SCRIPPS RANCH PUMP STATION
Discharge Pressure 123.1 PSI
V1-OPEN
V2-OPEN
V3-OPEN
V4-OPEN
V5-OPEN
V6-OPEN
LARGE PRV CLOSED
SMALL PRV OPEN
Pump1
Pump2
Pump3
Pump4
Pump5
Pump6
RUNNING
H O A
SCADA ON
CONTROL POWER
Station Flow 12345 GPM
Suction Pressure 123.1 PSI
MAIN MENU
mm/dd/yyyy
12:00 am
NEXT

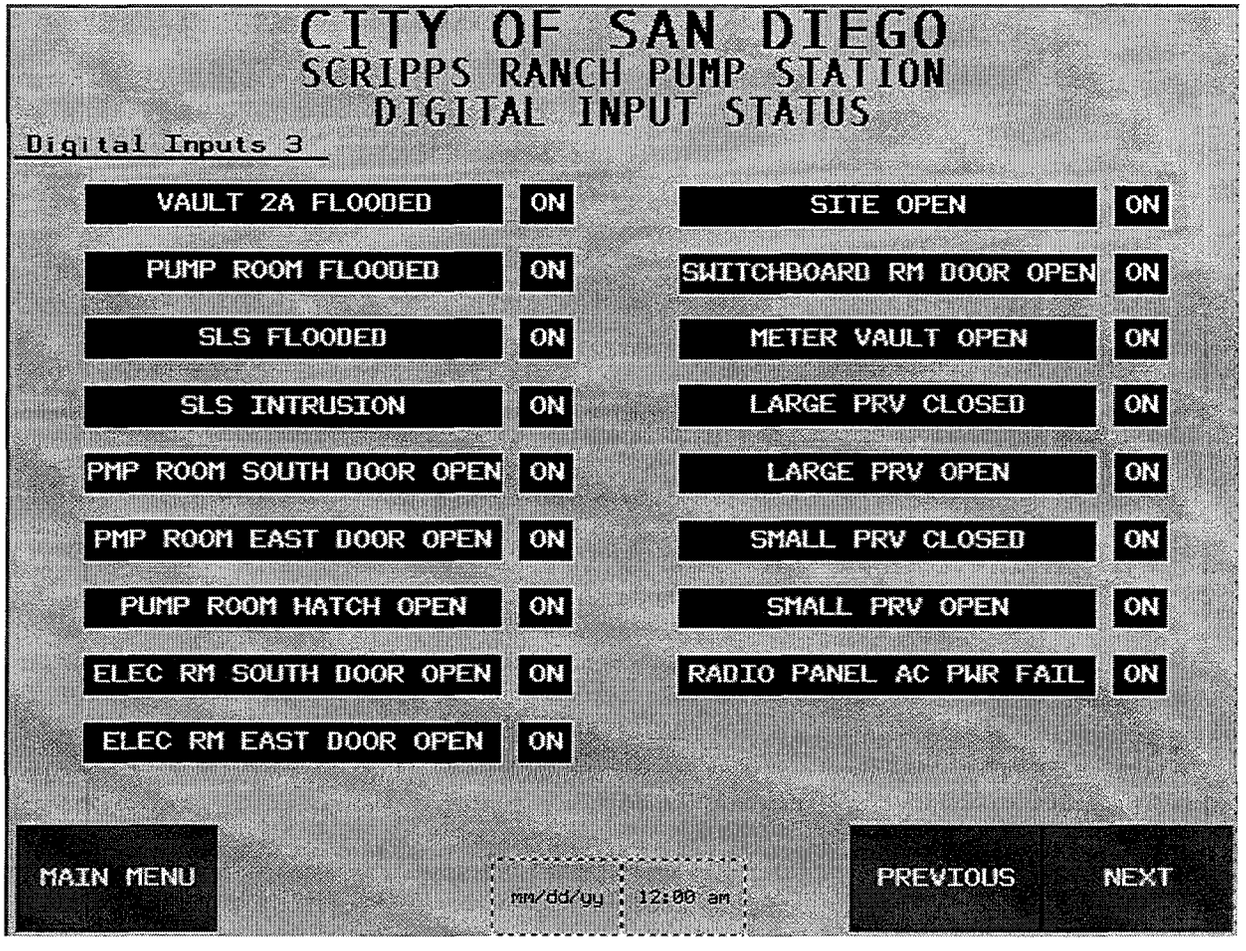

CITY OF SAN DIEGO
SCRIPPS RANCH PUMP STATION
MAIN MENU
OVERVIEW
PUMP STATUS
DIGITAL ALARMS
PRESSURE TREND
DYNAC LEVEL TREND
ALARM HISTORY
SETTINGS
STATION DATA
STATION POWER
SETPOINTS
DIGITAL I/O STATUS
ANALOG I/O STATUS
mm/dd/yy
12:00 am

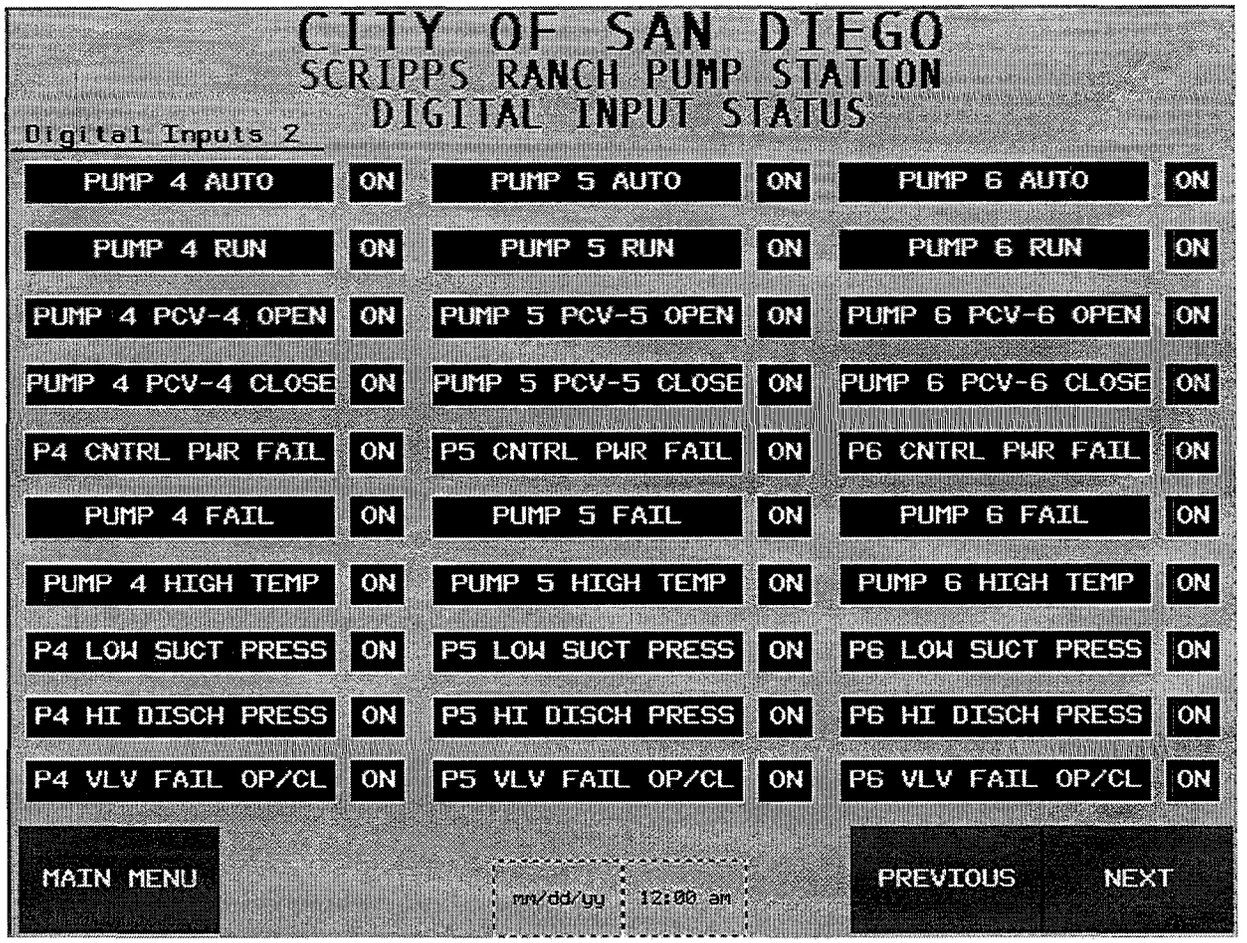

CITY OF SAN DIEGO
SCRIPPS RANCH PUMP STATION
LEVEL TREND
CONTROL LEVEL (FROM DYNAC)
35
32
28
25
21
18
14
11
7
4
0
MAIN MENU
mm/dd/yy
12:00 am
PREVIOUS
NEXT

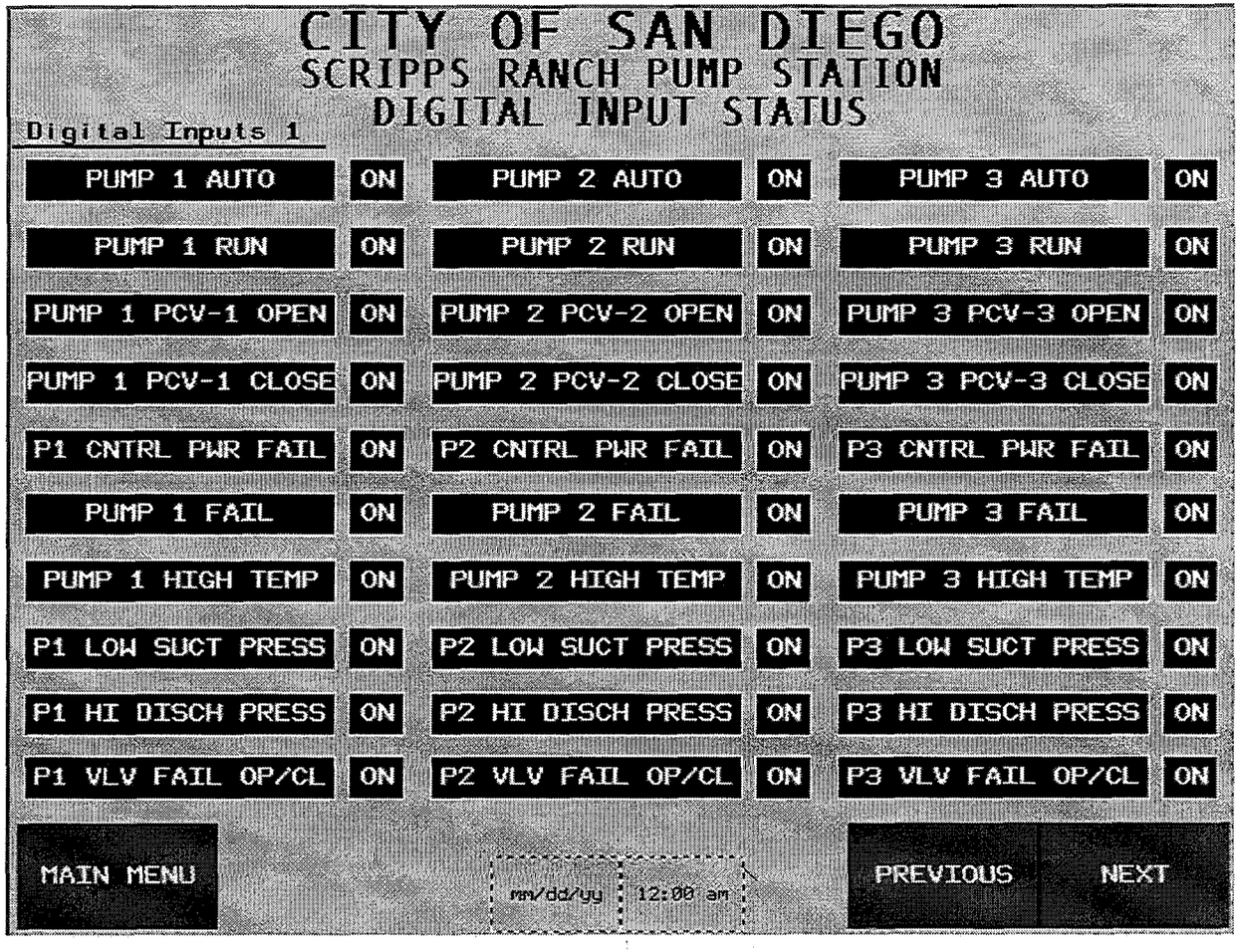

CITY OF SAN DIEGO
SCRIPPS RANCH PUMP STATION
DIGITAL OUTPUT STATUS
Digital Outputs
PUMP 1 CALL DIRECT
ON
PUMP 2 CALL DIRECT
ON
PUMP 3 CALL DIRECT
ON
PUMP 4 CALL DIRECT
ON
PUMP 5 CALL DIRECT
ON
PUMP 6 CALL DIRECT
ON
MAIN MENU
mm/dd/yy
12:00 am
PREVIOUS
NEXT

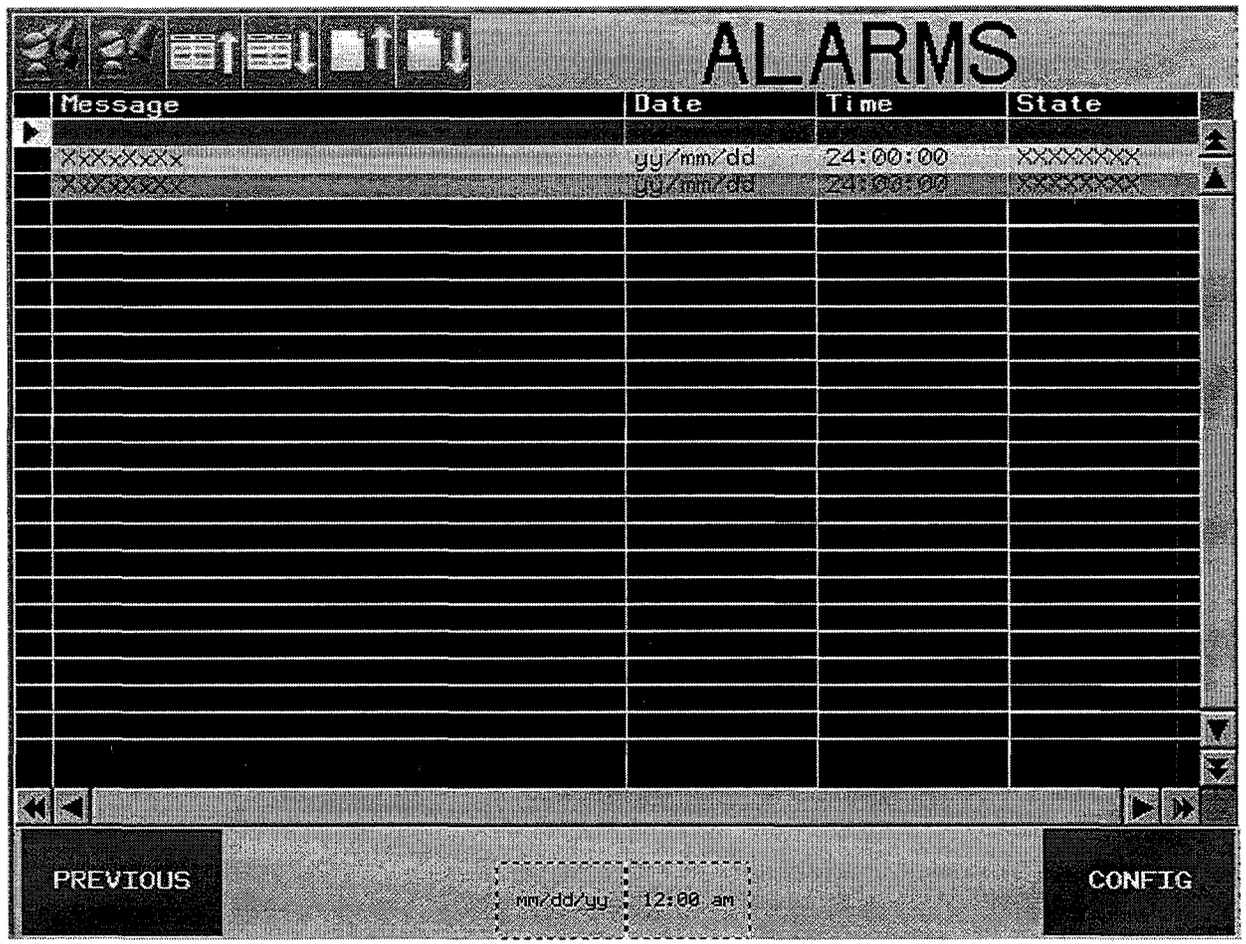

CITY OF SAN DIEGO
SCRIPPS RANCH PUMP STATION
DIGITAL INPUT ALARMS
ALARM DESCRIPTIONS
SLS INTRUSION
COMPRESSOR FAIL
GEN RUNNING
ATS FAULT
SLS FLOOD
ELE ROOM SOUTH
GEN MAIN TRIP
ATS IN NORMAL
VAULT 2A FLOODED
ELE ROOM EAST
SURGE TANK LOW
ATS STANDBY POWER
STATION FLOODED
SWITCHGEAR ROOM
SURGE TANK HIGH
PLC POWER FAILURE
PUMP ROOM SOUTH
PLC LOW BATTERY
PUMP ROOM EAST
RADIO POWER FAIL
PUMP ROOM HATCH
SITE OPEN
METER VAULT OPEN
MAIN MENU
mm/dd/yy
12:00 am
PREVIOUS
NEXT

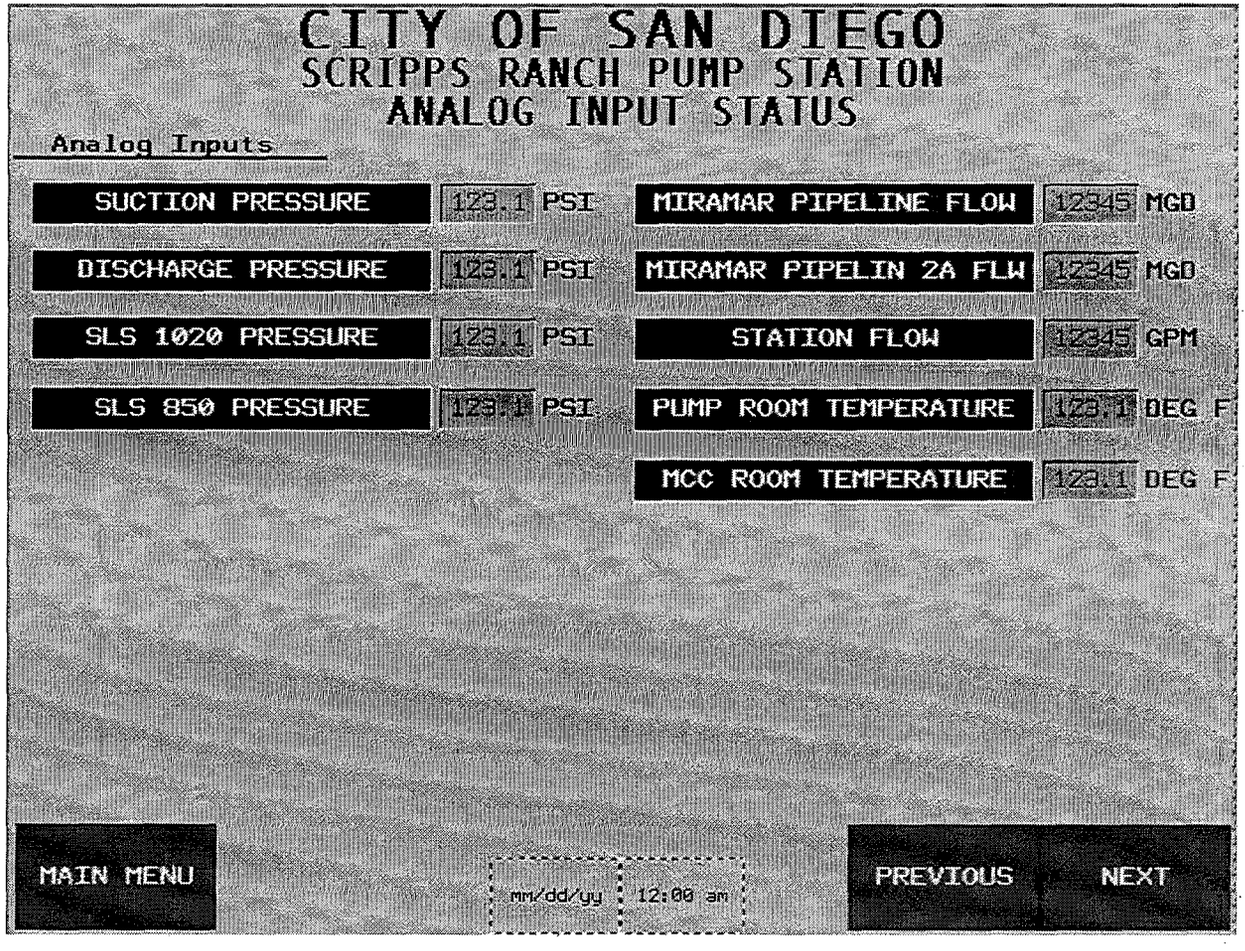

CITY OF SAN DIEGO
SCRIPPS RANCH PUMP STATION
DIGITAL INPUT STATUS
Digital Inputs 4
GENERATOR MAIN TRIP
ON
GENERATOR RUNNING
ON
PLC POWER SUPPLY AC FAIL
ON
PLC POW SUP LOW BAT/FAIL
ON
ATS FAULT
ON
ATS UTILITY POWER FAIL
ON
ATS STDBY POWER POSITION
ON
ST COMPRESSOR ALARM
ON
SURGE TANK LOW LEVEL
ON
SURGE TANK HIGH LEVEL
ON
MAIN MENU
mm/dd/yy
12:00 am
PREVIOUS
NEXT

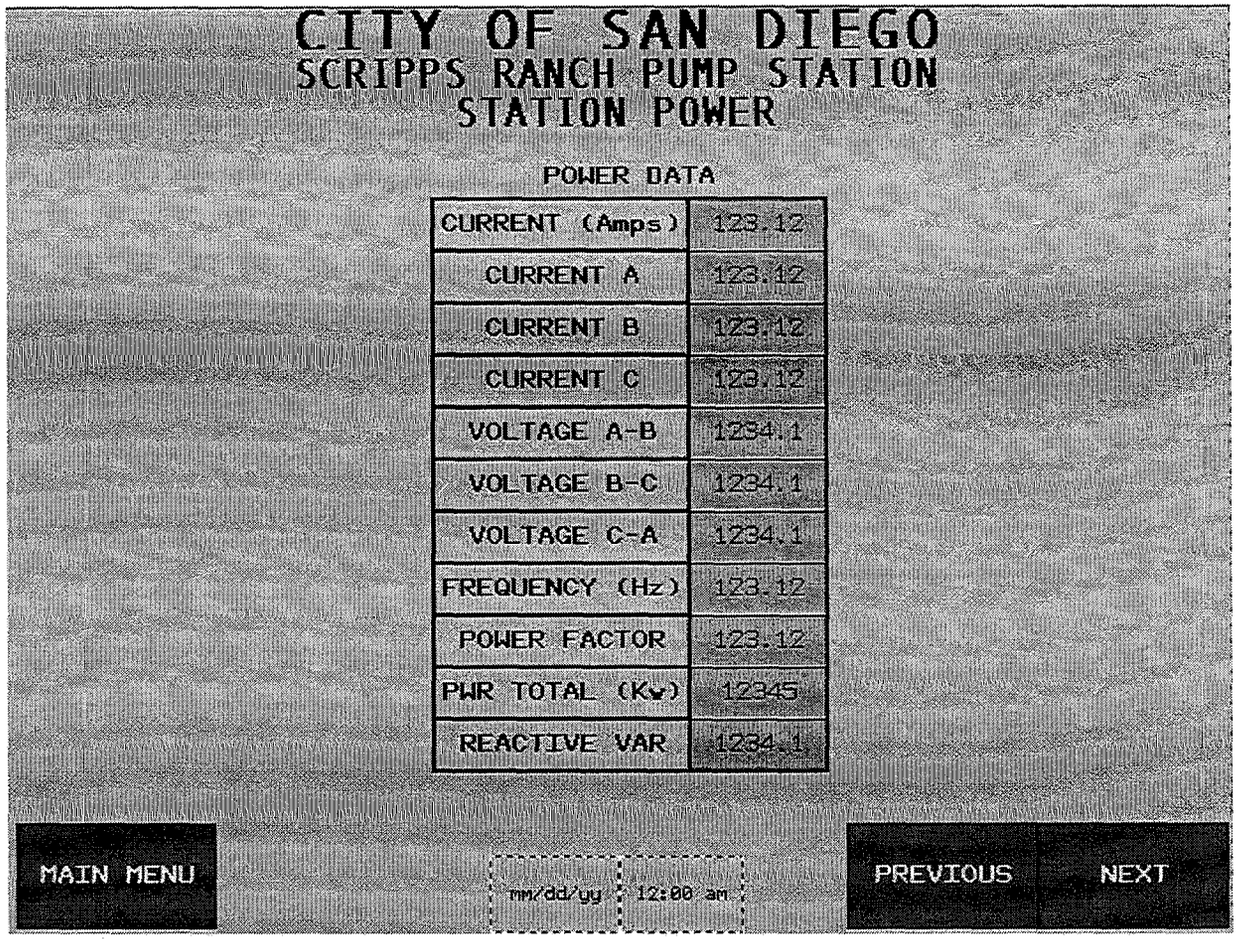

CITY OF SAN DIEGO
SCRIPPS RANCH PUMP STATION
DIGITAL INPUT STATUS
Digital Inputs 3
VAULT 2A FLOODED
ON
PUMP ROOM FLOODED
ON
SLS FLOODED
ON
SLS INTRUSION
ON
PMP ROOM SOUTH DOOR OPEN
ON
PMP ROOM EAST DOOR OPEN
ON
PUMP ROOM HATCH OPEN
ON
ELEC RM SOUTH DOOR OPEN
ON
ELEC RM EAST DOOR OPEN
ON
SITE OPEN
ON
SWITCHBOARD RM DOOR OPEN
ON
METER VAULT OPEN
ON
LARGE PRV CLOSED
ON
LARGE PRV OPEN
ON
SMALL PRV CLOSED
ON
SMALL PRV OPEN
ON
RADIO PANEL AC PWR FAIL
ON
MAIN MENU
mm/dd/yy
12:00 am
PREVIOUS
NEXT


CITY OF SAN DIEGO
SCRIPPS RANCH PUMP STATION
DIGITAL INPUT STATUS
Digital Inputs 2
PUMP 4 AUTO ON
PUMP 5 AUTO ON
PUMP 6 AUTO ON
PUMP 4 RUN ON
PUMP 5 RUN ON
PUMP 6 RUN ON
PUMP 4 PCV-4 OPEN ON
PUMP 5 PCV-5 OPEN ON
PUMP 6 PCV-6 OPEN ON
PUMP 4 PCV-4 CLOSE ON
PUMP 5 PCV-5 CLOSE ON
PUMP 6 PCV-6 CLOSE ON
P4 CNTRL PWR FAIL ON
P5 CNTRL PWR FAIL ON
P6 CNTRL PWR FAIL ON
PUMP 4 FAIL ON
PUMP 5 FAIL ON
PUMP 6 FAIL ON
PUMP 4 HIGH TEMP ON
PUMP 5 HIGH TEMP ON
PUMP 6 HIGH TEMP ON
P4 LOW SUCT PRESS ON
P5 LOW SUCT PRESS ON
P6 LOW SUCT PRESS ON
P4 HI DISCH PRESS ON
P5 HI DISCH PRESS ON
P6 HI DISCH PRESS ON
P4 VLV FAIL OP/CL ON
P5 VLV FAIL OP/CL ON
P6 VLV FAIL OP/CL ON
MAIN MENU
mm/dd/yy 12:00 am
PREVIOUS
NEXT


CITY OF SAN DIEGO
SCRIPPS RANCH PUMP STATION
DIGITAL INPUT STATUS
Digital Inputs 1
PUMP 1 AUTO ON
PUMP 2 AUTO ON
PUMP 3 AUTO ON
PUMP 1 RUN ON
PUMP 2 RUN ON
PUMP 3 RUN ON
PUMP 1 PCV-1 OPEN ON
PUMP 2 PCV-2 OPEN ON
PUMP 3 PCV-3 OPEN ON
PUMP 1 PCV-1 CLOSE ON
PUMP 2 PCV-2 CLOSE ON
PUMP 3 PCV-3 CLOSE ON
P1 CNTRL PWR FAIL ON
P2 CNTRL PWR FAIL ON
P3 CNTRL PWR FAIL ON
PUMP 1 FAIL ON
PUMP 2 FAIL ON
PUMP 3 FAIL ON
PUMP 1 HIGH TEMP ON
PUMP 2 HIGH TEMP ON
PUMP 3 HIGH TEMP ON
P1 LOW SUCT PRESS ON
P2 LOW SUCT PRESS ON
P3 LOW SUCT PRESS ON
P1 HI DISCH PRESS ON
P2 HI DISCH PRESS ON
P3 HI DISCH PRESS ON
P1 VLV FAIL OP/CL ON
P2 VLV FAIL OP/CL ON
P3 VLV FAIL OP/CL ON
MAIN MENU
mm/dd/yy
12:00 am
PREVIOUS
NEXT


ALARMS
Message
Date
Time
State
XXXXXXXX
yy/mm/dd
24:00:00
XXXXXXXX
XXXXXXXX
yy/mm/dd
24:00:00
XXXXXXXX
PREVIOUS
mm/dd/yy
12:00 am
CONFIG


CITY OF SAN DIEGO
SCRIPPS RANCH PUMP STATION
ANALOG INPUT STATUS
Analog Inputs
SUCTION PRESSURE
123.1
PSI
DISCHARGE PRESSURE
123.1
PSI
SLS 1020 PRESSURE
123.1
PSI
SLS 850 PRESSURE
123.1
PSI
MIRAMAR PIPELINE FLOW
12345
MGD
MIRAMAR PIPELIN 2A FLW
12345
MGD
STATION FLOW
12345
GPM
PUMP ROOM TEMPERATURE
123.1
DEG F
MCC ROOM TEMPERATURE
123.1
DEG F
MAIN MENU
mm/dd/yy
12:00 am
PREVIOUS
NEXT



*** END OF SECTION ***

2.10 GEARS AND GEAR DRIVES

A. Unless otherwise indicated, gears shall be of the helical or spiral-bevel type, designed and manufactured in accordance with AGMA Standards, with a minimum service factor of 1.7, a minimum L-10 bearing life of 60,000 hours and a minimum efficiency of 94 percent. Worm gears shall not be used unless specifically approved by the RESIDENT ENGINEER.

B. All gear speed reducers or increasers shall be of the enclosed type, oil- or grease-lubricated and fully sealed, with a breather to allow air to escape but keep dust and dirt out. The casing shall be of cast iron or heavy duty steel construction with lifting lugs and an inspection cover for each gear train. An oil level sight glass and an oil flow indicator shall be provided, arranged for easy reading.

C. Gears and gear drives as part of an equipment assembly shall be shipped fully assembled for field installation.

D. Material selections shall be left to the discretion of the manufacturer, provided the above AGMA values are met. Input and output shafts shall be adequately designed for the service and load requirements. Gears shall be computer-matched for minimum tolerance variation. The output shaft shall have two positive seals to prevent oil leakage.

E. Oil level indicators and drain shall be easily accessible. Oil coolers or heat exchangers with all required appurtenances shall be furnished when necessary.

F. Where gear drive input or output shafts have to connect to couplings or sprockets supplied by others, the CONTRACTOR shall have the gear drive manufacturer supply matching key taped to the shaft for shipment.

2.11 DRIVE CHAINS

A. Power drive chains shall be commercial type roller chains and meet ANSI Standards.

B. A chain take-up or tightener shall be provided in every chain drive arrangement to provide easy adjustment.

C. A minimum of one connecting or coupler link shall be provided with each length of roller chain.

D. Chain and attachments shall be of the manufacturer's best standard material and suitable for the process fluid.

2.12 SPROCKETS

A. General: Sprockets shall be used in conjunction with all chain drives and chain-type material handling equipment.

B. Materials: Unless otherwise indicated, materials shall be as follows:

1 Sprockets with 25 teeth or less, normally used as a driver, shall be made of medium carbon steel in the 0.40 to 0.45 percent carbon range.

2 Type A and B sprockets with 26 teeth or more, normally used as driven sprockets, shall be made of minimum 0.20 percent carbon steel.

3 Large diameter sprockets with Type C hub shall be made of cast iron conforming to ASTM A 48, Class 30.

C. All sprockets shall be accurately machined to ANSI Standards. Sprockets shall have deep hardness penetration in tooth sections.

D. Finish bored sprockets shall be furnished complete with keyseat and set screws.

E. To facilitate installation and disassembly, sprockets shall be of the split type or shall be furnished with taper-lock bushings as required.

F. Idler sprockets shall be furnished with brass or Babbitt bushings, complete with oil hole and axial or circumferential grooving. Steel collars with set screws may be provided in both sides of the hub.

2.13 V-BELT DRIVES

A. V-belts and sheaves shall be of the best commercial grade and shall conform to ANSI, MPTA, and RMA Standards.

B. Unless otherwise indicated, sheaves shall be machined from the finest quality gray cast iron.

C. All sheaves shall be statically balanced. In some applications where vibration is a problem, sheaves shall be dynamically balanced. Sheaves operating at belt speeds exceeding 6,500 fpm may be required to be of special materials and construction.

D. To facilitate installation and disassembly, sheaves shall be furnished complete with taper-lock or QD bushings as required.

E. Finish bored sheaves shall be furnished complete with keyseat and set screws.

F. Sliding motor bases shall be provided to adjust the tension of V-belts.

2.14 DRIVE GUARDS

A. All power transmission, prime movers, machines, shaft extensions, and moving machine parts shall be guarded to conform with the OSHA Safety and Health Standards (29CFR1910, as adopted and amended by the State of California). The guards shall be constructed of minimum 10-gauge expanded, flattened steel with smooth edges and corners, galvanized after fabrication and securely fastened. Where required for lubrication or maintenance, guards shall have hinged and latched access doors.

2.15 FLEXIBLE CONNECTORS

A. General: Flexible connectors shall be installed in all piping connections to engines, blowers, compressors, and other vibrating equipment and in piping systems in accordance with Section 15000 - Piping Components.

2.16 INSULATING CONNECTIONS

A. General: Insulating bushings, unions, couplings, or flanges, as appropriate, shall be used in accordance with the requirements of the Section 15000 - Piping Components, and 15950 – Corrosion Control for Buried Piping.

2.17 GASKETS AND PACKINGS

A. Gaskets shall be in accordance with the requirements of Section 15000 - Piping Components. Gaskets containing asbestos will not be permitted.

B. Packing around valve stems and reciprocating shafts shall be of compressible material, compatible with the fluid being used. Chevron-type "V" packing shall be Garlock No. 432, John Crane "Everseal," or equal.

C. Packing around rotating shafts (other than valve stems) shall be "O"-rings, stuffing boxes, or mechanical seals, as recommended by the manufacturer and approved by the RESIDENT ENGINEER, in accordance with Section 11175 - Pumps, General.

2.18 NAMEPLATES

A. Equipment nameplates of Type 316 stainless steel shall be engraved or stamped and fastened to the equipment in an accessible location with No. 4 or larger oval head Type 316 stainless steel screws or drive pins. Nameplates shall contain the manufacturer's name, model, serial number, size, characteristics, and appropriate data describing the machine performance ratings.

2.19 SAFETY REQUIREMENTS

A. Where Work areas are located within a flammable or toxic gas environment, suitable gas detection, ventilating, and oxygen deficiency equipment shall be provided. Workers shall be equipped with approved breathing apparatus.

2.20 OVERLOAD PROTECTION

A. General:

1. Unless otherwise indicated in individual equipment Sections, all equipment drives incorporating overload protection shall be provided with an overload protection device as follows:

a. Mechanical System: The overload protection shall be a mechanical device to provide for reliable protection in the event of excessive overload. It shall be a ball detent type designed for long term repeatability and life. It shall be infinitely adjustable by a single adjusting nut. Once set it shall be tamperproof, and incorporate a torque monitoring and control system. It shall activate an alarm set for 85 percent, and a motor cutout switch set for 100 percent of maximum continuous running torque. A visual torque indication shall be provided and oriented so that it may be read from the walkway. The dial shall be calibrated from 0 to 100 percent of maximum continuous running torque.

The design of the torque limiter should initiate the mechanical disengagement of the drive upon overload. Each unit shall be suitable for outdoor/corrosive environments with a protective finish, corrosion inhibiting lubricants and a Type 316 stainless steel cover.

b. Electronic System: As an alternative to the mechanical system, the overload protection may be an Electronic Torque Monitoring Control System capable of displaying torque, rpm's, one level of overload, and two levels of overload of the drive system. It shall incorporate a time-delay for start-up and a voltage monitoring and compensation circuit for up to ±15 percent variation.

2. The overload device shall be housed in an enclosure with NEMA rating in accordance with the area designations of Section 16050- Basic Electrical Materials and Methods. A visual torque dial shall be provided and oriented so that it can be easily read from the walkway.

3. The torque monitoring system shall be calibrated to: alarm and shut down the system in the event the torque drops to 50 percent of normal running; alarm at 85 percent of maximum continuous running torque and shut down the motor at maximum continuous running torque of the equipment. The system shall be calibrated at the factory of the equipment manufacturer and it shall be capable of monitoring twice the maximum continuous running torque of the equipment.

B. Manufacturers, or equal:

1. American Autogard Corporation;
2. Ferguson Enterprises, Inc.

PART 3 -- EXECUTION

3.1 PROTECTION

A. Box, crated, or otherwise completely enclosed and protected during shipment, handling and storage in accordance with the manufacturer's recommendations.

1. Protect equipment from exposure to the elements. Keep thoroughly dry and clean at all times.

2. Store pumps, blowers, motors, electrical equipment, and other equipment having anti-friction or sleeve bearings in weathertight storage facilities such as warehouses. Turn shafts during storage as recommended by the manufacturer to prevent bearing set.

3. Clean and restore all materials and equipment showing evidence of rust, dirt contamination, or other surface or subsurface deterioration to the Engineer's satisfaction before installation.

B. Protect painted surfaces against impact, abrasion, discoloration, and other damage.

1 Repaint and repair damaged surfaces to the satisfaction of the RESIDENT ENGINEER before acceptance in accordance with the requirements of Section 09800 - Protective Coating.

C. Protect electrical equipment, controls, and insulation against moisture or water damage.

D. The CONTRACTOR shall maintain equipment storage facilities in accordance with the provisions of Section 01600 - Materials and Equipment.

E. Store all equipment in the designated storage facilities from delivery until installation.

F. Periodically exercise all mechanical equipment, whether in the CONTRACTOR's designated storage facility before final installation, or whether installed, but not yet placed into service or accepted by the OWNER, in accordance with procedures prescribed by each manufacturer.

3.2 EQUIPMENT INSTALLATION

A. Install all equipment in full accordance with the equipment manufacturer's recommendations and good practice.

1. Where specified in other sections of this specification, factory-trained service personnel shall be on-site to supervise the installation.

2. Sufficient notice shall be given to the Engineer before equipment installation in order that the Engineer or his representative may be present during installation.

B. General installation requirements:

1. Examine equipment for damage in shipping and handling. The examination shall include checking for corrosion, poor workmanship, dirt or deleterious substances, and poor fits.

2 Level the base plate or bedplate.

3. Install equipment.

4. Check alignment of couplings.

5. If grout has been used, check alignment and levelness after the grout has set.

6. Check direction of rotation and correct, if necessary, to insure proper operation.

7. Provide drain lines from all equipment gland leakage housings, seal water openings, spent cooling water outlets, and strainers to nearest floor drain or point of disposal. Blow-down valves shall be provided on all strainers whether or not shown on the drawings.

8. Ensure that all submerged or intermittently submerged powered equipment does not have power and control cable splices of any kind inside wells or pits.

9. Include oil and grease for equipment lubrication in initial operation.

3.3 PLACING EQUIPMENT IN OPERATION

A. Before being placed in operation, equipment shall be inspected by the manufacturer's factory-trained personnel.

1. Correct all defects discovered during this inspection before initial equipment start-up.

2. Remove internal coatings applied at the factory if required.

3. Lubricate equipment per manufacturer's recommendations and ensure operating levels are correct.

B. Conduct full-load operations test in the presence of the RESIDENT ENGINEER and the results of such tests shall be recorded.

1. Unsatisfactory performance shall be corrected and tests shall be repeated until the equipment performance meets the Specifications.

2. The CONTRACTOR shall furnish all power, materials, services, test equipment and labor required to successfully complete all full load equipment testing specified.

3. The CONTRACTOR shall certify in writing to the RESIDENT ENGINEER, in triplicate, that al tests were conducted in accordance with these Specifications and that all components within each system successfully function as required.

C. The CONTRACTOR shall notify the RESIDENT ENGINEER 10 calendar days in advance of the time when the equipment will be placed into operation.

D. During the course of initial operation, the CONTRACTOR shall instruct the OWNER's personnel in the proper operation and maintenance of the equipment, as specified herein.

3.4 COUPLINGS

A. The CONTRACTOR shall have the equipment manufacturer select or recommend the size and type of coupling required to suit each specific application; installation shall be per equipment manufacturer's printed recommendations.

3.5 INSULATING CONNECTIONS

A. All insulating connections shall be installed in accordance with the manufacturer's printed instructions.

3.6 PIPE HANGERS, SUPPORTS, AND GUIDES

A. Hangers, supports, seismic bracing and guides shall be spaced in accordance with ANSI/ASME B.31.1 standard, and with tables in Section 15020 - Pipe Supports.

3.7 PACKAGED EQUIPMENT

A. When any system is furnished as pre-packaged equipment, the CONTRACTOR shall coordinate with subcontractors all necessary space and structural requirements, clearances, utility connections, signals, and outputs.

3.8 INSTALLATION CHECK

A. Provide an experienced, competent, and authorized representative of the manufacturer or supplier of each major item of equipment, as specified in Divisions 11, 13 14 15 and 16 of these specifications, to check adjust if necessary, and approve the equipment installation.

1. In each case, the equipment supplier's representative shall be present when the equipment is placed in operation.

2. The CONTRACTOR shall have the equipment supplier's representative revisit the job site as often as necessary until al problems are corrected and the equipment installation and operation is satisfactory to the RESIDENT ENGINEER.

B. Each equipment supplier's representative shall furnish through the CONTRACTOR, a written report certifying that the equipment:

1. has been properly installed and lubricated;

2. is in accurate alignment;

3. is free from all stress imposed by connecting piping or anchor bolts;

4. has been operated successfully under full load conditions for a 24-hour period without interruption; and

5. is ready for continuous operation under specified conditions.

C. Equipment manufacturers shall furnish the services of competent, factory-trained personnel during the warranty period specified to inspect, service, and repair the equipment where required.

1. Service requests shall be answered and acted upon promptly.

2. This requirement shall not include normal maintenance and service of equipment, which will be the responsibility of the OWNER.

D. All costs for this work shall be included in the price bid by the CONTRACTOR.

*** END OF SECTION ***

SECTION 11033

VARIABLE FREQUENCY DRIVES

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide pulse width modulated (PWM) variable frequency drive (VFD) units with motor, controls, and accessories. The VFDs specified herein shall be mounted in Motor Control Centers as depicted on the Drawings.

B. The Work requires that one OWNER-approved manufacturer be given responsibility for furnishing the indicated Work but without altering the CONTRACTOR's responsibilities under the Contract Documents.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 13300 Instrumentation and Control
2. Section 16040 Electric Motors
3. Section 16050 Basic Electrical Materials and Methods
4. Section 16431 Short Circuit and Coordination Report
5. Section 16480 Motor Control Center
6. Section 16950 Electrical Tests

1.3 CODES

A. The Work of this Section shall comply with the current edition of NFPA 70, National Electrical Code (NEC), as adopted by the City of San Diego.

1.4 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated, the current edition of IEEE Standard 519, Guide for Harmonic Control and Reactive Compensation of Static Power Converters, applies to the Work of this Section.

1.5 CONTRACTOR SUBMITTALS

A. General: The CONTRACTOR shall furnish submittals in accordance with Section 01300 Submittals, except that shop drawing information for the drives shall be submitted as part of the drawing information for the driven equipment.

B. Shop Drawings: Shop drawings shall include the following information:

1. Equipment Information:

a. Name of drive manufacturer
b. Type and model

c. Assembly drawing and nomenclature
d. Maximum heat dissipation capacity in kW

2. Written description of ladder diagram operation, system operation, and analog signal processing.

3. Calculation of VFD/motor efficiencies at 50, 75, and 100% speed. The system efficiency shall include power losses from the cooling system, controls, contactors, isolation transformers (if required), line reactors, and harmonic filters.

4. System block diagram, system schematic diagram, and interconnection diagrams

5. Enclosure outline and seismic support calculations stamped and signed by a

6. Structural Engineer registered in California.

7. Factory test data certifying compliance with requirements of similar equipment from the same manufacturer.

8. Justification for any proposed exception taken to the requirements of this Section. Exceptions shall be in bold letters and be underlined.

C. The CONTRACTOR shall submit the following documentation in accordance with Section 01730 - Operations and Maintenance Information:

1. Manufacturer's 1-year warranty
2. Harmonic analysis report

D. Spare Parts List: The CONTRACTOR shall submit the list of spare parts recommended by the drive manufacturer.

1.6 SERVICES OF MANUFACTURER

A. Inspection, Startup and Field Adjustment: An authorized service representative of the manufacturer shall visit the site to perform the following services:

1. Verify proper installation of the equipment.
2. Inspection, checking and adjusting the equipment.
3. Startup and field testing of the VFD controller.

B. Instruction of OWNER's Personnel: The authorized service representative shall instruct the OWNER's personnel in all aspects of drive operation and maintenance, including step-by-step troubleshooting procedures with necessary test equipment. Instruction shall be provided for a maximum of 6 personnel for 3 days.

PART 2 -- PRODUCTS

2.1 PRE-APPROVED VFD MANUFACTURERS

A. VFDs from the following manufacturers, or equal, are pre-approved:

1. Eaton Cutler-Hammer
2. Or equal

2.2 QUALIFICATIONS, APPROVAL, AND DOCUMENTATION OF VFD MANUFACTURER'S NOT PRE-APPROVED

A. Procedures: The procedure for the review of VFD manufacturers that are not pre-approved is defined herein.

B. Approval: If the CONTRACTOR proposes a manufacturer that is not pre-approved, the CONTRACTOR shall submit the name and documented qualifications of the proposed manufacturer. The RESIDENT ENGINEER will review the CONTRACTOR's proposed selection. If the RESIDENT ENGINEER does not approve the proposed selection, the CONTRACTOR shall select one of the pre-approved manufacturers listed above at no additional cost to the OWNER.

C. Documentation to be Submitted by the Manufacturer:

1. A list of at least three PWM variable frequency drive installation of this type, voltage and similar horsepower operating successfully. The VFD manufacturer shall have performed system engineering, including harmonic filter and power factor correction calculations, system fabrication and installation, documentation (including schematic, wiring and panel assembly drawings), field testing, calibration and startup, operator instruction, and maintenance training. In addition, the list shall include the following information for each project:
   a. Name of facility, owner, contact name, and telephone number.
   b. Name and type of drive equipment, including horsepower, voltage, speed range, and application.
   c. Drive system furnished (12-step etc.).
2. The names and qualifications of manufacturer's representatives who will be responsible for the following:
   a. Office engineering
   b. Project management
   c. Field testing, calibration, startup
   d. Operator training
3. A letter certifying that the manufacturer's representatives have read and studied the Contract Documents and agreed to the requirements of this Section.

2.3 SYSTEM PUMP DRIVES

A. General:

1. Number of drive units -6
2. Driven equipment –P-102, P-103, P-201, P-202, P-203
3. Driven equipment specification -Section 11214 Vertical Turbine Pumps
4. Drive voltage -460 V

B. Service Conditions: The VFD shall be designed and constructed to operate within the following service conditions:

1. Elevation –up to 3300 feet
2. Ambient Temperature Range -32 to 122 degrees F
3. Atmosphere -Noncondensing relative humidity to 95%
4. AC Line Voltage Variation --5% to +10%
5. AC Line Frequency Variation -+ 3 Hz

C. Operating Conditions:

1. Minimum VFD efficiency shall be 95% at 100% speed and 100% torque and 87% at 60% speed based on nominal 1800 RPM motor with load horsepower to vary as cube of speed.

2. Distribution voltage shall be 480 V, three phase, three wire, 60 Hz as indicated for the Motor Control Center.

3. Total harmonic voltage and current distortion with filtration shall be not more than the specified limits in IEEE Standard 519, 1992. For the purpose of harmonic calculations, unless specified otherwise, a power system short circuit ratio of 10 shall be assumed with all VFDs operating at maximum speed and maximum load. The point of common coupling for all harmonic calculations shall be defined as the primary connection of each VFD, unless specified otherwise.

4. Notching area, as defined by IEEE 519, shall be not more than 22,800 volt-microseconds. Notch depth shall not exceed 10% of normal peak voltage for line-toneutral observations.

2.4 GENERAL

A. Basic Description: The VFD shall consist of three sections: converter, inductor and inverter. These sections shall be grouped into separate sections with each section modularized for ease of troubleshooting. All SCRs in the converter and inverter sections will be standard rectifier grade devices containing the SCR manufacturer's standard catalog numbers such that they can be readily cross-referenced and interchanged with other SCR manufacturer's devices. SCR catalog numbers must be submitted as part of the submittal package. No fast switching SCRs will be allowed.

1. Converter: The converter section shall be a full wave, phase controlled, three-phase converter to change the input AC power to DC power. The output of the converter shall feed an inductor and the converter/inductor combination shall form a current source whose output is regulated and limited. The current limit feature of the converter shall be sufficiently fast and effective so as to protect against a sudden or random application of a short circuit to the output terminals of the current source.

2. Inverter: The inverter section shall convert the DC power of the current source to adjustable frequency power to the motor. The VFD shall not induce excessive power losses in the motor. The worst case RMS motor line current measured at rated speed, torque and voltage shall not exceed 1.05 times the rated RMS motor current for pure sine wave operation.

3. Inductor: The drive shall contain an input AC reactor to allow the VFD to operate properly without an isolation transformer. The reactor shall attenuate the commutation notches generated by the VFD. The line reactor shall be mounted and wired within the drive enclosure.

4. Power Bridges: The power bridge shall utilize an SCR configuration to provide a 12 pulse waveform to minimize harmonics on the main AC power line. The power bridge must be fed by a transformer with a second winding phase shifted 30 degrees electrically.

5. Isolation Contactor: The isolation contactor shall be a NEMA rated contactor sized as required for the load served. Contactor shall be full voltage, 3-pole, 600 volt AC, NEMA size 1 minimum. Contacts shall be double break, silver-cadmium oxide, and weld resistant. Contacts shall be isolated to prevent arcing. Coils and magnets shall be capable of being removed without special tools.

6. All remaining system components including auxiliary contacts, overload relay and ground fault protection shall be as specified in 16480 – Motor Control Center.

B. The motor shall be squirrel-cage induction design in accordance with Section 16040 Electric Motors, suitable for variable speed operation with the following additional features:

1. Copper windings.
2. One (1) Bimetalic temperature switch per winding.
3. Class F insulation (Class B rise).
4. 120-V space heaters.
5. High efficiency.
6. Inverter Duty
7. Operating voltage: 480 V

C. Basic Features: The controller(s) shall be suitable for use with any standard NEMA-B squirrel-cage induction motor(s) having a 1.15 service factor or with existing standard NEMA-B squirrel-cage induction motor(s) with nameplate data as indicated. The controller shall have the following basic features:1. The

1. Motor Control Center door of each power unit shall include

   a. Input circuit breaker disconnect switch handle integrally interlocked with power unit door.

   b. One manual speed control potentiometer.

   c. One 3-position mode selector switch marked "HAND-OFF-AUTOMATIC".

   d. One 2-positon selector switch marked "VFD-BYPASS"

   e. A " Power On" light.

   f. A speed indicating meter with a range of 0 to 110% of full speed.

   g. One elapsed time meter with five digits, without reset.

   h. One VFD fault reset pushbutton.

   i. One ammeter with a range of 0 to 125% of drive current rating.

   j. One output voltmeter with a range of [0 - 600 V

   k. VFD fault diagnostics.

   l. Indicating lights to show running and ready status.

   m. Other indicating lights as shown on Drawings

2. Switches in the door shall control the drive as follows:

   a. With the "HAND-OFF-AUTOMATIC" switch in the "HAND" position, and the "VFD-BYPASS" switch in the VFD position, the drive output speed shall be controlled by the manual potentiometer.

   b. With the "HAND-OFF-AUTOMATIC" switch in the "AUTOMATIC" position, the drive shall start when an external isolated contact closes and its speed shall be controlled by a 4-20 mA external reference signal.

   c. With the "HAND-OFF-AUTOMATIC" switch in the "HAND" position, and the "VFD-BYPASS" switch in the BYPASS position, the driven equipment is started at full speed.

3. The VFD shall be selectable to provide automatic restart after a trip condition resulting from overcurrent, overvoltage, undervoltage, or over-temperature. For safety, the drive shall shut down and require manual reset and restart if the automatic reset/restart function is not successful within a maximum of three attempts within a short time period.

4. Speed Profile: Individual adjustable settings for start, stop, entry, slope, and minimum and maximum speed points. Speed reference shall be from an external 4 to 20 mA DC signal.

5. Control Circuit: Fused 120 VAC control transformer and control relays for system logic functions. For system logic, see electrical drawings.

6. Provision for an external 4 to 20 mA DC speed reference input signal. VFD manufacturer shall provide a signal current isolator to ensure signal and galvanic isolation of the grounded or ungrounded input speed reference signal. Where indicated, a frequency proportional 4 to 20 mA powered output signal shall be provided for external use and wired out to terminals.

7. Status and alarm outputs, each consisting of SPDT electrically isolated auxiliary contacts rated 10 A at 120 VAC.

   a. Alarm output shall consist of:

      (1) Output or input under-voltage.
      (2) SCR over-temperature.
      (3) Instantaneous overcurrent.
      (4) Commutation failure.
      (5) Convertor saturation.
      (6) Current limit timeout.
      (7) Incorrect phase sequence or control power failure.

   b. VFD failure, motor overtemp failure, and other alarm conditions as shown on the electrical control diagrams shall latch in the trip mode and shall require operator intervention to reset.

   c. Status and alarm outputs shall be as required by the electrical control diagrams.

8. Adjustable minimum to maximum frequency limits of 30 to 66 Hz.

9. Independent timed linear acceleration and deceleration functions, adjustable from 4 to 300 seconds.

10. Terminal blocks for wires entering and leaving the VFD unit. Terminals shall be identified with alpha- numeric characters identical to the terminal identifiers indicated on the schematic and connection diagrams.

11 Frequency regulator to operate within the following tolerances:

   a. Frequency regulator span shall be 4 mA at minimum speed and 20 mA at maximum speed.

   b. Frequency regulator accuracy shall be within 1.0% of span.

   c. Frequency regulator deadband shall be within 0.5% of span.

   d. Frequency regulator repeatability shall be within 0.5% of span.

   e. Frequency reference signal input resistance shall be 0 to 550 ohms.

2.5 ENCLOSURE

A. The VFDs shall be mounted in the motor control center specified in specification Section 16480.

2.6 PROTECTIVE FEATURES AND CIRCUITS

A. The controller shall include the following protective features:

1. Static instantaneous overcurrent and overvoltage trip.

2. Power loss and undervoltage protection.

3. Power unit over-temperature protection.

4. Electronic motor inverse time overload protection.

5. The VFD shall be capable of transient operation with a line voltage dip of 15% of normal operating voltage on a variable torque load. During line dip, the VFD shall automatically provide a speed droop limiting maximum capable speed for the duration of the input voltage dip.

6. When power is restored after a complete power outage, the VFD shall be capable of catching the motor while it is still spinning and restoring it to proper operating speed.

B. The VFD system shall include distribution class arrestors to protect the VFD against voltage surges. The VFD shall include power fuses on the input to the converter rectifier.

C. The power circuit design shall be such that the following fault conditions can occur without damage to the power circuit components:

1. Single phase fault or three-phase short circuit on VFD output terminals.

2. Failure to commutate inverter SCR due to severe overload or other conditions.

3. Opening of VFD output contactor or motor disconnect switch during VFD operation.

4. Loss of input power due to opening of VFD input disconnect device or utility power failure during VFD operation.

5. Loss of one phase of input power.

D. Drive shall be provided with a main circuit breaker, mechanically interlocked with the drive motor control center cubicle door. Interlock shall be provided with defeater. Circuit breaker shall be as specified in specification section 16480.

2.7 CONTROL DEVICES

A. Pilot devices and instruments shall be flush mounted on a VFD unit door. Pilot devices and relays shall be as specified in specification section 16485.

2.8 DIAGNOSTICS

A. The VFD shall include a microprocessor based digital diagnostic system which monitors its own control functions and displays faults and operating conditions.

2.9 POWER FACTOR

A. The collective power factor of the VFD and the motor, when running at full load amps, shall not be less than 0.95.

2.10 AIR COOLING REQUIREMENTS

A. Air cooled VFDs shall be provided with 50% redundant fans for enhanced reliability. The drive shall have air flow detection switches to monitor the proper operation of the system and notify the operator of the blower system failure.

2.11 SPARE PARTS

A. Spare Parts: Furnish the following spare parts for each VFD:

1. One (1) printed circuit board of each type used.
2. One (1) complete SCR bridge phase cell with snubbers.
3. Two (2) spare SCRs.
4. Two (2) spare diodes.
5. Five (5) spare light bulbs of each type used.
6. Three (3) spare fuses of each type used.
7. Two (2) spare relays of each type used.
8. Two (2) cans of aerosol spray touch-up paint.

2.12 FACTORY TESTING

A. Component Tests:

1. All components shall be 100% tested. Components shall be burned-in for 24 hours at 125 degrees F and retested to detect any drift. All printed circuit boards shall be burned-in continuously for 24 hours at 149 degrees F. The printed circuit boards shall be tested after burn-in to ensure they are functioning within specification. Every thyristor shall have the following critical parameters tested at rated current: gating, turn-on, turn-off, high temperature, forward blocking, reverse blocking, and waveform characteristics. All assembled phase cells shall be tested for cell balance at rated voltage, maximum current, maximum dV/dT and maximum dI/dT.

2. Control power shall be applied to microprocessors, printed circuit boards, diagnostic boards and similar devices including software to test for proper operation, sequencing, logic, and diagnostics.

3. All wiring shall be checked for continuity and for compliance with the wiring diagrams.

B. System Tests: Testing shall proceed in the order given below. For the motor test and the combined drive and motor test, submit a sketch of the proposed test setup, along with a description of the proposed testing procedure to the RESIDENT ENGINEER for acceptance at least 10 weeks in advance of the proposed testing date. No tests shall be performed until the test procedure meets with the RESIDENT ENGINEER's approval. In addition, furnish the RESIDENT ENGINEER with at least 4 weeks advance written notice of the date and location of the system tests. The OWNER and the RESIDENT ENGINEER (at the option of either or both) reserve the right to witness the system tests.

1. Horizontal Motor Test:

   a. Each variable frequency drive, along with the actual AC horizontal motor to be provided, shall be tested with the system logic and a dynamometer load coupled to simulate field operation conditions and be given complete factory tests at 25, 50, and 100% full load current.

   b. After dynamometer tests are complete, the VFD shall be load-tested in a heat room maintained at 122 degrees F for 24 hours. The motor shall be cyclically loaded via the dynamometer as follows:

      (1) 100% full load current for 6 hours
      (2) 75% full load current for 6 hours
      (3) 50% full load current for 6 hours
      (4) 100% full load current for 6 hours

   c. Failure of a SCR or other major components during this test requires repair and commencement of a new test. Motor and dynamometer need not be in the elevated temperature room with the VFD.

2. Vertical Motor Test: In the case of vertical motors, tests shall be identical to the ones required for horizontal motor except an electrically equivalent horizontal motor may be substituted for the actual vertical drive motor.

3. Harmonic Analysis for All Drives: Harmonic analysis shall be performed at unit full load using an harmonic analyzer by Hewlett Packard, or equal. Results shall be corrected for a source impedance delineated in terms of noncontributing short circuit amps listed below and shall be listed in a report. Tests shall prove that sufficient filtering has been provided to limit the harmonic distortion to a magnitude of 5% of the fundamental. The report shall include the following:

   a. Expected harmonic components through the 49th harmonic, calculated with and without harmonic filtering.

   b. RMS value of THD expected.

   c. Drive Number Short Circuit Amps

PART 3 -- EXECUTION

3.1 INSTALLATION

A. VFDs shall be installed in accordance with manufacturer's recommendations.

B. Inspection, field adjustment and startup services shall be provided by manufacturer's service representative in accordance with Subsection 11033-1.6.

3.2 FIELD TESTING

A. Field testing shall be performed in accordance with Section 16950 - Electrical Tests.

*** END OF SECTION ***

SECTION 11175

PUMPS, GENERAL

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide all pumps and pumping appurtenances, complete and operable, in accordance with the Contract Documents. The provisions of this Section shall apply to all pumps and pumping equipment except where otherwise indicated in the Contract Documents.

B. Unit Responsibility: A single manufacturer shall be responsible for furnishing the Work and for coordination of design, assembly, testing, and installation of the Work of each pump Section; however, the CONTRACTOR shall be responsible for compliance with the requirements of the individual pump Sections. Unless otherwise indicated, the single manufacturer shall be the manufacturer of the pump. Where two or more pump systems of the same type or size are required, the pumps shall all be produced by the same manufacturer.

C. Examination of Site Conditions: The supplier shall examine the site conditions, intended applications, and operation of the pumping system and recommend the pump which will satisfy the indicated requirement.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 11000 Equipment General Provisions
2 Section 11214 Vertical Turbine Pumps
3. Section 16040 Electric Motors

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated, the current editions of the following standards apply to the work of this Section:

1.	ANSI/ASME B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800
2.	ANSI/ASME B16.5	Pipe Flanges and Flanged Fittings Dimensions
3.	ANSI/IEEE 112	Test Procedure for Polyphase Induction Motors and Generators
4.	ANSI/IEEE 115	Test Procedure for Synchronous Machines

5.	ASTM A278	Gray Iron Castings for Pressure-Containing Parts for Temperatures Up to 650°F
6.	ASTM A395	Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures
7.	ASTM B62	Composition Bronze or Ounce Metal Castings
8.	ASTM B584	Copper Alloy Sand Castings for General Applications
9.	Hydraulic Institute, Inc. (HI)	Test Code for Centrifugal Pumps

1.4 CONTRACTOR SUBMITTALS

A. General: CONTRACTOR submittals shall be furnished in accordance with Section 01300 - Submittals and Section 11000 - Equipment General Provisions.

B. Shop Drawings: Shop drawings and pump data sheets shall include the following information:

1. Pump name, identification number, and specification Section number.

2. Performance data curves showing head, capacity, horsepower demand, net positive suction head required (NPSHR), minimum submergence (for vertical turbine pumps), and pump efficiency over the entire operating range of the pump. The equipment manufacturer shall indicate separately the head, capacity, horsepower demand, overall efficiency, NPSHR, and minimum submergence (for vertical turbine pumps) required at the design flow conditions and the maximum and minimum flow conditions. A family of performance curves at intervals of 100 rpm from minimum speed to maximum speed shall be provided for each centrifugal pump equipped with a variable speed drive. For fixed speed driven pumps, the family of performance curves shall cover maximum diameter, rated and minimum diameter impellers.

3. Limits shall be indicated on the performance curves recommended for stable operation without cavitation or excessive vibration. The stable operating range shall be as wide as possible based on actual hydraulic and mechanical tests.

4. Assembly and installation drawings including shaft size, seal, coupling, bearings, anchor bolt plan, part nomenclature, bill or materials, outline dimensions, and shipping weights.

5. Data in accordance with Section 16040 - Electric Motors, for the electric motor proposed for each pump.

6. Elevation of proposed local control panel showing panel-mounted devices, details of enclosure type, single line diagram of power distribution, and current draw of panel, and list of all terminals required to receive inputs or to transmit outputs from the Local Control Panel.

7. Wiring diagram of field connections with identification of terminations between Local Control Panels, junction terminal boxes, and equipment items.

8. Complete electrical schematic diagram.

9. Completed pump data sheets.

C. Operations and Maintenance Information: The CONTRACTOR shall submit information on pumps in accordance with the requirements of Section 01730- Operations and Maintenance Information.

D. Spare Parts List: The CONTRACTOR shall submit a Spare Parts List that contains the required information for each pump Section.

E. Factory Test Data: The CONTRACTOR shall submit signed, dated, and certified factory test data for each pump system which requires factory testing, submitted before shipment of the equipment.

F. Certifications: The CONTRACTOR shall submit the following certifications:

1. Manufacturer's certification of proper installation.
2. CONTRACTOR's certification of satisfactory field testing.

PART 2 -- PRODUCTS

2.1 GENERAL

A. General: Compliance with the requirements of the individual pump Sections may necessitate modifications to the manufacturer's standard equipment.

B. Performance Curves: All centrifugal pumps shall have a continuously rising curve of at least 10%. The required horsepower at any point on the performance curve shall not exceed the rated nameplate horsepower of the motor or engine. Encroachment into the service factor is only permitted on motors 150 hp and larger.

C. Compatibility: All components of each pump system provided under the pump Sections shall be entirely compatible. Each unit of pumping equipment shall incorporate all basic mechanisms, couplings, electric motors, variable speed controls if required, necessary mountings, and appurtenances.

D. Pump Rating: The pump rated and normal flows shall straddle the pumps best efficiency point (BEP).

E. Parallel Operation: Where parallel operation of pumps is required, the deviation in differential head at any given flow rate shall not exceed 2% between any two pumps. Performance test data must corroborate this requirement.

F. Net Positive Suction Head Available: The net positive suction head available (NPSHA) shall exceed the NPSHR by a minimum of 3 feet at the rated condition.

2.2 MATERIALS

A. All materials shall be suitable for the intended application; materials not specified shall be high-grade, standard commercial quality, free from all defects and imperfection that might affect the serviceability of the product for the purpose for which it is intended, and shall conform to the following requirements:

1. Cast iron pump casings and bowls shall be either close-grained gray cast iron or ductile iron, conforming to ASTM A278 Class 30, or ASTM A395 respectively.

2. Bronze pump impellers shall conform to ASTM B62, or ASTM B584, where dezincification does not exist.

3. Pump shafts shall be constructed from materials identified under the respective pump types. Miscellaneous stainless steel parts shall be of Type 316.

4. All anchor bolts, nuts, and washers shall be Type 316 stainless steel.

2.3 PUMP COMPONENTS - GENERAL

A. Flanges: Suction and discharge flanges shall conform to ANSI/ASME B16.1, Suction - Class 125, Discharge – Class 250

B. Lubrication: Vertical pump shafts of clean water pumps shall be product water-lubricated, unless otherwise specified. Deep-well pumps and pumps with dry barrels shall have water- or oil-lubricated bearings seals with enclosed lineshafts. Horizontal pumps shall be lubricated with either oil or grease.

C. Handholes: Handholes on pump casings shall be shaped to follow the contours of the casing to avoid any obstructions in the water passage.

D. Drains: All gland seals, air valves, cooling water drains, and drains from variable speed drive equipment shall be piped to the nearest floor sink, or drain, with galvanized steel pipe or copper tube, properly supported with brackets.

E. Grease Lubrication: For all vertical turbine pumps of bowl sizes 10 inches and larger, the CONTRACTOR shall provide a stainless steel tube attached to the column for grease lubrication of the bottom bearing.

F. Seal Chambers: Where seal chambers are indicated for the pump seal, they shall be of the best quality, using the Manufacturer's suggested materials best suited for the specific application. For drainage and liquids containing sediments, the seals shall be fresh-water flushed, using lantern rings.

1. Unless otherwise specified, the packing material shall be interlaced Teflon braiding, containing 50% ultrafine graphite impregnation to satisfy the following:

a.	Shaft speeds	-	up to 2500 fpm
b.	Temperature	-	up to 500 degrees F
c.	pH range	-	0 to 14

2. If fresh water is not available, the seal shall be flushed with product water cleaned by a solids separator as manufactured by John Crane Co., Lakos (Claude Laval Corp.), or equal.

G. Mechanical Seals: Mechanical seals shall be fresh water-flushed unless indicated otherwise, in which case product water shall be used and shall be cleaned by a solids separator. Mechanical seals for hot and cold water pumps shall be single seals manufactured by Flowserve, Type I, 21 or Type L, or equal.

H. Seal Buffer Fluid: The seal buffer fluid must be supplied at a minimum 20 psi above seal chamber pressure in order to maintain reliable seal performance.

I. Mechanical Seal Features: Mechanical seals for all services shall be equipped with nonclogging, single coil springs and nonsliding, internal, secondary elastomers. Metal parts shall be Type 316 stainless steel, Alloy 20, or Hastelloy B or C.

J. Bearing Temperatures: The bearing temperature at the worst loading condition and ambient temperature shall not exceed 150 degrees F.

2.4 PUMP APPURTENANCES

A. Nameplates: Each pump shall be equipped with a Type 316 stainless steel nameplate indicating serial numbers, rated head and flow, impeller size, pump speed, and Manufacturer's name and model number.

B. Solenoid Valves: The pump manufacturer, when required, shall provide solenoid valves on the flushing water or oil lubrication lines. Solenoid valve electrical ratings shall be compatible with the motor control voltage.

C. Gauges:

1. All pumps (including sump pumps) shall be equipped with pressure gauges installed in pump suction and discharge lines. Pump suction lines shall be provided with compound gauges. Gauges shall be located in a representative location, where not subject to shock or vibrations, in order to achieve true and accurate readings.

2. Where subject to shock or vibrations, the gauges shall be wall-mounted or attached to galvanized channel floor stands and connected by means of flexible connectors.

3. Pressure and compound gauges shall be provided in accordance with Section 13334 - Pressure Measuring Systems.

4. Gauge ranges shall be selected upon achieving utilization of 50-70% of the range for the rated conditions.

2.5 FACTORY TESTING

A. Inspection and Testing Costs: The CONTRACTOR shall be responsible for all costs associated with inspection and testing of materials, products, or equipment at the place of manufacture. This shall include costs for travel, meals, lodging, and car rental, and 10 minutes per day of long distance phone calls to San Diego for an OWNER-designated inspector as required to complete such inspections or observations, exclusive of travel days, if the place of manufacture, fabrication and factory testing is more than 50 miles outside the geographical limit of the City. If the manufacturing plant operates a double shift, the costs of an additional OWNER-designated inspector shall be included in the inspection costs. At the option of the OWNER, full-time inspection will continue for the length of the manufacturing period. If the manufacturing period exceeds three consecutive weeks, the expenses of one 2-day trip per month by the OWNER's supervisor shall be included. The CONTRACTOR shall not be responsible for salary or salary-related costs of the OWNER-designated inspectors and supervisors.

B. Testing: The following tests shall be conducted on each indicated pump system:

1. Motors: All motors of sizes 100 hp and larger shall be assembled, tested, and certified at the motor factory and the working clearances checked to insure that all parts are properly fitted. The tests shall be in accordance with ANSI/IEEE 112 and ANSI/IEEE 115, including heat run and efficiency tests. All computations shall be recorded and certified and dated copies of the test results shall be furnished.

2. Pump Systems: All centrifugal pump systems 10 hp and larger shall be tested at the pump factory in accordance with the Test Code for Centrifugal Pumps of the Standards of the Hydraulic Institute, Inc. Tests shall be performed using the complete pump system to be furnished, including the motor. Calibration certificates for the motor(s) shall be provided to the pump manufacturer. For motors smaller than 100 hp, the pump manufacturer's certified shop motor shall be acceptable. Testing of prototype models will not be acceptable. The following minimum test data shall be submitted:

   a. Hydrostatic test data (30 minutes at 1.5 times the maximum allowable working pressure (MAWP)

   b. A minimum of six hydraulic test readings shall be taken between shutoff and 125% of the BEP. Two of these points shall be the normal and rated capacities.

   c. Pump curves showing head, flow, bhp, efficiency, and NPSHR.

   d. Certification that the pump horsepower demand did not exceed the rated nameplate motor hp at any point on the curve (for motors under 150 hp).

3. Test tolerances for the performance testing shall be as follows based on the total dynamic head (TDH) range:

TDH Range (feet)	Rated Point	Shutoff
0-500	+5, -2%	±8%
501-1000	+3, -2%	±6%

4. Vibration Limits:

   a. For pumps over 200 hp with sleeve bearings and sensing proximity probes: the maximum allowable overall shaft vibration (at maximum speed) shall not exceed 2.0 mils peak-to-peak throughout the full operating range. The maximum allowable transient shaft vibration shall be 3.5 mils peak-to-peak throughout the normal startup and shutdown speed range. These vibration values do not include shaft surface runout (electrical and mechanical) sensed by the probes. The maximum allowable shaft runout (roll speeds of less than 100 rpm) shall be less than 0.25 mils.

   b. The maximum allowable bearing housing vibration at full operating speed shall not exceed 0.12 IPS RMS (whichever is smaller) throughout the normal operating flow range. The maximum allowable transient bearing housing vibration shall be 0.05 IPS zero to peak throughout the normal startup and shutdown speed range.

   c. The machinery shall not exhibit unusual or abnormal frequency components when measured on either the shaft or the casing. Normal frequency components are defined as excitations such as rotational speed or blade passing frequency that are inherent with the mechanical construction of the machinery. Unusual or abnormal frequency components are excitations that are nonsynchronous or not related to the known geometry of the machinery. All vibration measurements taken during the performance testing shall utilize the project vibration instrument (when furnished).

5. Factory Witnessed Tests: All pumps, variable speed drives, and motors, 150 hp and larger shall be factory-tested as complete assembled systems and may be witnessed by the OWNER and RESIDENT ENGINEER. The use of one of each type project motor and variable frequency drive for testing all pumps shall be acceptable. The CONTRACTOR shall give the RESIDENT ENGINEER a minimum of 4 weeks notification prior to the test.

C. Acceptance: In the event of failure of any pump to meet any of the indicated requirements, the CONTRACTOR shall make all necessary modifications, repairs, or replacements to conform to the requirements of the Contract Documents and the pump shall be re-tested at no additional cost to the OWNER until found satisfactory.

PART 3 -- EXECUTION

3.1 SERVICES OF MANUFACTURER

A. Inspection, Startup, and Field Adjustment: Where required by the individual pump Sections, the manufacturer's authorized service representative shall visit the site for the number of days indicated in those Sections to witness the following and to certify in writing that the equipment and controls have been properly installed, aligned, lubricated, adjusted, and readied for operation.

1. Installation of the equipment.

2. Inspection, checking, and adjusting the equipment.

3. Startup and field testing for proper operation.

4. Performing field adjustments to ensure that the equipment installation and operation comply with the specified requirements.

B. Instruction of the OWNER's Personnel:

1. Where required by the individual pump Sections, the manufacturer's authorized training representative shall visit the site for the number of days indicated in those Sections to instruct the OWNER's personnel in the operation and maintenance of the equipment, including step-by-step troubleshooting with necessary test equipment. Instruction shall be specific to the models of equipment provided.

2. The representative shall have at least two year's experience or training. A resume for the representative shall be submitted.

3. Training shall be scheduled a minimum of three weeks in advance of the first session.

4. Proposed training material and a detailed outline of each lesson shall be submitted for review. Comments shall be incorporated into the material.

5. The training materials shall remain with the trainees.

6. The OWNER may videotape the training for later use with the OWNER's personnel.

3.2 INSTALLATION

A. General: Pumping equipment shall be installed in accordance with the manufacturer's written recommendations.

B. Alignment: All equipment shall be field tested to verify proper alignment, operation as specified, and freedom from binding, scraping, vibration, shaft runout, or other defects. Pump drive shafts shall be measured just prior to assembly to ensure correct alignment without forcing. Equipment shall be secure in position and neat in appearance.

C. Lubricants: The CONTRACTOR shall provide the necessary oil and grease for initial operation.

3.3 PROTECTIVE COATING

A. Materials and equipment shall be coated in accordance with the requirements in Section 09800 - Protective Coating.

3.4 FIELD TESTS

A. General: Where required by the individual pump Sections, each pump system shall be field tested after installation to demonstrate satisfactory operation without excessive noise, vibration, cavitation, or overheating of bearings.

B. Field Tests: The following field testing shall be conducted:

1. Startup, check, and operate the pump system over its entire speed range. Vibration shall be within the amplitude limits recommended by the Hydraulic Institute Standards at a minimum of four pumping conditions defined by the RESIDENT ENGINEER.

2. Obtain concurrent readings of motor voltage, amperage, pump suction, and pump discharge pressure for at least four pumping conditions at each pump rotational speed. Check each power lead to the motor for proper current balance.

3. Determine bearing temperatures by contact or non contact type thermometer. A run time of at least four hours shall precede this test, unless insufficient liquid volume is available.

4. Electrical and instrumentation tests shall conform to the requirements of the Sections under which that equipment is indicated.

5. Provide operational and pump efficiency test prior to final pump station acceptance. The CONTRACTOR shall subcontract with Pump Check or other qualified vendor for this service. Submit system head curves following the pump test.

C. Witnessing of Field Tests: Field testing will be witnessed by the RESIDENT ENGINEER. The CONTRACTOR shall furnish 5 days advance notice of field testing.

D. Retesting: In the event any pumping system fails to meet the test requirements, it shall be modified and retested as above until it satisfies the requirements.

E. Certification: After each pumping system has satisfied the requirements, the CONTRACTOR shall certify in writing that it has been satisfactorily tested and that all final adjustments have been made. Certification shall include the date of the field tests, a listing of all persons present during the tests, and the test data.

F. Costs of Field Tests: The CONTRACTOR shall bear all costs of field tests, including related services of the Manufacturer's representative, except for power and water which the OWNER will bear.

*** END OF SECTION ***

SECTION 11214

VERTICAL TURBINE PUMPS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section is to provide vertical turbine pumps and drives with associated piping, controls, wiring, and appurtenances, complete and operable, in accordance with the CONSTRUCTION DOCUMENTS

1.2 RELATED SECTIONS

A. Submittals: Submittals shall be furnished in accordance with Section 01300 - Submittals, and the requirements herein.

B. Shop Drawings: The CONTRACTOR shall submit the following within 30 calendar days after the commencement date stated in the Notice to Proceed with construction.

1. Experience Qualifications: A list of at least 10 vertical turbine pump installations, which meet the experience requirements, indicated below. Include the following information for each project:

a. Name of facility, owner of facility, contact name, address, and telephone number.

b. Fluid pumped, capacity, head, horsepower, and speed.

c. Pump model number and size.

d. Year installed.

e. Local Maintenance Facility Qualifications: Service facility name, address, telephone number, and name of responsible manager. Experience record of local facility.

C. CONTRACTOR shall submit the Vertical Turbine Pump Data Sheets with relevant information completed to the maximum extent possible.

D. CONTRACTOR shall submit certification from the pump manufacturer that the pump manufacturer has reviewed the submittal information for the associated variable speed drive unit, and has confirmed that it is compatible with the pump and motor being provided.

1.3 QUALIFICATION REQUIREMENTS

A. At least 10 canned vertical turbine pump installations of the same size units, or larger, as proposed for this project, shall have been in operation for at least 5 years. The pump

manufacturer shall have performed torsional analysis of pump, motor assembly, installation, start-up, and operator training instruction.

B. The manufacturer shall have a local service facility in California capable of installation, alignment, part replacement and stocking parts of pumps of the same size or larger as the units in this section.

1.4 WARRANTY

A. The pump manufacturer shall warrant the pump and motor assemblies against material and workmanship defects for a minimum period of 1 year which starts on the date of Substantial Completion of the Project. The CONTRACTOR shall submit the manufacturer's warranty document before final acceptance.

1.5 OPERATING CONDITIONS

A. Performance Requirements:

Operating Conditions - Pumps P-102, P-103 (Zone 752)

Condition A[1,4]

Capacity, gpm	370
Total head, feet	170
NPSHa, feet	50+

Condition B[2,4]

Capacity, gpm	from pump H/Q curve
Total head, feet	140
NPSHa, feet	50+

Condition C[3,4]

Capacity, gpm	from pump H/Q curve
Total head, feet	125
NPSHa, feet	50+

Operating Conditions - Pumps P-104, P-105 (Zone 752)

Condition A[1,4]

Capacity, gpm	2000
Total head, feet	180
NPSHa, feet	50+

Condition B[2,4]

Capacity, gpm	from pump H/Q curve
Total head, feet	125
NPSHa, feet	50+

Operating Conditions - Pumps P-201, P-202, P-203 (Zone 900)

Condition A[1,4]

Capacity, gpm	220
Total head, feet	180
NPSHa, feet	50+

Condition B[2,4]

Capacity, gpm	from pump H/Q curve
Total head, feet	170
NPSHa, feet	50+

Condition C[3,4]

Capacity, gpm	140
Total head, feet	175
NPSHa, feet	50+

Operating Conditions - Pumps P-204, P-205 (Zone 900)

Condition A[1,4]

Capacity, gpm	1108
Total head, feet	205
NPSHa, feet	50+

Condition B[2,4]

Capacity, gpm	from pump H/Q curve
Total head, feet	170
NPSHa, feet	50+

NOTES:

1. Condition A shall be taken as the rated, continuous-duty operating condition. Performance at the rated condition shall be guaranteed. Condition A has been selected to obtain the rated pumping capacity for the installation. It is not intended that the pumps be selected for maximum efficiency at Condition A. Pumps furnished under this section should be selected to achieve Condition A performance, but also operate continuously without objectionable vibration or cavitation at the head specified under Condition B.

2. Condition B head is presented to indicate operating conditions when the pump is operating against minimum anticipated system head, assuming a hypothetical head-capacity curve. Condition B shall be used for pump selection. Condition B shall be located within the Preferred Operating Region as established by the pump manufacturer in accordance with ANSI/HI 9.6.3 and listed in the manufacturer's published application data for the specific model proposed for this application.

3. Condition C is the anticipated continuous duty minimum speed condition. Pumps furnished under this specification shall be capable of sustained (24 hours per day) operation at this condition within the requirements. Condition C shall be located within the Preferred Operating Region as established by the pump manufacturer in accordance with ANSI/HI 9.6.3 and listed in the manufacturer's published application data for the specific model proposed for this application.

4. Total head in the above tabulation is the algebraic difference between the discharge head and suction head as defined in ANSI/HI 2.1 – 2.6 and are exclusive of pump intake, bowl, discharge column, discharge head and lineshaft losses. A curve showing these losses separately shall be provided as a part of the submittal information.

B. Design Requirements:

Equipment provided under this section shall conform to the following:

Pumps P-102, P-103 (752 Zone)

Maximum efficiency, minimum, percent[a]	
Pump	80
Impeller type	Enclosed
Piping connection size, inches, minimum	
Discharge	6
Operating speed, rpm, maximum	1800
Motor horsepower, maximum	25

Pumps P-104 and P-105 (752 Zone)

Maximum efficiency, minimum, percent[a]	
Pump	84
Impeller type	Enclosed
Piping connection size, inches, minimum	
Discharge	12
Operating speed, rpm, maximum	1800
Motor horsepower, maximum	150

Pumps P-201, P-202, P-203 (Zone 900)

Maximum efficiency, minimum, percent[a] Pump	82
Impeller type	Enclosed
Piping connection size, inches, minimum Discharge	6
Operating speed, rpm, maximum	1800
Motor horsepower, maximum	15

Pumps P-204 and P-205 (Zone 900)

Maximum efficiency, minimum, percent[a] Pump	82
Impeller type	Enclosed
Piping connection size, inches, minimum Discharge	10
Operating speed, rpm, maximum	1800
Motor horsepower, maximum	100

NOTES:

[a] The maximum efficiency is the minimum acceptable peak efficiency and is not required to coincide with any specified operating condition in paragraph 11214A-1.5. Pump efficiency shall be within 2 percent of bowl efficiency when calculated at the point of peak bowl efficiency on the pump's head/capacity curve.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Pump Data: The performance requirements for canned vertical turbine pumps shall be as determined by the ENGINEER to comply with the design criteria list in Exhibit I.

B. Pump Design, Construction, and Testing: Construction of canned vertical turbine pumps shall conform to the following requirements:

1. Type - Vertical canned turbine pump.

2.	Barrel or Can	-	Heavy duty steel, cement mortar coated in accordance with Section 09800 - Protective Coating, for mounting in concrete encasement, designed to support the unit without vibration at any operating speed. Barrel or can shall be provided by the pump manufacturer.
3.	Bowls	-	Cast-iron bowl units coated accordance with Section 09800 - Protective Coating.
4.	Impeller	-	Cast bronze (ASTM B62 or B584) statically and dynamically balanced.
5.	Wear rings	-	Bronze.
6.	Bowl Shaft	-	Type 316 stainless steel with Chromalloy (or equal) hard facing under bearing surfaces.
7.	Suction Bell	-	Cast iron bell, with bottom bearing and streamlined ribs. Lining and coating in accordance with Section 09800 - Protective Coating.
8.	Column	-	Steel pipe, not less than Schedule 30, lined and coated in accordance with Section 09800 - Protective Coating, in maximum 10-foot lengths, flanged with registered fit and through bolting.
9.	Line shaft and couplings	-	Type 316 stainless steel with Chromalloy or equal hard facing under bearing areas, in maximum 10-foot lengths, sized for a critical speed of a minimum of 20% above the maximum operating speed. Shaft runout at seal chamber shall not exceed 0.002 inches. Shaft coupling Type 304 stainless steel.
10.	Shaft lubrication	-	Product lubricated.
11.	Shaft seal	-	Mechanical.
12.	Line Shaft Bearings	-	Neoprene. Maximum center to center spacing shall be 5 feet.

13.	Discharge head	-	Fabricated steel, reinforced to withstand pipe thrust and maximum internal pressure, epoxy-lined in accordance with Section 09800 - Protective Coating, with flange, base plate, and minimum 1.25-inch, 3000-lb forged steel half-couplings for air valve, pressure switch, and drain connections.
14.	Motor shaft coupling	-	4-piece, heavy-duty adjustable spacer coupling, with registered fit, to allow for impeller adjustment. Spacer size shall permit mechanical seal removal without disturbing motor driver.
15.	Bottom bearing	-	Bronze sleeve, with Type 316 stainless steel grease tube and fitting, extended to base plate.
16.	Bowl and suction	-	Product-lubricated bronze sleeves case bearings

C. Drive:

1. Each pump shall be provided with a vertical, solid shaft, high efficiency, high thrust, 480V, 3-phase, 60 Hz, 1800 RPM, heavy duty, electric motor. Each electric motor shall be designed to accept the total, unbalanced thrust (down thrust and momentary up thrust) imposed by the pump under all operating capacities and at shutoff. Refer to Section 16040 – Electric Motors for all other requirements.

2.2 SPARE PARTS

A. Vertical turbine pumps shall be provided with the following spare parts for each pump:

1. One suction bell bearing assembly
2. One set of all bowl and discharge case bearings
3. One set of all pump shaft bearings
4. One mechanical seal
5. Two sets of all gaskets and o-rings
6. One set of special tools

2.3 MANUFACTURERS

A. Acceptable manufacturers include the following, or equal:

1. Flowserve
2. Goulds Pumps, Inc.
3. Peerless Pumps
4. Ingersoll-Dresser Pump Company
5. Johnston
6. Fairbanks Morse

PART 3 – EXECUTION

3.1 GENERAL

A. Pumping equipment shall be installed under the presence of a factory authorized installation specialist or specialists. Under no circumstances shall any installation procedures take place without the installation specialists present.

B. Pump discharges shall be connected to field piping using equipment connection fittings conforming to the requirements of Section 15000. Restraining rods on equipment connection fittings shall be designed specifically to restrain the unbalanced hydraulic thrust developed by the pump when operating at full speed against a closed valve. All restraining rod nuts shall be torqued to assure that any moment or shear transmitted to the pump nozzles is within the values permitted under ANSI/HI 9.6.2 or that permitted by the equipment manufacturer, whichever is greatest. Where ANSI/HI 9.6.2 is silent with respect to any particular aspect of allowable nozzle loads, the CONTRACTOR shall follow the written requirements provided by the equipment manufacturer.

3.2 SOLE PLATES

A. Sole plates shall be leveled in the presence of a factory authorized installation specialist to a maximum tolerance of 0.002-inches/foot in all directions. Where the equipment manufacturer requires more stringent tolerances, those tolerances shall prevail.

3.3 PUMP INLET WELLS

A. Pump inlet wells shall be installed as indicated to the following tolerances:

1.	Horizontal position:	± 0.125 inches in all directions
2.	Vertical axis:	within ½ degree from vertical
3.	Level:	0.02 inches per foot of diameter at the pump baseplate bolt circle
4.	Elevation:	± 0.125 inches from planned elevation

B. Where the equipment manufacturer requires more stringent tolerances, those tolerances shall prevail.

C. Installation of equipment in pump inlet wells shall not take place until the pump manufacturer's factory trained and authorized installation specialist has furnished the RESIDENT ENGINEER with written and signed certification that the inlet well has been installed satisfactorily and is acceptable for installation of the equipment.

3.4 ALIGNMENT

A. Journeymen millwrights shall perform alignment of equipment furnished under this section and any referencing section. Carpenters, laborers or any other trades are specifically excluded from performing this work. In locations where such trades are not available, the CONTRACTOR shall retain the services of a firm specializing in this type

of work to perform the setting and alignment work. The CONTRACTOR shall submit the qualifications of the proposed firm to the RESIDENT ENGINEER for acceptance prior to performing the work. The RESIDENT ENGINEER shall personally witness final alignment procedures for each item of equipment as a condition precedent to beginning any work required under Section 01680.

3.5 FIELD TESTING

A. Field testing shall conform to the requirements of Section 01680. For all units, the testing procedure shall be a plan developed jointly by the CONTRACTOR and the equipment manufacturer to demonstrate performance of each item of equipment at all specified operating conditions.

B. Field testing may include vibration and torsional vibration testing, as applicable.

3.6 FIELD VIBRATION

A. General:

1. Vibration shall be measured in accordance with ISO 10816 for all installed pumps. An independent testing laboratory specializing in this work, retained by the CONTRACTOR but acceptable to the RESIDENT ENGINEER, shall perform the measurements and shall submit the results directly to the RESIDENT ENGINEER.

2. The independent laboratory shall provide the services of a vibration specialist to supervise all data collection work, analysis and reporting, and who shall hold a current certificate as an ISO qualified - Level IV Vibration Analyst as recognized by the Vibration Institute. Data collection and analysis shall be conducted by the vibration specialist or may be conducted by an individual holding a current ISO Level III Vibration Analyst certificate with vibration specialist oversight.

3. The independent testing laboratory shall be fully equipped to provide continuous velocity and displacement values for all rotating equipment installed under the requirements of this section. Vibration readings shall be taken at all bearing pedestals in orthogonal radial directions and the axial direction. All vibration measurements and equipment settings should be per procedures advocated by the vibrations institute.

B. Pumps: Vibration testing equipment shall include sufficient calibrated pressure and flow monitoring devices to determine pump operating conditions as well as vibration levels. Overall (RMS) vibration velocity and discrete frequencies, when the pump is operating at any specified continuous duty operating condition, shall not exceed the limits established for the appropriate machine by Table A1 of ISO 10816-7 for In situ acceptance test for Category I or II service.

C. Pump Drive Train Components:

1. For pump drive train components such as motor/driver, flywheel and other auxiliary components, vibration limits shall be determined in accordance with ISO 10816-1, with the acceptance vibration limits per machine class, as follows:

a. 0.07 in/sec RMS for machine Class III (>75 kilowatt/100 HP) mounted on heavy, rigid foundations.

2. Axial readings shall not exceed one half any radial reading. Machines equipped with rolling element bearings shall be per ISO 10816 excluding part 7.

D. Reports: Vibration test reports shall be submitted directly to the RESIDENT ENGINEER, and shall bear the signature of the responsible vibration specialist. Vibration spectra shall be of sufficient resolution for legibility of magnitude and frequency data to be properly reviewed by the RESIDENT ENGINEER. Separate spectra shall be provided at the maximum and minimum operating speeds and any potential resonant frequencies.

*** END OF SECTION ***

SECTION 11346

SUBMERSIBLE SUMP PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: This section specifies submersible sump pumps complete with motor, discharge flange, cable, and lifting chain. Sump pump, pump control, accessories and auxiliary equipment shall be supplied by the pump manufacturer.

B. Type: Pumps shall be of the submersible, centrifugal nonclog type for use in pumping operations of maintenance wash-down utility water, general pump room drainage, and small volumes of surface drainage. The pumped liquid could contain up to 10,000 mg/l of solids, industrial solvents, and grease.

C. Equipment List:

Item	Equipment No.
Pump Room Trench Sump Pump 1	P-301
Pump Room Trench Sump Pump 2	P-302
Meter Vault Sump Pump 1	P-601
Meter Vault Sump Pump 2	P-602
Pump Room Sump Pump Control Panel	PNL-300
Meter Vault Sump Pump Control Panel	PNL-600

D. Operating Requirements: Equipment provided under this section shall conform to the following:

Equipment number	Rated capacity, gpm at BEP[a]	Design head, feet	Max. speed, rpm	Voltage and phase	Max. horsepower	Discharge pipe size, inches	Max. sphere passage, size, inches
P-301	60	12	1750	1	0.4	2	2
P-302	60	12	1750	1	0.4	2	2
P-601	65	11	1750	1	0.4	2	2
P-602	65	11	1750	1	0.4	2	2

[a] Because the pumps are to operate at constant speed, the pump shall be selected so that the rated condition lies within 5 percent (based upon capacity) of the best efficiency point (BEP) on the pump's head-capacity curve.

1.2 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

1. American Society of Testing Materials

ASTM A48	Gray Iron Castings
ASTM A276	Stainless and Heat-Resisting Steel Bars and Shapes

2. Underwriters' Laboratories

UL 674	Motors and Generators, Electric, for Use in Hazardous Locations, Class I, Groups C and D, Class II, Groups E, F, and G

1.3 ENVIRONMENTAL CONDITIONS

A. The pumps and motors shall be suitable for the service specified. Pumps and motors will be submerged for extended periods of time. The pumped fluid temperature is expected to range from 40 degrees F to 80 degrees F.

1.4 SUBMITTALS

A. The Contractor shall provide the following submittals in accordance with Section 01300:

1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The RESIDENT ENGINEER shall be the final authority for determining acceptability of requested deviations. The

remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

2. A copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked *"no changes required"*. Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.

3. Manufacturer's data including materials of construction and equipment weight.

4. Predicted performance curves developed for the specific application.

B. Motor data sheets with information completed to the maximum extent possible.

PART 2 - PRODUCTS

2.1 ACCEPTABLE PRODUCTS

A. Pumps shall be ABS Scavenger EJ Models, Hydromatic Series SP or SK Models, Weil Series 2500 or Series 2400, or equal modified to provide specified features and to meet specified operating conditions.

2.2 MATERIAL

A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose.

Component	Material
Pump and motor	Cast iron, A48
Casing discharge	Cast iron, A48
Impeller	Cast iron, A48
All exposed nuts and bolts	Stainless steel, ASTM A276, Type 304
Shaft	Stainless steel, ASTM 276, Type 303 or Type 420

2.3 EQUIPMENT

A. Impellers: Impellers shall be statically and dynamically balanced and designed to be nonclog and to pass stringy material. Maximum solids handling capacity shall be as specified in paragraph 11346-1.01 D.

B. Bearings: Bearings shall be heavy-duty permanently lubricated ball type. Bearings for pumps 3-inch diameter discharge and larger shall be designed for an L-10 life of 18,000 hours heavy-duty service without requiring additional lubrication.

C. Pump and Motor Casing: Casings shall be constructed of corrosion resistant cast iron and shall be designed to allow removal of all rotating parts from the motor end of the pumps. All mating surfaces where watertight sealing is required shall be machined and fitted with nitrile O-rings. Unless otherwise specified, pump volute shall have vertical discharge.

D. Mechanical Seal: Unless otherwise specified, pumps shall be provided with carbon and ceramic faced mechanical seals.

E. Motor: The motor shall be designed to be nonoverloading over the entire pump curve. The motor housing shall be of submersible construction with the windings operating in a sealed environment. Motors shall be either air or dielectric oil filled with built-in automatic reset overload protection. Explosion proof motors, where specified, shall be UL listed in accordance with UL 674 for Class I, Group D hazardous atmosphere.

F. Cable: Pump motor and detector cables shall be suitable for submersible pump applications. Power for the motor shall be carried by a heavy-duty, flexible, water-resistant portable cable, sealed at the motor bell and of sufficient length to connect to the junction box or the control panel as shown on drawings. The cable entry shall prevent water from leaking into the motor due to capillary action even if cable is cut or damaged.

G. Lifting Chain: 15-foot stainless steel (Type 304) lifting chain shall be provided for each pump.

2.4 CONTROLS

A. Controls shall be provided as specified in Divisions 16 and 17. The control system shall include, but not be limited to, the following features:

1. UL listed, NEMA4X rated enclosure
2. Hand Off Auto selectors
3. Integral starting system
4. Run time meters
5. Float switch for level control (3)
6. Thermal protection with auto reset
7. Auxiliary contacts for remote monitoring and alarming: RUN, FAIL, HI LEVEL, etc.

8. Status indicators

a. Alternating relay

B. Sump pumps shall be controlled by hermetically sealed float type non-mercury switches. The switches shall be sealed in solid propylene float housing. The float switches shall be supported in the sump by a heavy neoprene jacketed wire. A weight shall be attached to the support wire above the float to prevent sharp bends in the wire when the floats are submerged.

C. Two high level float switches shall be used for turning the pumps on in a Lead/Lag configuration and one low level float switch shall be used for turning the pumps off. The meter vault HI HI float switch (LSHH-600) will be used to activate an alarm at high water level and send a signal to SCADA, as shown on drawings. The alternating relay shall alternate the Lead pump for even run time.

2.5 SPARE PARTS

A. Each pump 3 inches and larger shall be provided with the following spare parts:

1. One (1) set - all gaskets
2. One (1) set - all bearings
3. One (1) set - mechanical seals

B. Spare parts shall be packed and boxed as specified in paragraph 11000-2.12.

2.6 PRODUCT DATA

A. Applicable operation and maintenance information (Section 01730) shall be provided in accordance with Section 01300.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Sump pumps shall be installed in accordance with the manufacturer's recommendations.

3.2 TESTING

A. Each pump system shall be tested for control and capacity over a 2-hour period.

*** END OF SECTION ***

SECTION 11870

SURGE TANK AND CONTROL SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: This section specifies surge tanks, complete with control devices, surge system control panels, air compressor system, and appurtenances.

B. Equipment List:

Item	**Zone 752**	**Zone 900**
Surge Tank	ST-01	ST-02
Air Compressor	CMP- 01	CMP-02

C. Type:

1. Pressure Vessels: The pressure vessels furnished under this specification shall be of the welded steel type, horizontal cylindrical in shape, with semi-elliptical heads.

2. Compressors: Simplex, reciprocating, air-cooled, with compressor mounted on the air receiver.

1.2 QUALITY ASSURANCES

A. References:

1. This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

2. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued or replaced.

a. ASME Boiler and Pressure Vessel Code
b. ASME Heat Exchanger Code

1.3 SUBMITTALS

A. The following items shall be provided in accordance with Section 01300:

1. Manufacturer's data sheet showing design and materials of construction.

2. Drawings showing dimensions.

3. A copy of this specification section with addenda updates, and all referenced sections with addenda updates, with each paragraph check marked to show specifications compliance or marked to show deviations.

4. Tank pressure certification.

5. Instruments and gauges.

6. Surge Tank & Level Control Panel layout, schematic diagram and device connection diagram.

7. Air Compressor & Control Panel layout, data sheets, schematic diagram and device connection diagram.

1.4 OPERATING AND DESIGN REQUIREMENTS

A. Design Requirements: The surge tank and accessories shall be designed and selected for continuous duty operation. Compressor shall meet the following:

Inlet pressure, psig:	14.3
Maximum working pressure, psig:	250
Discharge pressure, psig:	per surge control system manufacturer
Maximum rated motor, HP:	5
Minimum capacity, acfm:	14.1
Receiver size, gallons:	80
Environmental Conditions:	530 feet above seal level
Ambient temperatures:	60 – 100 degrees F
Humidity:	assume 100 percent

1.5 UNIT RESPONSIBILITY:

A. The Contractor shall assign unit responsibility, as specified in Section 11000, to the manufacturer of the SURGE TANK AND CONTROL SYSTEM for all equipment provided under this section. This shall include surge tanks, compressor systems, surge control panel, and valve panels. This manufacturer is the unit responsibility manufacturer and has unit responsibility, as described in paragraph 11000-1.02 C, for all the equipment and assembly specified in this section and all other equipment assembly components specified elsewhere but referenced in this section.

1.6 DESIGN OF SYSTEM

A. Manufacturer shall be provided the transient analysis report. Manufacturer shall review the report, and design the system to allow the surge system to meet the recommendations and pressures identified in the report.

PART 2--PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers shall be PULSCO (Irvine, California) or equal.

2.2 TANK

A. The tanks shall be as sized on the drawings, steel, electronically welded, horizontal cylindrical, with ellipsoidal or torispherical dished head and support saddles. Actual design, fabrication, erection and testing of the surge tank shall conform to all sections of the ASME Boiler and Pressure Vessel Code for Unfired Pressure Vessels, Section VIII, Division I. The tank shall bear the stamp of the National Board of Boiler and Pressure Vessel Inspectors and the manufacturer's number as registered with the Board. Each tank shall be accompanied by a completed form U-1A "Manufacturer's Data Report of Pressure Vessels."

B. Each tank shall be stamped with the following instructions and information:

1. Manufacturer's name
2. ASME Code Stamped 305 psig working pressure at 100 degrees F
3. Manufacturer's serial number
4. Date of manufacture
5. Thickness and tensile strength of shell steel (minimum is 1/4 inch)
6. Thickness and tensile strength of head steel (minimum is 1/4 inch)

C. Fittings, manholes (minimum 14" x 18") and flanged pipe outlets shall be welded to the tank on both inside and out. All horizontal and circumferential welding of the shell and the head shall be double butt joint type. Welding on the interior of the tanks shall be done in such a manner as not to have any areas which can not be painted and tested.

D. Tank connections in the bottom of the tank shall be installed flush with the bottom of the tank, no stick up shall be allowed.

E. All slag, weld metal accumulation and spatters shall be removed by chipping and/or grinding. All sharp edges shall be peened, ground or otherwise blunted.

F. Tank interior shall be shop or field painted in accordance with Section 09800 with an NSF Standard 61 approved epoxy coating (15-20 mils DFT). Tank exterior shall be shop primed and field painted in accordance with Section 09800.

G. Connections and Accessories:

1. Each tank shall have all connections shown, and connections for pressure relief valves, air relief valve, vacuum relief valve, sensors, gauges, and sight glasses as required for the specified equipment and instrumentation. Each tank shall be equipped with the following:

   a. Each tank shall be equipped with ASME pressure relief valves.

   b. Two stilling wells and sight gauge mounted on the same end of the surge tank.

2. Drain connection (2" NPT).

3. 8" flanged water supply connection

4. Level switches: Flange-mounted conductance type level probes (4), stainless steel body, electrode housing, and stilling well.

5. 18" ASME inspection manway.

6. Service air connection.

7. Lifting lugs

8. Level transmitter: differnetial pressure, 316L SST materials, silicone, BUANA, 3-way manifold, condensation valve, and copper tubing from tank.

H. Tank Data: The tank shall be sized as follows: ST-01 750 gallons for Zone 752, and ST-02 500 gallons for Zone 900.

2.3 AIR COMPRESSOR SYSTEM

A. Air compressor system and control panel shall be as provided by the surge tank vendor with the compressed air input into the Surge Control System. Each surge control system shall be supplied with its own air compressor system. Air compressor shall be two-stage reciprocating type, simplex, air-cooled, and belt-driven. Air compressor system shall be Ingersoll-Rand H2475 or equal.

B. Materials: Materials of components shall be as follows:

Component	Material
Piston Rings	Steel
Cylinders	Cast iron, ASTM Class 30B
Low pressure piston	Aluminum alloy, AISI S-132
High pressure piston	Cast iron or cast aluminum
Crankshaft	Forged steel
Connecting rods	Forged steel
Frame, intercooler, manifolds	Cast iron, ASTM A48, Class 20A
Baseplates	Fabricated steel
Valves	Type 316 stainless steel
Intercooler piping	copper

C. Compressor:

1. Compressor shall be either V-configuration or vertical two-stage type, with deep-ribbed construction for efficient heat dissipation. Valves shall be readily accessible. Crankshaft bearings shall be Class M3 (50,000 hours). The interstage cooler shall have a pressure relief valve and an automatic condensate drain valve. Compressors shall automatically unload during shutdown. An ASME relief valve, set at 110 percent of the compressor's rated discharge pressure and sized for not loess that the unit's maximum capacity, shall be provided on the compressor discharge. Provide crankcase low oil level switch. Provide adjustable high temperature discharge switch on compressor discharge.

2. Motor shall be 5hp(max), 480V, NEMA T with TEFC enclosure, Class F insulation, 1.15 service factor, grease lubricated ball bearings. The motor shall be able to drive the compressor continuously at full-rated output. The compressor, drive unit, and control panel shall be mounted on a common base rigidly mounted on the receiver.

D. Receiver: Tank shall meet the requirements for Section VIII, Division 1 or 2 of the ASME Boiler Code. The tank shall bear an ASME inspector'

E. Separator: The moisture separator shall be of the centrifugal impingement type, selected for the air flows specified. Moisture separator shall be Wright-Austin, Adams, Basco, or equal. The trap size shall be recommended by the separator manufacturer and shall be the automatic, float-actuated type.

F. Intake Filter-Silencer: Each compressor shall be provided with a cleanable, oil bath type inlet air filter and inlet silencer. Interior surfaces shall receive a rust-inhibitive coating. Minimum noise reduction by octave frequency band shall be as follows:

Octave band, Hz	Attenuation, decibels
63	14
125	19
250	25
500	22
1000	21
2000	18
4000	17
8000	17

G. Controls: The compressor motor shall be controlled by a MEMA4X rated compressor control panel housing the main circuit breaker disconnect, compressor motor combination starter, automatic start/stop operation, pressure switch, Hand-Off-Auto switch, low oil level switch, automatic drain valve, indication lights and other devices specified and shown. Auxiliary contacts shall be provided for all status and alarms to monitor at the PLC. Control panel shall be in accordance with Section 16485. Compressor shall be provided with a run time meter.

2.4 SURGE CONTROL PANEL

A. Purpose of the system is to maintain the level in the surge tanks within a normal operating range. When the water level is above the normal operating range, air shall be added to the surge tank through an air solenoid valve. When water is below the normal operating range, air shall be vented from the surge tank through a separate solenoid valve.

B. Furnish vendor custom surge system control panel for each tankrated for 120V, 20A. Outdoor cabinet shalld be rated NEMA-4X and mounted near the tanks as shown on the drawings.

C. The control panel shall contain Warrick relays (or equal) for the level probes mounted in the stillwell on the tank. The level relays control the solenoid valves for air into and out of the surge tank. The level relays provide the high-high and low-low alarms.

D. The status and alarm (high and low) signals are routed to PLC. Provide for remote monitoring as shown from the surge control system to the PLC cabinet.

E. Pilot System: The pilot system shall have a bronze pilot control conforming to ASTM B62, Type 303 stainless steel trim, and Buna N synthetic rubber.

F. Solenoid Control: Solenoid valves shall be 120 volt, 60 Hz, of the size, type, CS4SM class or as recommended by the manufacturer.

G. Controls shall manage the adding and venting of air, and shall be designed to prevent false alarms and to avoid adding or venting air during start up and shutdown or other minor fluctuations via time delays.

H. Surge control panel and instrumentation shall be in accordance with DIV 16 and DIV 13.

2.5 VALVE PANEL

A. Valves and piping to regulate air to the tanks shall be mounted on a unistrut rack similar to Det 3/E-13 at a location shown on the drawings adjacent to the tanks. Valve panel shall include, as a minimum:

1. Feed and Bleed solenoid valves, with isolation ball valves
2. Bypass piping with isolation ball valves
3. Pressure indicator with isolation valve
4. Check valve to prevent back flow
5. Vent with air muffler

PART 3--EXECUTION

3.1 INSTALLATION

A. The CONTRACTOR shall submit final equipment layout and proposed conduit installation prior to actual installation of the electrical systems. All piping conduit and wiring between the various components provided as part of this Surge Control specification shall be provided by the CONTRACTOR.

B. The Contractor shall install the equipment in accordance with the manufacturer's recommendations and as shown.

3.2 FIELD TESTING

A. The CONTRACTOR shall simulate changes in pressure and level to verify proper operation of the system. The tests shall be witnessed by the OWNER and RESIDENT ENGINEER. Schedule the field testing one-week in advance of the field tests.

B. As a minimum, perform the following tests:

1. Functional test of the level control system.
2. Surge system test by simulating a power failure of the pumps.

*** END OF SECTION ***

SECTION 13110

GALVANIC ANODE CATHODIC PROTECTION

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. Furnish all labor, materials, tools and incidentals to install a galvanic anode cathodic protection system for the Tierrasanta Pump Station Dielectrically Coated steel yard pipelines and connection pipelines. Cathodic protection installation, inspection, and testing are required for a complete and workable system.

B. The CONTRACTOR shall retain a qualified CORROSION ENGINEER to direct the construction of facilities specified herein. The CORROSION ENGINEER shall test and certify that the corrosion control facilities for this project are constructed properly and as specified, and are fully functional.

0.1 DEFINITIONS

A. CONTRACTOR: The licensed prime installer selected by the OWNER to install the pipeline.

B. OWNER: The City of San Diego.

C. CORROSION ENGINEER: A qualified CORROSION ENGINEER retained by the CONTRACTOR who is either a Registered Professional CORROSION ENGINEER or NACE-International Certified CATHODIC PROTECTION SPECIALIST or CORROSION SPECIALIST.

D. ENGINEER: The City of San Diego's Resident ENGINEER or designated representative.

E. CITY'S CORROSION ENGINEER: The ENGINEER'S appointed representative from the City's Corrosion Section.

1.3 CONTRACTOR AND CORROSION ENGINEER QUALIFICATIONS

A. All work must be conducted by qualified, experienced personnel working under continuous, competent supervision. Cathodic protection installation and testing shall be done under the direct supervision of a CORROSION ENGINEER. The CONTRACTOR doing the electrical installations shall have proper valid State of California licenses.

B. SERVICES OF CORROSION ENGINEER: The CONTRACTOR'S CORROSION ENGINEER shall inspect, activate, adjust, and evaluate the effectiveness of the cathodic protection system. The CORROSION ENGINEER is defined above and includes education and experience in cathodic protection of buried or submerged metal structures. The Corrosion Engineer shall directly oversee the CATHODIC PROTECTION TECHNICIAN (if used), review all specification sections in the cathodic protection

specification, verify inspections and field measurements, and certify the accuracy and completeness of all cathodic protection submittals and reports.

C. SERVICES OF CATHODIC PROTECTION TECHNICIAN: The CONTRACTOR'S CORROSION ENGINEER may use a CATHODIC PROTECTION TECHNICIAN to inspect, activate, adjust, and evaluate the effectiveness of the cathodic protection system as long as the CATHODIC PROTECTION TECHNICAN is directly supervised by the CORROSION ENGINEER. The CATHODIC PROTECTION TECHNICIAN is defined as a person accredited or certified by NACE International as a CATHODIC PROTECTION LEVEL 2 TECHNICIAN.

1.4 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. American Society for Testing and Materials (ASTM):

C94	Ready-Mixed Concrete
D-2220	Polyvinylchloride Insulation for Wire and Cable
D-1248	Polyethylene Plastics Molding and Extrusion Materials
B3	Soft or Annealed Copper Wire
B8	Concentric-Lay Stranded Copper Conductors

B. Federal Specifications (FS)

Military Specification (Mil. Spec):

MIL-C-18480B	Coating Compound, Bituminous, Solvent, Coal Tar Base

C. Underwriter's Laboratories, Inc. (UL) Publications:

83-80	Thermoplastic-Insulated Wires
486-76	Wire Connectors and Soldering Lugs for Use with Copper Conductors

D. National Association of Corrosion ENGINEERs (NACE):

SP0169	Recommended Practice, Control of External Corrosion on Underground or Submerged Metallic Piping Systems
SP0286	Electrical Isolation of Cathodically Protected Pipelines

1.5 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall furnish the following documents to the ENGINEER and the catalog cuts shall be accepted prior to installation:

B. Catalog Cuts (5 copies):

1. High potential magnesium anode
2. At-grade, traffic-rated concrete test box with cast iron lid
3. Shunts
4. Wire and cable
5. Exothermic weld kits
6. Weld caps
7. Weld coating
8. Plastic warning tape
9. Flange Isolation Couplings
10. Wax tape coating system

C. As-Built Drawings: The CONTRACTOR shall maintain As-Built drawings showing exact locations of anodes, insulators, test stations, and wire trenching runs. Location changes from the design shall be clearly marked in red on a blue line copy of the design drawings. The As-Built drawings shall be submitted to the ENGINEER at the end of the project. The project is not considered complete until As-Built drawings are submitted.

D. Contractor's Corrosion Engineer Qualifications: The CONTRACTOR shall submit qualifications of the CORROSION ENGINEER and CATHODIC PROTECTION TECHNICIAN (if used).

PART 2 -- PRODUCTS

2.1 GENERAL

A. Materials and equipment shall be new and the standard product of manufacturers regularly engaged in the manufacturing of such products. All materials and equipment shall bear evidence of safe operation approval from a nationally recognized testing laboratory.

2.2 STANDARD POTENTIAL MAGNESIUM ANODES

A. Capacity. Standard potential magnesium anodes shall have a theoretical energy content of 1000 ampere-hours per pound and have a minimum useful output of 500 ampere-hours per pound.

B. Chemical Composition (High Potential Magnesium) ASTM B843

aluminum	5.30 to 6.70 percent
manganese	0.15 to 0.70 percent
zinc	2.50 to 3.50 percent
copper	0.02 percent max
nickel	0.002 percent max
iron	0.003 percent max
silicon	0.10 percent max
others, total	0.30 percent max
magnesium	remainder

C. Open Circuit Potential: The open circuit potential of all anodes, buried in the soil, shall be between 1.50 and 1.60 volts dc versus a copper-copper sulfate reference electrode.

E. Ingot Size And Weight: Anodes shall be 17-pound pre-packaged, high potential ingots with a trapezoidal cross section. Ingot length shall be 25.25 inches long. The total packaged weight shall be 45 lbs.

F. Anode Construction: Anodes shall be cast magnesium with a galvanized steel core rod recessed on one end to provide access to the rod for connection of the lead wire. Silver braze the lead wire to the rod and make the connection mechanically secure. Insulate the connection to a 600 volt rating by filling the recess with epoxy and covering any exposed bare steel core or wire with heat shrinkable tubing. The insulating tubing shall extend over the lead wire insulation by not less than 1/2 inch. The anode lead wire shall be stranded copper and shall be connected directly to the anode steel core as described above. There shall be NO wire splices between the anode steel core and the tag end at the test station.

G. Anode Pre-Packaged Backfill Material: The anodes shall be completely encased and centered within a permeable cloth bag in a special low resistivity backfill mix with the following composition:

Gypsum	75%
Powdered bentonite	20%
Anhydrous sodium sulfate	5%

H. Backfill grains shall be such that 100 percent is capable of passing through a screen of 100 mesh. Backfill shall be firmly packed around the anode such that the ingot is approximately in the center of the backfill. The resistivity of the backfill shall be no greater than 50 ohm-cm when tested wet in a soil box. Total prepackaged weight shall be approximately 45 pounds.

2.3 AT-GRADE TEST STATIONS

A. At-Grade (Flush) Mounted:

1. Test Box: Concrete box of dimensions as shown on the Drawings. Use pre-cast concrete San Diego Pre-cast Model 1BSD\K with cast iron lid. The cast iron lid shall be 9-1/2 inch diameter with the letters "City of San Diego Corrosion Test Station".

2. Each CP Test Box shall include a 5 inch x 5 inch cross-laminated phenolic terminal board with a minimum thickness of 1/4-inch. The phenolic material shall be NEMA type CE or LE. The terminal board shall contain individual electrical lugs for each wire entering the test station or junction box.

2.4 SHUNTS

A. The shunt resistance shall be such that a 5-Amp current causes a voltage drop of 50-millivolts (i.e. 0.010-ohms). Shunts shall be the 1/2-inch wide by 2-1/2-inch long flat manganin ribbon style such as the Agra J. B. shunt, or Holloway Type SW, or approved equal.

2.5 WIRES

A. General: Conform to applicable requirements of NEMA WC 5 and WC 7. All wires shall be single conductor, unless otherwise specified. All wires shall be single conductor, stranded copper wire with 600-volt HMWPE insulation, unless otherwise specified.

B. Mechanical Joint (Non-Welded Pipe Joint) Bond: Two No. 4 AWG HMWPE.

C. Pipeline Test Leads: Two No. 8 AWG HMWPE.

D. Anode Wires: No. 12 AWG THWN with white insulation.

E. Rebar Ground Cable for Concrete Structures: Minimum size #2 AWG, bare copper stranded grounding cable. The quantity of cable required should be sufficient to run two ground cables from a flush-to-grade concrete ground box down to two separate exothermic connections made to rebar inside each concrete encasement or major reinforced concrete structure. Locate the rebar ground text boxes adjacent to cathodic protection test boxes.

2.6 CONCRETE

A. Reinforcing steel: ASTM A 615, Grade 60 deformed bars and welded wire fabric.

B. Welded Wire Fabric: ASTM A 497.

C. Formwork: Plywood, earth cuts may be used.

D. Concrete Design for Minimum Compressive Strength at 28 Days.

2.7 ANCILLARY MATERIALS

A. Electrical Tape: Linerless rubber high-voltage splicing tape and vinyl electrical tape suitable for moist and wet environments. Use Scotch 130C and Scotch 88 as manufactured by 3M Products.

B. Wire Connectors: One-piece, tin-plated crimp-on lug connector as manufactured by Burndy Co., Thomas and Betts.

C. Insulating Resin: At CONTRACTOR'S option, bitumastic coating (Koppers 50 or approved equal) may be used if allowed to dry completely before covering.

2.8 MARKING TAPE

A. Inert polyethylene, impervious to known alkalis, acids, chemical reagents, and solvents likely to be encountered in soil.

B. Thickness: Minimum 4-mils.

C. Width: 6-inches.

D. Identifying Lettering: Minimum 1-inch high, permanent black lettering imprinted continuously over entire length.

E. Color: Red with black lettering as follows: "CAUTION CATHODIC PROTECTION CABLES BURIED BELOW."

2.9 EXOTHERMIC WELDS

A. General: Wire sleeves, welders, and weld cartridges according to the weld manufacturer's recommendations for each wire size and pipe or fitting size and material. Welding materials and equipment shall be the product of a single manufacturer. Interchanging materials of different manufacturers will not be accepted.

B. Weld Caps: Exothermic welds shall be sealed with a pre-fabricated plastic cap filled with formable mastic compound on a base of elastomeric tape. Use Royston Handy Cap or approved equivalent. Primer for weld caps shall be Royston Roybond Primer 747 or approved equivalent.

C. Weld Coating: Exothermic welds and weld caps shall be coated with a cold-applied, fast-drying mastic consisting of bituminous resin and solvents per MIL-C-18480B. Use Koppers Bitumastic 50 or 505, 3M Scotch Clad, or approved equal.

2.10 INSULATING COUPLINGS

A. Flange Isolation Couplings:

1. Use Baker Series 216 Insulating Couplings or approved equal.

2. All buried insulators shall be wax taped coated per AWWA C217 with plastic outer wrap.

2.2 EXTERNAL COATING FOR BURIED SURFACES

A. All buried pipe sections, specials, and fitting surfaces that are not tape wrapped or epoxy coated shall be wrapped with a petrolatum wax tape coating per AWWA C217 with plastic outer wrap. No bare metallic surfaces shall be buried, backfilled, or in contact with the soil.

1. Primer: All surfaces shall be prime coated with a blend of petrolatum, plasticizer, inert fillers, and corrosion inhibitors having a paste-like consistency. It shall have a pour point of 100-degrees F to 110-degrees F and a flash point of 350-degrees. Use Trenton Wax-Tape Primer, or approved equal.

2. Wax Tape: Covering material shall be a synthetic felt tape, saturated with a blend of petrolatum, plasticizers, and corrosion inhibitors that is formable over irregular surfaces. The wax-tape shall consist of a synthetic-fiber felt, saturated with a blend of high melt microcrystalline wax, solvents, and corrosion inhibitors, forming a tape coating that is easily formable over irregular surfaces and which firms up after application. The tape shall have a saturant pour point between 125-degrees F and 130-degrees F and a dielectric strength equal to a minimum of 100-volts per mil. Tape thickness shall be 70-mils to 90-mils in 6-inch wide rolls. Use Trenton No. 1 wax-tape, or approved equal.

3. Plastic Outer Wrap: The primed and wax taped surface shall be covered with a plastic outer wrap consisting of three layers of 50-guage (10-mil) polyvinylidene chloride or PVC, high cling membrane wound together as a single sheet. Use Trenton Poly-Ply, or approved equal.

PART 3 -- EXECUTION

3.1 GENERAL

A. Standard: Work not specifically described herein shall conform to NACE SP0169, NACE SP0572, and the Standard Specifications for Public Works Construction 2012 (Greenbook).

B. Contractor Qualifications: All work shall be performed by qualified, experienced personnel working under continuous, competent supervision.

C. Test Results: The CONTRACTOR shall submit a CORROSION ENGINEER'S report including all test data, conclusions, repairs, and cathodic protection system performance.

D. Notification For Testing: The CONTRACTOR shall notify the ENGINEER at least seven days in advance of the anodes, insulators, and test station installations. The ENGINEER or the OWNER'S representative shall, at their discretion, witness the installation of all anodes and cathodic protection facilities. Testing shall be as described in this specification section.

3.2 MAGNESIUM ANODES

A. Inspection: All lead wires shall be inspected to ensure that the lead wire is securely connected to the anode core and that no damage has occurred to the lead wire. Lead wire failures shall require replacement of the complete anode and lead wire.

B. Pre-Packaged Anode Inspection: Each anode shall be inspected to ensure that the backfill material completely surrounds the anode and that the cloth bag containing the anode and backfill material is intact. If the prepackaged anodes are supplied in a waterproof container or covering, that container or covering shall be removed before installation. The CONTRACTOR shall notify the ENGINEER at least seven (7) days in advance of installing the anodes.

C. Location: Anodes are to be installed in augured holes as shown in the drawings. Anode positions can be adjusted slightly to avoid interference with existing structures. Alternate anode positions must be approved by the ENGINEER.

D. Handling: Care shall be taken to ensure that the anode is never lifted, supported, transported, or handled by the lead wire. All anodes shall be lowered into the hole using a sling or a rope.

E. Anode Hole Size and Depth: Anodes shall be placed vertically at the bottom of a 12 feet deep augured hole, 12 inches in diameter (minimum).

F. Soaking Requirements, Pre-Packaged Anodes: Once the prepackaged anodes are in the hole, water shall be poured into the hole so that the anodes are completely covered with water. Allow the anodes to soak for a minimum of 30 minutes before any soil backfill is added.

G. Soil Backfill: After the pre-packaged anodes are soaked, the hole is backfilled with stone-free, native soil. No voids shall exist around the anode bags and the anode lead wire shall not be damaged. The backfill shall be tamped and compacted in 18 inch lifts above the anode taking care not to damage the anode lead wire.

3.3 AT-GRADE TEST STATIONS

A. Location: At-grade corrosion monitoring test boxes shall be located behind the curb or sidewalk and NOT in traffic lanes or gutters. All test box locations shall be approved by the ENGINEER.

B. Test Box Bottom: Test boxes shall be set in native soil.

C. Test Lead Attachment: Test leads shall be attached to the pipe using the exothermic weld process. An 18-inch length of slack wire shall be coiled at each weld and inside each test box.

D. Concrete Pad: A 24-inch square by 4-inch thick reinforced concrete pad is required around each at-grade test station. Test boxes and concrete pad shall be flush with the top of the median curb.

3.4 WIRE AND CABLE

A. Test Lead Trench: Horizontal test or anode lead runs shall be placed in a 36-inch trench.

B. Wire Handling: Wire leads shall not be stretched or kinked. Care shall be taken when installing wire and backfilling. If wire insulation is damaged during installation, it shall be rejected and replaced completely at the CONTRACTOR's expense. All rejected wire shall be removed from the job site at the close of each workday.

C. Plastic Warning Tape: Plastic warning tape shall be installed in all wire trenches and 12 inches below finished grade.

D. Splicing: Wire splices are not permitted.

3.5 WIRE-TO-PIPE CONNECTIONS

A. All connections of copper wires to the pipe shall be made by the exothermic weld method.

B. Weld Charge Size: It is the CONTRACTOR'S responsibility to ensure that the manufacturer's recommended weld charge size is used.

C. Preparation Of Wire: Do not deform cable. Remove only enough insulation from the cable to allow for the exothermic weld.

D. Preparation Of Metal: Remove all coating, dirt, grime and grease from the metal structure by wire brushing. Clean the structure to a bright, shiny surface free of all serious pits and flaws by using a file. The surface area of the structure must be absolutely dry.

E. Wire Position: The wire is to be held at a 30-degree angle to the surface when welding. Only one wire shall be attached with each weld.

F. Testing Of All Completed Welds: After the weld has cooled, the weld shall be tested by striking the weld with a 2-lb hammer while pulling firmly on the wire. All unsound welds shall be cleaned, re-welded, and re-tested. All weld slag shall be removed.

G. Coating Of Welds: The area to be coated shall be clean and completely dry. Apply a primer specifically intended for use with an elastomeric weld cap. Apply the weld cap and a bituminous mastic coating material to all exposed areas around the cap in accordance with the manufacturer's recommendations. The coating shall overlap the structure coating by a minimum of 3 inches.

H. Coating Repairs: Coatings shall be repaired in the field per the coating manufacturer's recommendations. All coating repairs must be approved by the ENGINEER.

3.6 BOND WIRES

A. Non-Welded Joint Bond Wires: Two No. 4 HMWPE bond wires are required across each non-insulating, in-line valve; a third No. 4 HMWPE bond wire is required from the valve to one outside flange as shown in the drawings. The bond wires shall be attached using the exothermic weld process. Bond wires shall have some slack wire at each weld to allow for creep when backfilling.

3.7 FLANGE ISOLATION COUPLINGS

A. General: Flange isolation couplings shall be pre-assembled and installed as recommended by the manufacturer, and per NACE SP0286. Moisture, soil, and other foreign matter must be fully removed and prevented from contacting any portion of mating surfaces. If foreign matter contacts any portion of these surfaces, then the entire flange shall be disassembled, cleaned, and dried before reassembly.

B. Installation: Align and install insulating joints according to the manufacturer's recommendations to avoid damaging insulating materials. The manufacturer's bolt tightening sequence and torque specifications shall be followed.

C. Paint Pigments: No electrically conductive pigments or paints shall be used either internally or externally on the bolts, washers, or flanges.

D. Inspection: All buried insulating flanges shall be inspected, tested, and approved by the CONTRACTOR'S CORROSION ENGINEEER as described in Part 4 of this specification and prior to the application of wax tape coating.

3.8 EXTERNAL COATING

A. All insulating couplings shall be covered with a 3-layer wax tape coating system per AWWA C217 with plastic outer wrap. Additionally, all in-line valves, flanges couplings, and adapters that are not coated with a bonded dielectric coating shall be wax tape coated per AWWA C217 with plastic outer wrap.

B. Primer: Surfaces must be cleaned of all dirt, grime, and dust by using a wire brush and clean cloth. The surface shall be dry. Apply the primer by hand or brush. A thin coating of primer shall be applied to all surfaces and worked into all crevices. The primer shall be applied generously around bolts, nuts, and threads, and shall fully cover all exposed areas. The primer should overlap the pipe coating by a minimum of 3-inches.

C. Petrolatum Saturated Tape: The wax tape can be applied immediately after the primer. Short lengths of tape shall be cut and carefully molded around each individual bolt, nut, and stud end. For long bolts (such as in couplings), short lengths of tape shall be cut and circumferentially wrapped around each individual bolt. After the bolts are covered, the tape shall be circumferentially wrapped around the flange with sufficient tension to provide continuous adhesion without stretching the tape. The tape shall be formed, by hand, into all voids and spaces. There shall be no voids or gaps under the tape. The tape shall be applied with a 1-inch minimum overlap.

D. Outer Covering: A plastic outer cover shall be applied over the petrolatum-saturated tape. The plastic shall be a minimum of 50-guage (10-mils) and shall have two layers applied.

PART 4 -- TESTING AND INSPECTION

4.1 GENERAL

A. The CONTRACTOR'S CORROSION ENGINEER shall submit his proposed test procedures to the ENGINEER at least five (5) days in advance of the time that the cathodic protection system testing is scheduled. The ENGINEER or the OWNER'S representative shall witness all testing at their discretion. All test data shall be submitted to the ENGINEER within seven (7) days of the completion of the testing. All testing shall be conducted under the supervision of a qualified CORROSION ENGINEER who is retained by the CONTRACTOR. All deficiencies found to be due to faulty materials or workmanship shall be repaired or replaced by the CONTRACTOR and at his/her expense.

4.2 TEST LEADS

It is the CONTRACTOR's responsibility to test all test leads.

B. Test Method: All completed wire connection welds shall be tested by striking the weld with a 2-lb hammer while pulling firmly on the wire. Welds failing this test shall be re-welded and re-tested. Wire welds shall be spot tested by the ENGINEER. After backfilling the pipe, all test lead pairs shall be tested using a standard ohmmeter.

C. CP Test Wire Resistance Tests: After the pipeline is backfilled and the CP test wires are trenched to the CP Test Box or CP Monitoring Station, each pair of CP test wires shall be tested for integrity. The CONTRACTOR'S CORROSION ENGNEER shall measure the electrical resistance of one CP test wire to the pipeline and back on the second CP test wire. If more than twice the theoretical resistance of the total wire length installed is measured, the CONTRACTOR shall excavate the pipeline and replace or re-weld the CP test wires to the pipeline. Use the following copper wire unit resistance values to calculate the theoretical resistance of each pair of CP test wires.

1.	No. 4 AWG wire	0.258 Ohms / 1000 feet
2.	No. 6 AWG wire	0.411 Ohms / 1000 feet
3.	No. 8 AWG wire	0.653 Ohms / 1000 feet
4.	No. 10 AWG wire	1.038 Ohms / 1000 feet
5.	No. 12 AWG wire	1.650 Ohms / 1000 feet

6. No. 14 AWG wire 2.525 Ohms / 1000 feet

D. Acceptance: The resistance between each pair of test leads shall not exceed 150% of the total wire resistance.

4.3 ANODE INSTALLATIONS

A. The CONTRACTOR shall ensure that the anode pre-packed backfill or sack is not damaged and that the anode lead wire is properly attached. The CONTRACTOR'S CORROSION ENGINEER shall inspect each anode bag and anode lead wire for integrity before the anode is installed in the anode hole. Additionally, the CORROSION ENGINEER shall verify anode hole depths. The ENGINEER or the OWNER'S Representative shall inspect and test the anode installations at their discrepancy.

B. Test Method: A visual inspection of anode lead wires, anode pre-packed backfill, and anode hole depths (using tape measure). Obtain open-circuit anode potentials using a high impedance volt meter and copper/copper sulfate reference electrode.

C. Acceptance: All anode leads are properly attached (with no splices), anode hole depths verified, and open-circuit anode potentials are in compliance with this specification. Damaged test leads and damaged pre-packed anode backfill bags shall be rejected and removed from the project site.

4.4 TEST LEAD TRENCHING

A. The ENGINEER, at his or her discretion, shall inspect wire trenches and backfill material and methods.

B. Test Method: The depth, trench bottom, padding, and backfill material shall be visually inspected prior to backfilling.

C. Acceptance: Conformance with specifications.

4.5 PIPELINE CONTINUITY THROUGH IN-LINE APPURTENANCES AND PIPE JOINTS

A. The CONTRACTOR'S CORROSION ENGINEER shall measure the linear resistance of sections of pipe in which in-line valves, non-welded pipe joints, or other flanged mechanical joints have been installed. All testing shall be done by the CORROSION ENGINEER in the presence of the ENGINEER.

B. Test Method: Resistance shall be measured by the linear resistance method. A direct current shall be impressed from one end of the test section to the other (test station to test station). A voltage drop is measured for a given current level. The measured resistance (R) is calculated using the equation R=dV/I, where dV is the voltage drop between the test span and I is the corresponding current. The resistance shall be measured at least three (3) times for accuracy.

C. Alternative Methods: If other electrical continuity test methods are proposed, the CONTRACTOR shall prepare a written test procedure specifying the alternate method and equipment that will be used. A standard handheld digital multi-test meter's ohmmeter circuit (e.g. Fluke 87) is not suitable for properly making these electrical resistance measurements. Submit in writing the alternate proposed test method to the ENGINEER for approval a minimum of 30 days before the pipe laying begins.

D. Acceptance: Acceptance is a comparison between the measured resistance (from the field test data) and the theoretical resistance. The theoretical resistance must consider the pipe (length and wall thickness) and the resistance of the bond wires. The measured resistance shall not exceed the theoretical resistance by more than 130% to determine electrical continuity. The CONTRACTOR'S CORROSION ENGINEER shall submit, within seven (7) days of the completion of the testing, and in a report format, to the ENGINEER, all calculations of the theoretical resistance and measured pipe resistance for each section tested.

4.6 CATHODIC PROTECTION PERFORMANCE

A. The cathodic protection system shall be activated and tested by the CONTRACTOR'S CORROSION ENGINEER in the presence of the ENGINEER.

B. Test Method: The installed cathodic protection system testing shall include: native (static) pipe-to-soil potentials, open-circuit anode potentials, activated pipe-to-soil potentials, test lead to test lead resistance measurements, and anode current output measurements.

C. Acceptance: Shall be based on achieving the –850 mV polarized potential criterion as described in NACE SP0169. Voltage drops must be considered for valid interpretation of this voltage measurement. All data shall be submitted, in a typed 8-1/2 X 11 inch report to the ENGINEER for acceptance before the project is considered complete.

4.7 FLANGE ISOLATION KITS

A. Responsibility: Insulating flanges shall be inspected and tested by the CONTRACTOR'S CORROSION ENGINEER and in the presence of the ENGINEER, prior to backfilling or wax tape coating.

B. Test Method: Test the electrical isolation effectiveness of each insulated pipe flange. The testing shall be performed by the CONTRACTOR'S CORROSION ENGINEER and witnessed by the ENGINEER. The COINTRACTOR shall provide written notice of this testing to the ENGINEER a minimum of two days in advance. If the insulated pipe flange will be buried, it shall be tested for electrical isolation by the CONTRACTOR'S CORROSION ENGINEER before the wax tape coating is applied. At the ENGINEER'S option, the City may repeat this testing during or immediately after the installation of the insulating flange. Replace or repair any insulated pipe flange that is determined to not meet the minimum electrical isolation requirements in this specification. The effectiveness of insulating flanges shall be determined using the following test techniques in the order shown until one of the criteria is achieved or as otherwise directed by the ENGINEER.

1. Electrical Potential Difference Test: Electrically bond the pipe on the vault or unburied side of the insulating flange to an electrical ground with a maximum resistance to remote soil of 5-Ohms. If the pipe on both sides of the insulating flange is mechanically connected to a minimum of 50-feet of buried pipe, then the pipe does not need to be bonded to an electrical ground for this test. Measure the CP Potential of the pipe on both sides of the insulating flange using a copper/copper sulfate reference electrode. If the difference in CP Potentials is greater than or equal to 500-millivolts, the insulating flange is providing adequate electrical isolation. This test must be performed with all cathodic protection systems and anodes disconnected from the pipeline. If this criterion is not met, perform the Nilsson 400 Meter Direct Resistance Test to verify the effectiveness of the insulating flange.

2. Direct Resistance Test: Measure the electrical resistance across the insulated flange using a 97-Hertz square wave null balancing ohmmeter such as the Model 400 Nilsson Soil Resistance Meter and the four-wire resistance technique. A standard handheld digital multi-test meter's ohmmeter circuit (e.g. Fluke or Beckman) is not suitable for properly making these resistance measurements. Perform this test by connecting the meter's P1 and C1 terminals to one side of the insulating flange, using two wires, and then connecting the meter's P2 and C2 terminals to the other side of the insulating flange, using two additional wires. Use vise grips or temporary exothermic welds to make the wire connections to the flange or pipe. The criterion for a pipe filled with water is a minimum measurement of 5-Ohms. The criterion for a dry or a partially filled pipe is a minimum measurement of 100-Ohms. If none of the applicable criteria are met, perform the Inductive Ammeter Direct Resistance Test to verify the effectiveness of the insulating flange.

3. Inductive Ammeter Direct Resistance Test: Connect two separate wires via two separate connections to the pipe on both sides of the insulating flange. Use vise grips or temporary exothermic welds to make the wire connections. Use two pairs of test wires, one for current flow, one for voltage measurement. Using the first set of test wires, apply a minimum 12-volt DC electrical current across the insulating flange. Using the second set of test wires, measure the voltage across the insulating flange developed by the DC current flow. Use an inductive ammeter hoop (e.g. Swain hoop) clamped around the pipe immediately adjacent to the insulating flange to measure the change in DC current flow in the pipe, through the insulated flange. Calculate the electrical resistance across the insulating flange in Ohms by dividing the change in DC Volts by the change in DC Amps (i.e. Ohm's Law). The criterion for a pipe filled with water is a minimum measurement of 5-Ohms. The criterion for a dry pipe is a minimum measurement of 100-Ohms. If either of the applicable criteria is not met, perform the NACE Insulating Flange Leakage Test, per NACE Int'l SP0286, to verify the effectiveness of the insulating flange.

4. Insulating Flange Leakage Test: This test procedure shall conform to the "Leakage Test" described in the NACE Int'l SP0286, Section 8, "Field Testing and Maintenance", Figure 12. The test current used shall be between 3 and 5 DC Amps. The criterion for a pipe filled with water is a maximum "electrical leakage value" of 10-percent of the test current. The criterion for a dry pipe is a maximum "electrical leakage value" of 5-percent of the test current.

C. Individual Flange Bolt Testing: For all insulated flanges to be buried and for all other insulating flanges that do not meet any of the other criteria, measure the electrical resistance of each flange bolt to both sides of the insulated flange using a Nilsson Model 400 Soil Resistance Meter and four-wire resistance technique. The measured resistance value for each flange through-bolt shall be a minimum of 1,000-Ohms, as measured from each bolt to both flanges. This criterion applies to the flange through-bolts and does not apply to valve cap bolts which are threaded on one side. Remove, inspect, and replace all dielectric flange bolt sleeves and washers that do not meet the minimum resistance criterion.

D. If an insulated flange with threaded cap bolts passes the resistance tests for all the "through-bolts" yet fails the other previous tests, remove all the threaded cap bolts, inspect and replace all imperfect dielectric flange bolt sleeve and washer materials and retest.

E. In order to make an accurate resistance measurement that passes any of these criteria it may be necessary to disable the pipe inside a vault, flow control facility, or pump station on one side of the insulated flange (or temporarily remove any electrically grounded appurtenances) so that the pipe is not grounded on one side of the insulated flange. This temporary change may eliminate an electrical path which interferes with making an accurate resistance measurement.

F. Acceptance: The installation of the insulating flange kit shall be considered complete when the testing device indicates no shorts or partial shorts are present. The CONTRACTOR shall provide assistance in finding any and all shorts or shorted bolts. All disassembly and reassembly necessary for acceptance shall be done at the CONTRACTOR'S expense.

4.8 COMPLIANCE WITH SPECIFICATIONS.

A. Deficiencies or omissions in materials or workmanship found by these tests shall be rectified at the CONTRACTOR'S expense. Deficiencies shall include but are not limited to: broken leads, improper or unclean trenches, lack of 18-inch or slack wire in test boxes; improperly mounted test boxes; improper anode installations (including soaking), and other deficiencies associated with the workmanship, installation, and non-functioning equipment.

END OF SECTION

SECTION 13300

INSTRUMENTATION AND CONTROL

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide all Instrumentation and Control systems (I&C) design and installation services complete and operable, in accordance with the CONSTRUCTION DOCUMENTS. The requirements of this Section apply to all components of the I&C unless indicated otherwise.

B. Responsibilities

1. The CONTRACTOR, through the use of a qualified Instrumentation Subcontractor or vendor and qualified electrical and mechanical installers, shall be responsible to the OWNER for the implementation of the I&C and the integration of the I&C with other required instrumentation and control devices.

2. The CONTRACTOR shall develop the system design and integrate the system within the current control system (SCADA) employed by the City. The CONTRACTOR shall work with the Water Operations staff for implementation. At a minimum, all electrical and mechanical devices shall be tied into the programmable logic controller (PLC). Programming of the PLC and OIT and Device steup shall be the responsibility of the CONTRACTOR. The station shall be designed for automatic operational control by discharge flow of zone 900 and zone 752. In addition, provisions for remote control from the City's operations center shall be provided.

3. The CONTRACTOR shall provide complete technical specifications for all instrumentation and control systems, including control panels, communications and intrusion detection systems as part of the CONSTRUCTION DOCUMENTS. The Water Department's standard specifications may be used as a template for these items. Detailed P&ID diagrams shall be provided within the CONSTRUCTION DOCUMENTS.

4. Due to the complexities associated with the interfacing of numerous control system devices, the Instrumentation Subcontractor or vendor shall be responsible to the CONTRACTOR for the integration of the I&C with existing devices and devices provided under other Sections and provide a completely- integrated control system free of signal incompatibilities.

5. As a minimum, the Instrumentation Subcontractor or vendor shall perform the following work:

a. Implementation of the I&C:

(1) Prepare shop-drawing submittals

(2) Design, develop, and electronically draft control panel designs & coordinate with the City I&C group for implementation.

(3) Prepare the test plan, the training plan, and the spare parts submittals

(4) Procure hardware

(5) Fabricate panels

(6) Program the PLC and OIT

(7) Perform factory tests on panels

(8) Perform bench calibration and verify calibration after installation

(9) Oversee and certify installation

(10) Oversee, document, and certify loop testing

(11) Oversee, document, and certify system commissioning

(12) Conduct the performance test

(13) Prepare operations and maintenance information

(14) Conduct training classes

(15) Prepare record drawings

(16) Prepare calibration sheets

(17) Certify the installation of the I&C

(18) Prepare loop drawings showing definitive diagrams for every instrumentation loop system. These diagrams shall show and identify each component of each loop or system using legend and symbols from ANSI/ISA S5.4 - Instrument Loop Drawings, and as defined by the most recent revision in ISA. Each system or loop diagram shall be drawn on a separate drawing sheet. Loop drawings shall be developed for loops in equipment vendor supplied packages, equipment provided under the instrumentation sections, and OWNER furnished equipment.

b. Integration of the I&C with instrumentation and control devices being provided under other Sections:

(1) Develop all requisite loop drawings and record loop drawings associated with equipment provided under other Divisions and OWNER-furnished and existing equipment.

(2) Resolve signal, power, or functional incompatibilities between the I&C and interfacing devices.

C. Certification of Intent:

1. Fifteen days after Notice of Apparent Low Bidder, the CONTRACTOR shall submit a certification from the selected Instrumentation Subcontractor or vendor. The certification shall be typed on letterhead paper of the Instrumentation Subcontractor or vendor firm. The certification shall be signed by an authorized representative of the Instrumentation Subcontractor or vendor. The certification shall include the following statements:

a. (Company name) "hereby certifies intent to assume and execute full responsibility to the CONTRACTOR to perform all tasks defined under Subsection 13300-1.1B3 in full compliance with the requirements of the Contract Documents."

b. "It is certified that the quotation to the CONTRACTOR includes full and complete compliance with the requirements of the Contract Documents without exception."

D. Documentation of Instrumentation Subcontractor Qualifications:

1. Furnish the name of the individual person who will be responsible for office engineering and management of this project, and the individual who will be responsible for field testing, calibration, start-up, and operator training for this project. Include references of recent projects of these individual persons.

2. Submit specific documentation which verifies that Instrumentation Subcontractor employs the minimum of individuals who have been formally trained in the application of the:

a. Indicated operating systems.
b. Indicated software packages.
c. Indicated graphical user interface software packages.

3. Document that the applicant's company has been actively involved in the instrumentation systems business (under the same corporate name).

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 16050 Basic Electrical Materials and Methods
2. Division 13

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. The Work of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal code:

1 National Electrical Code (NEC)
2 Uniform Building Code (UBC)

B. Except as otherwise indicated, the current editions of the following apply to the Work of this Section:

1 ANSI/SA S 5.1 Instrumentation Symbols and Identification

2 ISA-S20 Specification Forms for Process Measurement and Control Instruments

1.4 CONTRACTOR SUBMITTALS

A. General: Submittals shall be furnished in accordance with Section 01300 - Submittals and the following:

1 Coordinate the instrumentation Work so that the complete instrumentation and control system will be provided and will be supported by accurate shop drawings and record drawings.

2 Symbology and Nomenclature: In these Contract Documents, all systems, all meters, all instruments, and all other elements are represented schematically, and are designated by symbology as derived from Instrument Society of America Standard ANSI/ISA S5.1 - Instrumentation Symbols and Identification. The nomenclature and numbers designated herein and on the Drawings shall be employed exclusively throughout shop drawings, and similar materials. No other symbols, designations, or nomenclature unique to the manufacturer's standard methods shall replace those prescribed above, used herein, or on the Drawings.

B. Presubmittal Conference:

1. Arrange and conduct a Presubmittal Conference within 30 days after award of the contract. The purpose of the Presubmittal Conference is to review and approve the manner in which the CONTRACTOR intends to carry out its responsibilities for shop drawing submittal on the Work to be provided under this Section. The CONTRACTOR, the Instrumentation Subcontractor or vendor, and the RESIDENT ENGINEER shall attend. Both the CONTRACTOR and the RESIDENT ENGINEER may invite additional parties at their discretion.

2. Allow one, 8-hour day for the Presubmittal Conference.

3. Submit 3 copies of the following items for discussion at the Presubmittal Conference:

a. A list of equipment and materials required for the I&C and the manufacturer's name and model number for each proposed item.

b. A list of proposed clarifications to the Contract Documents along with a brief explanation of each. Resolution shall be subject to a separate

formal submittal and review by the RESIDENT ENGINEER.

c. A sample of each type of submittal specified herein.

d. A flow chart showing the steps to be taken in preparing and coordinating each submittal.

e. A bar-chart type schedule for all system related activities from the Presubmittal Conference through start-up and training. Dates of submittals, design, fabrication, programming, factory testing, deliveries, installation, field testing, and training shall be shown. The schedule shall be subdivided to show activities relative to each major item or group of items when everything in a given group is on the same schedule.

f. An overview of the proposed training plan. The RESIDENT ENGINEER will review the overview and may request changes. All changes to the proposed training shall be resolved at the Presubmittal Conference. The overview shall include the following for each proposed course:

(1) Course title and objectives.
(2) Prerequisite training and experience of attendees.
(3) Course content - a topical outline.
(4) Course duration.
(5) Course format - lecture, laboratory demonstration, etc.

g. A preliminary copy of the Instrumentation Subcontractor Qualification submittal.

4. Take minutes of the Presubmittal Conference, including all events, questions, and resolutions. Before adjournment, all parties must concur with the accuracy of the minutes and sign accordingly.

C. Shop Drawings:

1. General:

a. Preparation of shop drawings shall not start until adjournment of the Presubmittal Conference.

b. Shop drawings shall include the letter head or title block of the Instrumentation Subcontractor. The title block shall include, as a minimum, the Instrumentation Subcontractor's registered business name and address, project name, drawing name, revision level, and personnel responsible for the content of the drawing.

c. Organization of the shop drawing submittals shall be compatible with eventual submittals for later inclusion in the operations and maintenance information submitted in accordance with Section 01730 - Operations and Maintenance Information. Submittals that are improperly organized or incomplete for a given loop will be rejected.

d. Shop drawing information shall be bound in standard size, 3 ring, loose leaf, vinyl plastic, and hard cover binders suitable for bookshelf storage. Binder ring size shall not exceed 3 inches.

e. Interfaces between instruments, motor starters, control valves, variable speed drives, flow meters, chemical feeders and other equipment related to the I&C shall be included in the shop drawing submittal.

2. Instrument Submittal: Submit the instrument submittal as a complete bound package at one time within 60 calendar days after the commencement date stated in the Notice to Proceed, including:

a. A complete index that lists each device by tag number, type, and Manufacturer. A separate technical brochure or bulletin shall be included with each instrument data sheet. The data sheets shall be indexed in the submittal by systems or loops, as a separate group for each system or loop. If, within a single system or loop, a single instrument is employed more than once, one data sheet with one brochure or bulletin may cover all identical uses of that instrument in that system. Each brochure or bulletin shall include a list of tag numbers for which it applies. System groups shall be separated by labeled tags.

b. Fully executed data sheets according to ISA-S20 - Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves, for each component, together with a technical product brochure or bulletin. The technical product brochures shall be complete enough to verify conformance to all Contract Document requirements. The data sheets, as a minimum, shall show:

(1) Component functional description used in the Contract Documents

(2) Manufacturer's model number or other product designation

(3) Project tag number used in the Contract Documents

(4) Project system or loop of which the component is a part

(5) Project location or assembly at which the component is to be installed

(6) Input and output characteristics

(7) Scale, range, units, and multiplier (if any)

(8) Requirements for electric supply (if any)

(9) Requirements for air supply (if any)

(10) Materials of component parts to be in contact with or otherwise exposed to process media and corrosive ambient air

(11) Special requirements or features

c. Flow Meter Sizing Calculations: Calculations shall be submitted on the Instrument Manufacturer letterhead and shall include the following:

(1) Proposed flow meter size based on indicated minimum, maximum and average flow rates

(2) Guaranteed flow meter accuracy based on the upstream and downstream straight runs associated with the location of each flow meter

(3) Permanent head loss associated with each flow meter

(4) Flow vs. differential pressure curves for all head-type devices. For compressible fluids, curves shall be pressure and temperature compensated.

(5) References to ASME and ISA standard equations used

(6) Values used for all parameters used in calculations

d. Calibration sheets in accordance with Subsection 13300-1.4C5.

e. Priced list of all spare parts for all devices.

f. Instrument installation, mounting, and anchoring details shall be submitted in an electronic INTERGRAPH MICROSTATION format and hard copy format. Each instrument shall have a dedicated 8-1/2" X 11" detail that pertains to the specific instrument by tag number. Instruments that share the same installation detail shall be tabulated by tag numbers on the same detail sheet. As a minimum, each detail shall have the following content:

(1) Show all necessary sections and elevation views required to define instrument location by referencing tank, building or equipment names and numbers, and geographical qualities such as north, south, east, west, basement, first floor.

(2) Ambient temperature and humidity of the environment where the instrument will be installed.

(3) Corrosive qualities of the environment where the instrument will be installed.

(4) Hazardous rating of the environment where the instrument will be installed.

(5) Process line pipe or tank size, service and material.

(6) Process tap elevation and location

(7) Upstream and downstream straight pipe lengths between instrument installation and pipe fittings and valves.

(8) Routing of tubing and identification of supports.

(9) Mounting brackets, stands, and anchoring devices.

(10) Conduit entry size, number, location, and delineation between power and signal.

(11) NEMA ratings of enclosures and all components.

(12) Clearances required for instrument servicing.

(13) List itemizing all manufacturer makes, model numbers, quantities, lengths required, and materials of each item required to support the implementation of the detail.

3. Project-Wide Loop Drawing Submittal: Furnish Loop Drawing Submittal (LDS) that completely defines and documents the contents of each monitoring, alarming, interlock, and control loop associated with equipment provided under the instrumentation sections, equipment provided under sections in other Divisions, existing, and OWNER-furnished equipment that is to be incorporated into the I&C. The LDS shall be a singular complete bound package electronically drafted in INTERGRAPH MICROSTATION format, submitted within 120 days after contract award, and shall include the following:

a. A complete index in the front of each bound volume. The loop drawings

shall be indexed by systems or process areas. All loops shall be tagged in a manner consistent with the Contract Documents. Loop drawings shall be submitted for every analog and discrete monitoring and control loop.

b. Drawings showing definitive diagrams for every instrumentation loop system. These diagrams shall show and identify each component of each loop or system using legend and symbols from ANSI/ISA S5.4 - Instrument Loop Drawings, and as defined by the most recent revision in ISA. Each system or loop diagram shall be drawn on a separate drawing sheet. Loop drawings shall be developed for loops in equipment vendor supplied packages, equipment provided under the instrumentation sections, and OWNER furnished equipment. The loop drawings shall also show all software modules and linkages. In addition to the expanded ISA S5.4 requirements the loop diagrams shall also show the following details:

(1) Functional name of each loop.

(2) Reference name, drawing, and loop diagram numbers for any signal continuing off the loop diagram sheet.

(3) MCC panel, circuit, and breaker numbers for all power feeds to the loops and instrumentation.

(4) Designation, and if appropriate, terminal assignments associated with every manhole, pullbox, junction box, conduit, and panel through which the loop circuits pass.

(5) Vendor panel, instrument panel, conduit, junction boxes, equipment and PLC I/O terminations, termination identification wire numbers and colors, power circuits, and ground identifications.

c. Itemized instrument summary. The summary shall be prepared with excel and shall be submitted on CD disk and hard copy. The instrument summary shall list all of the key attributes of each instrument provided under this Contract. As a minimum, attributes shall include:

(1) Tag number
(2) Manufacturer
(3) Model number
(4) Service
(5) Area location
(6) Calibrated range
(7) Loop drawing number
(8) Associated LCP, PLC, PCM, or RTU

4. Test Procedure Submittals:

   a. Submit the proposed procedures to be followed during tests of the I&C and its components.

   b. Preliminary Submittal: Outlines of the specific proposed tests and examples of proposed forms and checklists.

   c. Detailed Submittal: After approval of the Preliminary Submittal, the CONTRACTOR shall submit the proposed detailed test procedures, forms, and checklists. This submittal shall include a statement of test objectives with the test procedures.

   d. Certify in writing that for each loop or system checked out, and all discrepancies have been corrected.

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

   a. Project name
   b. Loop number
   c. Tag number
   d. Manufacturer
   e. Model number
   f. Serial number
   g. Calibration range
   h. Calibration data: Input, output, and error at 10, 50 and 90% of span
   i. Switch setting, contact action, and deadband for discrete elements
   j. Space for comments
   k. Space for sign-off by Instrumentation Supplier and date
   l. Test equipment used and associated serial numbers

6. Training Submittals: Subsequent to the receipt of the CONTRACT MANAGER's input made at the Presubmittal Conference, the CONTRACTOR shall submit a training plan that includes:

   a. A resubmittal of the training plan overview from the Presubmittal Conference with incorporation of all modifications agreed upon at that meeting.

   b. Schedule of training courses including dates, durations, and locations of each class.

   c. Resumes of the instructors who will actually implement the plan.

D. Operations and Maintenance Information:

1. General: Operations and maintenance information shall be based upon the approved shop drawing submittals as modified for conditions encountered in the field during the Work.

2. Operations and maintenance information submitted in compliance with Section 01730 Operations and Maintenance Information shall be organized as follows for each process:

   a. Section A - Process and Instrumentation Diagrams

   b. Section B - Loop Descriptions

   c. Section C - Loop Drawings

   d. Section D - Instrument Summary

   e. Section E - Instrument Data Sheets

   f. Section F - Sizing Calculations

   g. Section G - Instrument Installation Details

   h. Section H - Test Results

3. CONTRACTOR-certified results from Calibration Loop Testing, Precommissioning, and Performance Testing shall be included in Section H of the operations and maintenance information.

4. Start-up of systems shall begin no sooner than 15 days after final approval of the I&C operations and maintenance information provided in compliance with Section 01730 Operations and Maintenance Information.

E. Record Drawings: Keep current a set of complete loop and schematic diagrams which shall include all field and panel wiring, piping and tubing runs, routing, mounting details, point-to-point diagrams with cable, wire, tube, and termination numbers. These drawings shall include all instruments and instrument elements. One set of record drawings electronically formatted in INTERGRAPH MICROSTATION format and 2 hard copies shall be submitted after completion of all Precommissioning tasks but before Performance Testing. All such drawings shall be submitted for review before acceptance of the completed Work.

1.5 FACTORY TESTING

A. Arrange for the Manufacturers of the equipment and fabricators of panels and cabinets supplied under this Section to allow the RESIDENT ENGINEER to inspect and witness the testing of the equipment at the site of fabrication. Equipment shall include the cabinets, special control systems, flow measuring devices, and other pertinent systems and devices. A minimum of 10 working days notification shall be provided to the RESIDENT ENGINEER before testing. No shipments shall be made without the RESIDENT ENGINEER's approval.

1.6 PERIOD FOR CORRECTION OF DEFECTS

A. Correct all defects in the I&C upon notification from the OWNER within one year from the date of Substantial Completion. Corrections shall be completed within 5 days after notification.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Code and Regulatory Compliance: All I&C Work shall conform to or exceed the applicable requirements of the National Electrical Code.

B. Current Technology: All meters, instruments, and other components shall be the most recent field-proven models marketed by their manufacturers at the time of submittal of the shop drawings unless otherwise required to match existing equipment.

C. Hardware Commonality: All instruments that use a common measurement principle (for example, d/p cells, pressure transmitters, level transmitters that monitor hydrostatic head) shall be furnished by a single Manufacturer. All panel mounted instruments shall have matching style and general appearance. Instruments performing similar functions shall be of the same type, model, or class, and shall be from a single Manufacturer.

D. Loop Accuracy: The accuracy of each instrumentation system or loop shall be determined as a probable maximum error; this shall be the square-root of the sum of the squares of certified "accuracies" of the designated components in each system, expressed as a percentage of the actual span or value of the measured variable. Each individual instrument shall have a minimum accuracy of $\pm 0.5\%$ of full scale and a minimum repeatability of $\pm 0.25\%$ of full scale unless otherwise indicated. Instruments that do not conform to or improve upon these criteria are not acceptable.

E. Instrument and Loop Power: Power requirements and input/output connections for all components shall be verified. Power for transmitted signals shall, in general, originate in and be supplied by the control panel devices. The use of "2-wire" transmitters is preferred, and use of "4-wire" transmitters shall be minimized. Individual loop or redundant power supplies shall be provided as required by the Manufacturer's instrument load characteristics to ensure sufficient power to each loop component. All power supplies shall be mounted within control panels or in the field at the point of application.

F. Instrument Air: Dry, filtered control air at 30 psig nominal pressure shall be piped to all field instruments and instrument panels requiring air. Each field instrument shall be provided with an integral, non-adjustable filter/regulator assembly to provide regulated air. Each instrument panel requiring air shall be provided with an adjustable filter/regulator assembly with gauge and an air manifold to provide air to pneumatic instruments. All air shall be filtered to 5 micron maximum particle size. Pressure reducers and regulators shall be furnished with additional instrumentation as required.

G. Loop Isolators and Convertors: Signal isolators shall be provided as required to ensure adjacent component impedance match where feedback paths may be generated, or to maintain loop integrity during the removal of a loop component. Dropping precision wire-
wound resistors shall be installed at all field side terminations in the control panels to ensure loop integrity. Signal conditioners and converters shall be provided where required to resolve any signal level incompatibilities or provide required functions.

H. Environmental Suitability: All indoor and outdoor control panels and instrument enclosures shall be suitable for operation in the ambient conditions associated with the locations designated in the Contract Documents. Heating, cooling, and dehumidifying devices shall be provided in order to maintain all instrumentation devices 20% within the minimums and maximums of their rated environmental operating ranges. Provide all power wiring for these devices. Enclosures suitable for the environment shall be furnished. All instrumentation in hazardous areas shall be suitable for use in the particular hazardous or classified location in which it is to be installed.

I. Signal Levels: Analog measurements and control signals shall be as indicated herein, and unless otherwise indicated, shall vary in direct linear proportion to the measured variable. Electrical signals outside control panels shall be 4 to 20 mA DC except as indicated. Signals within enclosures may be 1 to 5 VDC. All electric signals shall be electrically or optically isolated from other signals. All pneumatic signals shall be 3 to 15 psig with 3 psig equal to 0% and 15 psig equal to 100%.

J. Control Panel Power Supplies: All control panels shall be provided with redundant power supplies that are configured in a fault-tolerant manner to prevent interruption of service upon failure and interruption of service necessitated by the replacement of a power supply. All power supplies shall have an excess rated capacity of 40%. The failure of a power supply shall be annunciated at the control panel and repeated to the SCADA System.

K. Alternative Equipment and Methods: Equipment or methods requiring redesign of any project details are not acceptable without prior written approval of the RESIDENT ENGINEER through the "or equal" process of Section 01600 Materials and Equipment. Any proposal for approval of alternative equipment or methods shall include evidence of improved performance, operational advantage and maintenance enhancement over the equipment or method indicated, or shall include evidence that an indicated component is not available.

2.2 OPERATING CONDITIONS

A. The I&C shall be designed and constructed for satisfactory operation and long, low maintenance service under the following conditions:

1. Environment - water treatment or pumping facility
2. Temperature Range - 32 through 104 degrees F
3. Thermal Shock - 1 degree F per minute, maximum
4. Relative Humidity - 20 through 90%, non-condensing

2.3 SPARE PARTS AND SPECIAL TOOLS

A. Spare Parts: Furnish the spare parts selected by the RESIDENT ENGINEER from the priced list of spare parts in the Instrument Submittal and Control Panel Engineering Submittal in conformance with Section 13370 - Control Panels.

B. Special Tools: Furnish a priced list of all special tools required to calibrate and maintain all of the instrumentation provided under the Contract Documents. After approval, furnish all listed tools.

C. Timing of Submittals: All special tools and spare parts shall be submitted before startup starts, and shall be suitably wrapped and identified.

PART 3 -- EXECUTION

3.1 PRODUCT HANDLING

A. Shipping Precautions: After completion of shop assembly, factory test, and approval, all equipment, cabinets, panels, and consoles shall be packed in protective crates and enclosed in heavy duty polyethylene envelopes or secured sheeting to provide complete protection from damage, dust, and moisture. Dehumidifiers shall be placed inside the polyethylene coverings. The equipment shall then be skid-mounted for final transport. Lifting rings shall be provided for moving without removing protective covering. Boxed weight shall be shown on shipping tags together with instructions for unloading, transporting, storing, and handling at the job site.

B. Special Instructions: Special instructions for proper field handling, storage, and installation required by the Manufacturer shall be securely attached to each piece of equipment before packaging and shipment.

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

D. Storage: Equipment shall not be stored outdoors. Equipment shall be stored in dry permanent shelters, including in-line equipment, and shall be adequately protected against mechanical injury. If any apparatus has been damaged, such damage shall be repaired by the CONTRACTOR at no additional cost to the OWNER. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through tests as directed by the RESIDENT ENGINEER. Such tests shall be at no additional cost to the OWNER, and if the equipment fails the tests, it shall be replaced at no additional cost to the OWNER.

3.2 MANUFACTURER'S SERVICES

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

1. All flow meters in new or potable water streams that relate to process control, mass balance calculations, and billing of customers.

2. Instruments that require specialized knowledge, such as surge tanks.

B. Furnish the following Manufacturer's services for the instrumentation listed above:

1. Perform bench calibration

2. Oversee installation

3. Verify installation of installed instrument

4. Certify installation and reconfirm Manufacturer's accuracy statement

5. Oversee loop testing, prepare loop validation sheets, and certify loop testing

6. Oversee precommissioning, prepare precommissioning validation sheets, and certify precommissioning

7. Train the OWNER's personnel

3.3 INSTALLATION

A. General:

1. All instrumentation, including instrumentation furnished under other Divisions, shall be installed under Division 13 and the manufacturers' instructions.

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

B. Conduit, Cables, and Field Wiring:

1. All conduit shall be provided under Division 16.

2. All 4-20 mA signal circuits, process equipment control wiring, signal wiring to field instruments, SCADA and PLC input and output wiring and other field wiring and cables shall be provided under Division 16.

3. All SCADA and PLC equipment cables, data highway communication networks shall be provided under Division 13.

4. All terminations and wire identification at I&C equipment furnished under this or any other Division shall be provided under Division 13.

5. All PLC panel conduit perforations shall be from the bottom of the enclosure.

C. Instrumentation Tie-Downs: All instruments, control panels, and equipment shall be anchored by methods that comply with seismic requirements that apply to the site.

D. Existing Instrumentation: Each existing instrument to be removed and reinstalled shall be cleaned, reconditioned and recalibrated by an authorized service facility of the instrument Manufacturer. Provide certification of this Work before reinstallation of each instrument.

E. Ancillary Devices: The Contract Documents show all necessary conduit and instruments required to make a complete instrumentation system. The CONTRACTOR shall be responsible for providing any additional or different type connections as required by the instruments and specific installation requirements at no additional cost to the OWNER. All such additions and all such changes, including the proposed method of installation, shall be submitted to the RESIDENT ENGINEER for approval before commencing the Work. Such changes shall not be a basis of claims for extra work or delay.

F. Installation Criteria and Validation: All field-mounted components and assemblies shall be installed and connected according to the requirements below:

1. Installation personnel have been instructed on installation requirements of the Contract Documents.

2. Technical assistance is available to installation personnel at least by telephone.

3. Installation personnel have at least one copy of the approved shop drawings and data.

4. Instrument process sensing lines shall be installed similar to conduit specified under Section 16050 - Basic Electrical Materials and Methods. Individual tubes shall run parallel and near the surfaces from which they are supported. Supports shall be used at intervals of not more than 3 feet of rigid tubing.

5. Bends shall be formed to uniform radii with the proper tool without deforming or thinning the walls of the tubing. Plastic clips shall be used to hold individual plastic tubes parallel. Ends of tubing shall be square-cut and cleaned before being inserted in the fittings. Bulkhead fittings shall be provided at all panels requiring pipe or tubing entries.

6. All differential pressure elements shall have three valve manifolds.

7. All flexible cables and capillary tubing shall be installed in flexible conduits. The lengths shall be sufficient to withdraw the element for periodic maintenance.

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

9. All connectors shall be, as a minimum, water tight.

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

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

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

13. Verify the correctness of each installation, including polarity of electric power and signal connections, and making sure all process connections are free of leaks. Certify in writing that for each loop or system checked out, all discrepancies have been corrected.

14. The OWNER will not be responsible for any additional cost of rework attributable to actions of the CONTRACTOR or the Instrumentation Subcontractor.

3.4 CALIBRATION

A. General: All devices provided under the instrumentation sections shall be calibrated according to the manufacturer's recommended procedures to verify operational readiness and ability to meet the indicated functional and tolerance requirements.

B. Calibration Points: Each instrument shall be calibrated at 20, 40, 60, 80 and 100% of span using test instruments to simulate inputs. The test instruments shall have accuracies traceable to National Institute of Testing Standards.

C. Bench Calibration: Instruments that have been bench-calibrated shall be examined in the field to determine whether any of the calibrations are in need of adjustment. Such adjustments, if required, shall be made only after consultation with the RESIDENT ENGINEER.

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

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

3.5 LOOP TESTING

A. General: Individual instrument loop diagrams per ISA Standard S5.4 - Instrument Loop Diagrams, expanded format, shall be submitted to the RESIDENT ENGINEER for review before the loop tests. The CONTRACTOR shall notify the RESIDENT ENGINEER of scheduled tests a minimum of 30 days before the estimated completion date of installation and wiring of the I&C. After the RESIDENT ENGINEER's review of the submitted loop diagrams for correctness and compliance with the specifications, loop testing shall proceed. The loop check shall be witnessed by the RESIDENT ENGINEER.

B. Control Valve Tests: All control valves, cylinders, drives and connecting linkages shall be stroked from the operator interface units as well as local control devices and adjusted to verify proper control action, hand switch action, limit switch settings, torque settings, remote control actions, and remote feedback of valve status and position. Control valve actions and positioner settings shall be checked with the valves in place to insure that no changes have occurred since the bench calibration.

C. Interlocks: All hardware and software interlocks between the instrumentation and the motor control circuits, control circuits of variable-speed controllers and packaged equipment controls shall be checked to the maximum extent possible.

D. Instrument and Instrument Component Validation: Each instrument shall be field tested, inspected, and adjusted to its indicated performance requirement in accordance its Manufacturer's specifications and instructions. Any instrument that fails to meet any Contract requirement, or, in the absence of a Contract requirement, any published manufacturer performance specification for functional and operational parameters, shall be repaired or replaced, at the discretion of the RESIDENT ENGINEER at no additional cost to the OWNER.

E. Loop Validation: Controllers and electronic function modules shall be field tested and exercised to demonstrate correct operation. All control loops shall be checked under simulated operating conditions by impressing input signals at the primary control elements and observing appropriate responses of the respective control and monitoring elements, final control elements, and the graphic displays associated with the SCADA and PLC. Actual signals shall be used wherever available. Following any necessary corrections, the loops shall be retested. Specified accuracy tolerances for each analog network are defined as the root-mean-square-summation of individual component accuracy requirements. Individual component accuracy requirements shall be as indicated by Contract requirements or by published manufacturer accuracy specifications, whenever Contract accuracy requirements are not indicated. Each analog network shall be tested by applying simulated analog or discrete inputs to the first element of an analog network. For networks that incorporate analog elements, simulated sensor inputs corresponding to 20, 40, 60, 80 and 100% of span shall be applied, and the resulting element outputs monitored to verify compliance to calculated root-mean-square-summation accuracy tolerance requirements. Continuously variable analog inputs shall be applied to verify the proper operation and setting of discrete devices. Provisional settings shall be made on controllers and alarms during analog loop tests. All analog loop test data shall be recorded on test that includes calculated root-mean-square-summation system accuracy tolerance requirements for each output.

F. Loop Validation Sheets: Prepare loop confirmation sheets for each loop covering each active instrumentation and control device except simple hand switches and lights. Loop confirmation sheets shall form the basis for operational tests and documentation. Each loop confirmation sheet shall cite the following information and shall provide spaces for sign-off on individual items and on the complete loop by the Instrumentation Supplier:

1. Project name
2. Loop number
3. Tag number, description, manufacturer and model number for each element
4. Installation bulletin number
5. Specification sheet number
6. Loop description number
7. Adjustment check
8. Space for comments
9. Space for loop sign-off by Instrumentation Supplier and date
10. Space for RESIDENT ENGINEER witness signature and date

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

3.6 PRECOMMISSIONING

A. General: Precommissioning shall start after acceptance of all wire tests, calibration tests and loop tests, and all inspections have demonstrated that the instrumentation and control system complies with all Contract requirements. Precommissioning shall demonstrate proper operation of all systems with process equipment operating over full operating ranges under conditions as closely resembling actual operating conditions as possible.

B. Precommissioning Procedures and Documentation: All precommissioning and test activities shall follow detailed test procedures and check lists accepted by the CONSTRUCTION MANGER. All test data shall be acquired using equipment as required and shall be recorded on test forms accepted by the RESIDENT ENGINEER, that include calculated tolerance limits for each step. Completion of all system precommissioning and test activities shall be documented by a certified report, including all test forms with test data entered, delivered to the RESIDENT ENGINEER with a clear and unequivocal statement that all system precommissioning and test requirements have been satisfied.

C. Operational Validation: Where feasible, system precommissioning activities shall include the use of water to establish service conditions that simulate, to the greatest extent possible, normal final control element operating conditions in terms of applied process loads, operating ranges, and environmental conditions. Final control elements, control panels, and ancillary equipment shall be tested under start-up and steady-state operating conditions to verify that proper and stable control is achieved using motor control center and local field mounted control circuits. All hardwired and software control circuit interlocks and alarms shall be operational. The control of final control elements and ancillary equipment shall be tested using both manual and automatic (where provided) control circuits. The stable steady-state operation of final control elements running under the control of field mounted automatic analog controllers or software based controllers shall be assured by adjusting the controllers as required to eliminate oscillatory final control element operation. The transient stability of final control elements operating under the control of field mounted, and software based automatic analog controllers shall be verified by applying control signal disturbances, monitoring the amplitude and decay rate of control parameter oscillations (if any) and making necessary controller adjustments as required to eliminate excessive oscillatory amplitudes and decay rates.

D. Loop Tuning: All electronic control stations incorporating proportional, integral or differential control circuits shall be optimally tuned, experimentally, by applying control signal disturbances and adjusting the gain, reset, or rate settings as required to achieve a proper response. Measured final control element variable position/speed set point settings shall be compared to measured final control element position/speed values at 20, 40, 60, 80 and 100% of span and the results checked against indicated accuracy

tolerances.

E. Precommissioning Validation Sheets: Precommissioning shall be documented on one of two types of test forms as follows:

1. For functions that can be demonstrated on a loop-by-loop basis, the form shall include:

   a. Project name

   b. Loop number

   c. Loop description

   d. Tag number, description, manufacturer and data sheet number for each component.

   e. Space for sign-off and date by both the Instrumentation Subcontractor and RESIDENT ENGINEER.

2. For functions that cannot be demonstrated on a loop-by-loop basis, the test form shall be a listing of the specific tests to be conducted. With each test description the following information shall be included:

   a. Specification page and paragraph of function demonstrated

   b. Description of function

   c. Space for sign-off and date by both the Instrumentation Subcontractor and RESIDENT ENGINEER.

F. Precommissioning Certification: Submit instrumentation and control system precommissioning completion report that shall state that all Contract requirements have been met and shall include a listing of all instrumentation and control system maintenance and repair activities conducted during the precommissioning testing. Acceptance of the instrumentation and control system precommissioning testing must be provided in writing by the RESIDENT ENGINEER before the performance testing may begin. Final acceptance of the control system shall be based upon plant completion as stated in the General Conditions.

3.7 ONSITE SUPERVISION

A. Furnish the services of an on-site service engineer to supervise and coordinate installation, adjustment, testing, and start-up of the I&C. The RESIDENT ENGINEER will be present during the total period required to affect a complete operating system. A qualified team of the Instrumentation Subcontractor personnel shall be on site for 40 hours to check all equipment, perform the tests indicated in this Section, and furnish startup services.

3.8 PERFORMANCE TEST

A. The entire I&C shall operate for 30 days without failure.

B. Furnish all necessary support staff as required to operate the system and to satisfy the repair or replacement requirements.

C. If any component fails during the performance test, it shall be repaired or replaced and the I&C shall be restarted on another 30-day period.

3.9 TRAINING

A. General: Train the OWNER's personnel on the maintenance, calibration and repair of all instruments provided under this Contract.

B. Instructions: The training shall be performed by qualified representatives of the equipment manufacturers and shall be specific to each piece of equipment.

C. Duration: Each training class shall be a minimum of 8 hours in duration and shall cover, as a minimum, operational theory, maintenance, troubleshooting/repair, and calibration of instruments.

D. Schedule: Training shall be performed during the precommissioning phase of the project. The training sessions shall be scheduled a minimum of 3 weeks in advance of when the courses are to be initiated. The RESIDENT ENGINEER will review the course outline for suitability and provide comments that shall be incorporated.

E. Agenda: The training shall include operation and maintenance procedures, trouble shooting with necessary test equipment, and changing set points, and calibration for that specific piece of equipment.

F. Documentation: Within 10 days after the completion of each session the CONTRACTOR shall submit the following:

1 List of all OWNER personnel who attended the session.

2 Evaluation of OWNER personnel via written testing or equivalent evaluation.

3 Copy of the training materials used including all notes, diagrams, and comments.

3.10 ACCEPTANCE

A. For the purpose of this Section, the following conditions shall be fulfilled before the Work is considered substantially complete:

1. All submittals have been completed and approved.

2. The I&C has been calibrated, loop tested and precommissioned.

3. The OWNER training has been performed.

4. All required spare parts and expendable supplies and test equipment have been delivered to the RESIDENT ENGINEER.

5. The performance test has been successfully completed.

6. All punch-list items have been corrected.

7. All record drawings in both hard copy and electronic format have been submitted.

8. Revisions to the operations and maintenance manuals information that may have resulted from the field tests have been made and reviewed.

9. All debris associated with installation of instrumentation has been removed.

10. All probes, elements, sample lines, transmitters, tubing, and enclosures have been cleaned and are in like-new condition.

*** END OF SECTION ***

SECTION 13301

INSTRUMENTATION AND CONTROL DESCRIPTION

PART 1 - GENERAL

1.1 THE CONTROL SYSTEM ARCHITECTURE

A. The Control system Architecture includes the following key elements;

1. New Tierrasanta PLC, PLC-1. New panel installed at Tierrasanta Pump Station (TPS) to control and monitor the pumps via the Tierrasanta Pump Station PLC.

2. New TPS OIT. Installed at New TPS PLC-1. Provide operator interface functions to control and monitor the TPS PLC-1. PanelMate Power Pro series OIT screens from the existing Via Dominique PS (VDPS) will be duplicated into the TPS OIT to allow control and monitoring of the existing VDPS from the new OIT.

3. The TPS and VDPS communicate over a complete and operational communication system between the TPS radio network and the existing Chollas SCADA system Control Room (CHOLLAS). See section 13400 for additional information.

4. Power monitors. Power monitors read by CHOLLAS over Ethernet.

5. City operators may control and monitor both the TPSP and the VDPS from CHOLLAS.

6. Weather station. Weather station read by CHOLLAS over ethernet.

7. Generator. Generator read by CHOLLAS over ethernet.

8. The OIT screens shall have the same look and feel as the sample screen shots provided in section 13301-3.16.

1.2 WORK OF THIS SECTION

A. This Section describes the Instrumentation and Control (I&C) system for the Project.

B. The new Tierrasanta Pump Station PLC shall be provided and programmed by the CONTRACTOR as shown in the contract documents and specifications. The CONTRACTOR shall provide a new radio communications system and demonstrate that the new TPS PLC is interfacing with the City's existing SCADA network. The new TPS radio communications provided will include all of the hardware and software necessary to allow the existing SCADA system Control Room (CHOLLAS) to read and write to TPS PLC provided by the CONTRACTOR. In addition, the TPS radio communications will also allow for CHOLLAS to read and write to the existing PLC located at the existing Via Dominique pump station that will be connected to the TPS via Ethernet.

C. The City will be responsible for programming the existing SCADA system which is located in the main control room identified as CHOLLAS. Contractor shall coordinate with the City programmer to allow the existing SCADA system at CHOLLAS the capability of monitoring all input signals available to the PLC as well as limited process control functions such as changing set-points, or modifying start and stop schedules etc. Contractor shall provide the City programmer on a CD disk all programming, screen shots, IO map, internal addresses, final setpoints, alarms, etc, neccesary to complete the SCADA programming.

D. The CONTRACTOR shall be responsible for providing and testing all communications hardware, cabling and connectors necessary to bring the radio communication link to the existing network. The radio survey and aligning of the antenna to the nearest repeater station will be performed by the City. The CONTRACTOR will install the radio antenna in coordination with the survey report.

1.3 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Division 11
2. Division 13
3. Division 16

PART 2 -- PRODUCTS

2.1 PLC FUNCTIONS

A. General: The PLC shall provide readable registers and coils to allow the existing SCADA system computer to display the status or value of all PLC input and output points. The PLC shall be configured to allow the SCADA system to read all pertinent internal values such as commanded state of outputs, countdown timer values, software interlock bits and any other program functions which are useful to the operator in understanding the present state of the automatic functions of any given process.

B. Power Failures: The PLC shall retain all set-points and other operator selectable bits in their last commanded state during a complete power failure of the PLC and the existing Network Monitor will generate a FAILURE alarm. PLC shall resume normal operations when power is restored.

C. Remote Control Devices: All necessary memory registers and control logic shall be provided by the CONTRACTOR for the PLC controlled devices to allow remote and manual control of that device. The SCADA system shall select the device for Automatic or Manual control. In AUTOMATIC Mode, the device will be controlled by the PLC per control descriptions. In MANUAL mode, a device may be manually started or stopped from the PLC.

D. PLC Limited Set Points: Operator entered set points shall be limited by the PLC so that ''illogical'' set point values or overlap does not occur.

E. Software Generated Failure Alarms: In addition to monitoring failure contacts for controlled equipment, if at any point a device fails to start, stop, open or close as commanded by the PLC, that device shall be considered failed. A separate FAIL alarm shall be generated by the PLC and provided for display at the SCADA system for that device. Individual alarms shall be provided for FAIL TO START, FAIL TO STOP etc. Software/ PLC generated fail alarms shall be reset by cycling the field control switch for the failed device out of AUTO and then back to AUTO. Upon receiving the AUTO status, the PLC shall reset any software/ PLC generated FAIL alarms. A reset feature shall also be provided at the SCADA level to allow remote resets of PLC generated fail alarms.

F. Software Interlocks and Inhibits: The PLC shall provide readable registers to the SCADA system to indicate interlocks or inhibits which prevent any device from normal operation. Interlock bits will be used to display information near the graphic display of a device or on the applicable process display screen of the existing Network SCADA system.

1. The PLC database listing shall be fully documented describing each point's function in enough detail to allow complete configuration of the existing Network SCADA system.

2.2 CONTROL MODES

A. Three control modes are implemented:

1. AUTOMATIC (select at SCADA)
2. MANUAL (select at SCADA)
3. HAND (selected at and controlled from individual piece of equipment)

B. Automatic/Manual Control (from PLC): When the Hand-Off-Auto switch at each piece of equipment is in the Auto position, operator can select between two modes of operation (either Automatic or Manual) where specified at SCADA system. In Automatic mode, the equipment is controlled by the PLC, according to the control strategies described in this control narrative.

C. In Manual mode, the operator can manually control equipment from the SCADA System.

D. Local Control: When the Hand-Off-Auto at each piece of equipment is in the Hand position, the operator can control the equipment locally. Hand control has priority over Auto control; when in Hand mode, commands from PLC have no effect.

2.3. INTERLOCKS:

A. Software interlocks are provided on equipment through PLC for example, in Automatic a pump may not be allowed to stop until PLC senses the pump's discharge valve is closed.

B. These PLC interlocks are not in effect when controlling equipment locally, although there are some cases where hardwired interlocks are in effect in all three modes.

2.4 RESETTING

A. The PLC locks-out equipment when the PLC determines it has failed. The PLC will not allow the equipment to operate under AUTO until the operator executes a RESET at PLC by switching the equipment from AUTO to MANUAL and back to AUTO modes.

2.5 MOTOR SPIN DELAYS

A. In Automatic PLC and Manual PLC modes, PLC will not allow a pump motor to start until an operator adjustable time of 1 minute after the run status has dropped out. This allows time for the motor to come to a complete stop before it is started again.

2.6 RUN TIMERS

A. The Network Monitor SCADA system shall monitor the motor running time.

B. The Network Monitor SCADA system shall monitor the Generator running time.

2.7 EQUIPMENT FAILURE ALARMS

A. When the PLC attempts to control equipment, whether in AUTO or MANUAL mode, the PLC will subsequently check to confirm that the command was executed successfully. For example, after attempting to start a pump, it checks that the pump is running. If, after several seconds, the PLC does not receive confirmation, it generates a FAILURE alarm at the PLC as well as at the existing Network SCADA system. Likewise, if the PLC itself would lose power or lose communication link, a FAILURE alarm will generate at the PLC and/or the existing Network SCADA system.

2.8 INSTRUMENTS, ADJUSTABLE SETTINGS, AND ALARMS

A. In the instrument list, the tag name next to each instrument is the name used in the Operator Interface (OI) software for that instrument. It is used in the OI software to create historical trend displays.

B. The Adjustable settings will be provided for operator to modify the settings of set-points from PLC for control equipment, alarms and trip points generated based on process variables, such as High/ Low level.

C. Alarms shall be generated on the PLC as well as on the existing Network SCADA system.

2.9 INPUT/OUTPUT SUMMARY

A. General: The Input/Output Summary presented at the end of this Section itemizes all inputs and outputs for the I&C system.

B. Content: Each column on the I/O summary is defined as follows:

1. Tag Number: The identifier assigned to a device which performs a function in the control system.

2. Loop Number: The number assigned to the control loop associated with the I/O.

3. Description: A process-oriented functional description that defines the measured/monitored/controlled parameter and the associated process/process equipment.

4. P&ID Number: The P&ID drawing number upon which the device appears.

5. Specification Section: The Specification Section associated with each instrument.

6. I/O Classification: The type of I/O required for current and future monitoring and control activities (spare I/O is not included).

   a. I/O type (analog, discrete, digital link, etc.)
   b. Total number of digital input, digital output, analog input and analog output points associated with each RTU and PLC

2.10 INSTRUMENT SUMMARY

A. General: The Instrument Summary presented at the end of this Section itemizes all required instruments for the Project.

B. Content: Each column on the Instrument Summary is defined as follows:

1. Instrument tag and loop number
2. Specification section number
3. Instrument range
4. Calibrated span
5. Instrument setpoints
6. NEMA rating
7. Material requirements

PART 3 – EXECUTION

3.1 LOOP 1-TIERRASANTA PUMP STATION

A. Purpose: Dual zone pumping station to 752 pressure zone and 900 pressure zone.

B. Reference:

1. Process Drawing: I-3, I-4, I-5, I-6, I-7, I-8
2. Plan Drawing: E-4, E-5
3. Equipment Specification Section: 11214

C. Description:

1. Tierrasanta pump station contains two pumping systems. Each pumping system, pumps to a dedicated pressure zone, 752 pressure zone and 900 pressure zone.

2. Each pressure zone pumping system consists of two constant speed high duty pumps, and three VFD normal system pumps. All pumps will be controlled automatically by the PLC based on pressure. Pumps will be sequenced on and off based on the associated zone pressure and operator selected pressure set points. The zone pressure signals will be transmitted to the pumping station PLC by redundant zone discharge pressure transmitters, PIT-125A/125B (Zone 752) and PIT-225A/225B (Zone-900). The PLC program will allow the operator to select primary/standby pressure transmitter, perform pressure set points, and timer adjustments through the operator interface on the control panels located at CHOLLAS. The timers will delay the start/stop of pumps upon detection of zone pressure set points. The PLC interlocks will prevent simultaneous pump starts with 15 second intervals allowed between pump starts.

D. Equipment:

752 Zone Equipment Name	Equipment Number
System Water Pump	P-101 (future)
System Water Pump	P-102
System Water Pump	P-103
High Duty Water Pump	P-104
High Duty Water Pump	P-105
Suction Pressure	PIT-120
Discharge Pressure	PIT-125
900 Zone Equipment Name	**Equipment Number**
System Water Pump	P-201
System Water Pump	P-202
System Water Pump	P-203
High Duty Water Pump	P-204
High Duty Water Pump	P-205
Suction Pressure	PIT-220
Discharge Pressure	PIT-225
PLC	N/A

E. Control: The pumps are operated locally at the MCC or remotely from the PLC. The pumps are automatically controlled based on pressure on the discharge of their respective zones.

1. The pump(s) shall stop running in Hand (via hardwire interlocking) as well as in Auto mode because of high discharge pressure, low inlet pressure, valve fail to open, valve fail to close, and soft start fail or VFD fail.

2. The pumps shall be automatically started and stopped in sequence based on set-point pressure as identified in the control strategy table. After a pressure setpoint has been reached for selectable time duration, the pumps Start and stop actions shall be initiated via the PLC's on-off controller. Once started, each pump shall run for a minimum adjustable time (initial value set at 120 seconds). Also, each pump shall be prevented from restarting for an adjustable time (initial value set at 60 seconds).

3. As the 5 pumps are not of equal capacity, there will be two sequence modes for normal and high flow demand operations. The assignment of Small (System pump) Lead, Lag 1, Lag 2, and Large (High Duty) Lead, Lag1, pumps sequence shall be operator adjustable via the PLC Small/Large Lead/Lag (Auto Mode) selector switch. In the Auto position the pump sequence shall be automatically rotated based on equalization of pump run times selected by the operator.

4. In normal operation, the normal system pumps, lead pump, lag pump1, and lag pump2 are controlled by the PLC in a sequential mode based on the zone pressure. Each zone has a system pressure setpoint which the control system tries to maintain. As the minimum pressure set point for pump operation is reached and after a selectable time duration, the Lead pump starts up at minimum rpm. When the flowrate demand increases, the discharge pressure will decrease automatically due to hydraulics. When this occurs, the Lead pump will gradually increase and up to full speed to maintain pressure. If the pressure continues to decrease, the PLC will call (delay) on Lag1 to start at minimum speed with the Lead pump maintaining full speed. The lead pump will decrease in speed so that both pumps operate at the same speed. As the flow demand increases, Lag1 pump and Lead pump will gradually increase up to full speed. Lag2 pump will start and run in the same manner as Lag1 if the flow demand continues to increase, with all three pumps operating at the same speed. When the flow demand decreases, the pump sequence will reverse in order starting with Lag2 pump slowing down to minimum speed, based on pressure, before the run command is removed

5. In high flow demand operation, all three system pumps are at full speed and the pressure continues to decrease. At this point, all three system pumps will be requested to stop. Once the pumps are shutdown, the Lead High duty pump will startup and run at full speed (it is a constant speed pump). After the Lead pump has been running for 15 seconds (adjustable), Lag1 high duty pump will start and run at full speed. These pumps will be stopped manually, either local or remote. To signify that a high flow demand event is over and to notify the operator to manually stop the pumps, an alarm will generate whenever the high duty pumps have been running for selectable amount of time and the flow is less than a selectable flow setpoint.

6. In PLC Automatic mode, the PLC shall not allow the Lead pump or any of the other pumps to run if there is a low suction pressure alarm. This is to protect the pump from damage which may result from running dry.

7. If one of the Lead or Lag pumps is unavailable for automatic operation, or failed, it shall be substituted by running the next Lag pump in sequence. The initialization and deactivation of the pumps are described in the Control Strategy Table below.

8. The PLC shall contain the control algorithms, permissive and interlocks required to initiate an automatic start and stop sequence. During a PLC automatic start sequence, the control algorithm shall check the pumps status, verify that all start permissive interlocks are normal and initiates a start sequence. A PLC manual start sequence follows the same control sequence with exception of certain permissive interlocks addressed in the software interlock section.

752 Zone Control Strategy Table PLC Automatic Mode			
Pump Calls	On (psig)	Off (psig)	Comments
System Pump Setpoint			80 psig (maintain)
			High duty pumps have manual off. An alarm will generate when the high duty pumps have been running with a flow less than 600 gpm for 15 minutes.
System Pump-Lead	78	84	
System PumpLag1	76	82	
High Duty Pump-Lead	74	NA	
High Duty Pumplag	69	NA	
The pumps can be turned on/off remotely by SCADA Water Distribution Operator from the SCADA control center located at CHOLLAS.			

900 Zone Control Strategy Table PLC Automatic Mode			
Pump Calls	On (psig)	Off (psig)	Comments
System Pump Setpoint			155 psig (maintain)
			High duty pumps have manual off. An alarm will generate when the high duty pumps have been running with a flow less than 500 gpm for 15 minutes.
System Pump-Lead	153	161	
System Pump-Lag1	151	159	
System Pump-Lag2	149	157	
High Duty Pump-Lead	147	NA	
High Duty Pump-Lag	142	NA	
The pumps can be turned on/off remotely by SCADA Water Distribution Operator from the SCADA control center located at CHOLLAS.			

9. The pressure transmitter signals from form PIT-125A (Zone 752) and PIT-225A (Zone 900) shall provide a continuous indication of the zone pressure, at the PLC and at the existing network SCADA system. If the PLC detects a failure (<4mA) from one of the transmitters, the PLC will generate an alarm and the operate will manually select PIT-125B and PIT225B as the primary device. In addition, if the PLC detects both respective zone PIT's readings are in disagreement by more than 5%, the PLC will generate an alarm and the operator will manually select which PIT to be the primary.

10. In an event if TPS 900 zone pumps are inoperable, the operator will have the ability to manually manual select via a software switch to operate the existing Via dominique pump station pumps which also feeds 900 zone. Selection of iether set of pumps will desable the other from operate to prevent overloading the electrical distribution system and the generator.

F. Local Control:

1. Manual: When the Hand/Off/Auto selector switch in the field is in the "Hand" position, the operator can manually start and stop the pump.

2. Auto: When the Hand/Off/Auto selector switch in the field is in the "Auto" position, the PLC starts and stops the pump based on the pressure in the downstream distribution system.

G. PLC/OIT/SCADA:

1. Manual: When the Hand/Off/Auto selector switch in the field is in the Auto position and the software Auto / Manual switch located at the PLC is in the Manual position, the operator controls the pumps with the software Start/Stop switch. A software Lead-Lag1-Lag2 selector switch is used to select the Lead system pump. In addition, a software Lead-Lag1 selector switch is used to select the Lead High Duty pump.

2. Automatic: When the Hand/Off/Auto selector switch in the field is in the "Auto" position and the software Auto / Manual switch located in the PLC is in the "Auto" position, the pump(s) shall start or stop automatically in response to the water pressure at their respective discharge zones. The systems pump sequence shall be automatically rotated based on equalization of pump run times. Similarly, the High Duty pumps sequence shall be automatically rotated between the two based on equalization of pump run times. If trouble is detected with a pump, the next lag pump in sequence shall take the place of the failed pump.

3. Primary/Standby: The software Primary/Standby switch will allow the operator to designate one of the two pressure transmitters for each zone as the primary pressure device. If the PLC detects a failure (signal < 4mA, or >20mA) from a pressure transmitter, the PLC will generate an alarm. If the PLC detects both respective zone PIT's readings are in disagreement by more than an operator selected margin (initially set at 5%) for greater than 60 seconds, the PLC will generate an alarm.

H. Interlocks:

1. Hardwire interlocks:

   a. The pump will stop by positioning the Hand/Off/Auto switch to the off position.

   b. The pump shall stop when high discharge pressure, low suction pressure, high motor temperature, valve fail to open, valve fail to close and soft start fail or VFD fail is detected.

2. Software interlocks:

   a. The pumps shall be interlocked to start when the decreasing zone pressure reaches to their respective set-point.

   b. The pumps shall be interlocked to stop when the selected zone pressure reaches its set-point.

3. Software Interlocks Permissive:

   a. When a PLC automatic or PLC manual start sequence is initiated, a number of permissive interlocks must be satisfied prior to starting the pump. The start permissive for both a PLC automatic start and PLC manual start sequence are provided as follows:

      1) Pump Start Permissive for PLC Auto Start:

         - MCC Panel Hand/Off/Auto switch in AUTO
         - Time Since Last Start > set point 1 Minutes
         - Pump Not OUT OF SERVICE
         - Pump at ZERO SPEED (Restart timer timed out)
         - PLC AUTO/MANUAL switch in AUTO
         - No PRESSURE FAIL
         - System pumps are off prior to starting the High Duty pumps

      2) Pump Start Permissive PLC Manual Start:

         - MCC Panel Hand/Off/Auto switch in AUTO
         - Pump Not OUT OF SERVICE
         - Pump at ZERO SPEED (Restart timer timed out)
         - PLC AUTO/MANUAL switch in MANUAL
         - No PRESSURE FAIL
         - System pumps are off prior to starting the High Duty pumps

I. Alarms/Monitoring:

1. Local (at MCC):

a. Pump running indication
b. Motor winding high temperature alarm indication
c. Pump high pressure alarm indication
d. Pump low pressure alarm indication
e. RVSS (soft start) fail alarm indication
f. Valve fail to open alarm indication
g. Valve fail to close alarm indication
h. VFD Fail alarm indication

2. PLC/SCADA:

a. Pump in Auto indication
b. Pump running indication
c. Motor high temperature alarm
d. Valve open indication
e. Valve closed indication
g. Valve fail alarm
f. Motor control power fail alarm.
g. Pump hi discharge pressure fail alarm
h. Pump low suction pressure fail alarm
i. Soft Start At-speed indication
j. VFD fail alarm
j. VFD in-bypass indication
k. VFD speed indication
l. RVSS (soft start) fail alarm indication
m. High flow demand over indication.
n. motor running time
o. Small Lead/Lag1/Lag2, Large Lag1/Lag2 Auto position indication
p. Pump Out Of Service indication (Operator initiated tag)

3.2 PRESSURE RELIEF VALVES

A. General: The following signals shall be monitored by the PLC/OIT and the existing SCADA system.

1. Zone 752

a. PRV-122 valve open (initial set point 86 psig)
b. PRV-122 valve closed
c. PRV-123 valve open (initial set point 88 psig)
d. PRV-123 valve closed

2. Zone 900

a. PRV-222 valve open (initial set point 163 psig)
b. PRV-222 valve closed

c. PRV-223 valve open (initial set point 165 psig)
d. PRV-223 valve closed

3.3 FLOW MEASUREMENT AND PRESSURE INDICATION

A. General: an in-line magnetic flowmeter will be installed on the station discharge piping and to monitor pumping throughput for each zone. In addition, one pressure transmitter on the inlet piping and two pressure transmitters on the outlet piping will be installed for each zone. The following signals shall be monitored by the PLC/OIT and the existing SCADA system.

1. Zone 752

a. PIT-120 suction header pressure
b. PIT-125A discharge header pressure 1
c. PIT-125B discharge header pressure 2
d. FIT-124 flow
e. Pressure transmitters fail alarm (reading < 4 ma)
f. Pressure transmitters 125 A&B accuracy alarm (> 5%)

2. Zone 900

a. PIT-220 suction header pressure
b. PIT-225A discharge header pressure 1
c. PIT-225B discharge header pressure 2
d. FIT-224 flow
e. Pressure transmitters fail alarm (reading < 4 ma, > 20mA)
f. Pressure transmitters 225 A&B accuracy alarm (> 5%)

3.4 ATS

A. General: The following ATS signals shall be monitored by the PLC/OIT and the existing SCADA system.

1. ATS fault
2. ATS normal power
3. ATS standby power

3.5 GENERATOR

A. General: Contractor shall configure the generator for the following data points to be readable over ethernet with rexception of the generators running status which will be hardwired. Generator IP Addresse will be provided by the City upon request by the Contractor. The OIT shall be configured by the Contractor to read and display data from the generator for the points described. Radio communications will be configured by the Contractor to allow reading of the generator by the existing SCADA system over the existing radio network.

1. Generator fail to run
2. Generator low fuel level
3. Generator in auto

4. Generator coolant high temp shutdown
5. Generator coolant low level
6. Generator over speed shutdown
7. Generator over crank shutdown
8. Generator battery low voltage
9. Generator battery charger fault
10. Generator common fail
11. Generator low oil pressure shutdown
12. Generator fail to run
13. Generator running (hardwired)
15. Generator running time

3.6 ROOM TEMPERATURE

A. General: The following signals shall be monitored by the PLC/OIT and the existing SCADA system.

1. TIT-511 MCC room temperature
2. TIT-510 Pump room temperature

3.7 BUILDING INTRUSION MONITORING

A. General: Each door allowing access into the electrical room, SDG&E room and pump room shall be monitored by PLC and the existing Network SCADA system. The security panel will also monitor any door intrusion sent to the PLC via interposing relays An indication of which door has been accessed will generate as follows:

1. Pump room double door open
2. Pump room W. door open
3. Pump room E. door open
4. Pump/MCC room door open
5. MCC room door open
6. Switchboard room door open
7. Flow meter vault open
8. Pump room skylight open

3.8 PUMP ROOM LEVEL

A. General: The following signals shall be monitored by the PLC/OIT and the existing Network SCADA system. Upon high level, the switch will provide a SCADA system flood alarm warning. Upon, a high high level, the switch will immediately (hard wired) shut down both main power as well as backup generator power.

1. LSH-512 High level pump room flood

3.9 POWER MONITOR

A. General: Contractor shall configure the Power monitors for the following data points to be readable over ethernet. Power monitor IP Addresses will be provided by the City upon request by the Contractor. The OIT shall be configured by the Contractor to read and

display data from the power monitors for the points described. Radio communications will be configured by the Contractor to allow reading of the power monitors by the existing SCADA system over the existing radio network.

1. MCC AC Voltage (each phase)
2. MCC AC Current (each phase)
3. MCC Wattage
4. MCC VARs
5. MCC power factor
6. Pump AC Voltage (each phase)
7. Pump AC Current (each phase)
8. Pump Wattage
9. Pump VARs
10. Pump power factor

3.10 SURGE TANK SYSTEM

A. General: The following signals shall be monitored at each surge tank system by the PLC/OIT and the existing SCADA system of the following signals.

1. Surge tank low level alarm
2. Surge tank high level alarm
3. Surge tank fault4. Surge tank level
5. Compressor Alarm
6. Compressor low oil alarm

3.11 SUMP PUMP STATION

A. General: The sump pumps in the pump room trench and in the flow meter vault shall be monitored by the PLC/OIT and the existing SCADA system of the following signals.

1. Pump(s) Running
2. Pump(s) fail
3. Sump High Level (meter vault)

3.12 WEATHER STATION

A. General: Contractor shall configure the weather station for the following data points to be readable over ethernet. Weather station IP Address will be provided by the City upon request by the Contractor. The OIT shall be configured by the Contractor to read and display data from the weather station for the points described. Radio communications will be configured by the Contractor to allow reading of the weather station by the existing SCADA system over the existing radio network.

1. Ambient temperature
2. Relative humidity
3. Wind speed

3.13 VIA DOMINIQUE PUMP STATION

A. General: The TPS OIT shall be configured to display all IO, control, status and alarm points which reside in the existing Via Dominique Quantum PLC (Part number; 140CPU43412A) The TPS OIT will read/write data to the VDPS PLC via Ethernet. The ethernet connection will also make the VDPS available to the existing Network SCADA system via TPS radio network. The existing PanelMate Power Pro OIT screens at the existing Via Dominique PLC panel shall be duplicated and re-created by the Contractor at the new TPS OIT in Tierrasanta pump station for the Magelis platform. A CD Copy of the existing Via Dominique OIT and PLC program shall be provided by the City upon request by the Contractor. See P&ID I-11 for I/O information.

3.14 TPS I/O LIST

TAG #	LOOP #	DESCRIPTIONS	P&ID	I/O TYPE			
				DI	DO	AI	AO
PI	120	ZONE 752 SUCTION PRESSURE	I-3			X	
PI	125A	ZONE 752 DISCHARGE PRESSURE 1	I-3			X	
PI	125B	ZONE 752 DISCHARGE PRESSURE 2	I-3			X	
ZLO	122	ZONE 752 PRV-122 OPEN	I-3	X			
ZLC	122	ZONE 752 PRV-122 CLOSED	I-3	X			
ZLO	123	ZONE 752 PRV-123 OPEN	I-3	X			
ZLC	123	ZONE 752 PRV-123 CLOSED	I-3	X			
YA	105A	P-105 RVSS FAIL	I-3	X			
YA	105B	P-105 CONTROL POWER FAIL	I-3	X			
TAH	105	P-105 HI TEMP	I-3	X			
YI	105A	P-105 RUNNING	I-3	X			
HS	105C	P-105 RUN	I-3		X		
YI	105B	P-105 IN AUTO	I-3	X			
YI	105C	P-105 AT SPEED	I-3	X			
PAL	105	P-105 LOW SUCT PRESS S/D	I-3	X			
PAH	105	P-105 HI DISCH PRESS S/D	I-3	X			
ZLO	105	P-105 VALVE OPEN	I-3	X			
ZLC	105	P-105 VALVE CLOSED	I-3	X			
YA	104A	P-104 RVSS FAIL	I-3	X			
YA	104B	P-104 CONTROL POWER FAIL	I-3	X			
TAH	104	P-104 HI TEMP	I-3	X			
YI	104A	P-104 RUNNING	I-3	X			
HS	104C	P-104 RUN	I-3		X		
YI	104B	P-104 IN AUTO	I-3	X			
YI	104C	P-104 AT SPEED	I-3	X			
PAL	104	P-104 LOW SUCT PRESS S/D	I-3	X			
PAH	104	P-104 HI DISCH PRESS S/D	I-3	X			

TAG #	LOOP #	DESCRIPTIONS	P&ID	I/O TYPE			
				DI	DO	AI	AO
ZLO	104	P-104 VALVE OPEN	I-3	X			
ZLC	104	P-104 VALVE CLOSED	I-3	X			
YA	103A	P-103 VFD FAIL	I-4	X			
YA	103B	P-103 CONTROL POWER FAIL	I-4	X			
TAH	103	P-103 HI TEMP	I-4	X			
YI	103A	P-103 RUNNING	I-4	X			
HS	103C	P-103 RUN	I-4		X		
YI	103B	P-103 IN AUTO	I-4	X			
YI	103C	P-103 VFD IN BYPASS	I-4	X			
PAL	103	P-103 LOW SUCT PRESS S/D	I-4	X			
PAH	103	P-103 HI DISCH PRESS S/D	I-4	X			
ZLO	103	P-103 VALVE OPEN	I-4	X			
ZLC	103	P-103 VALVE CLOSED	I-4	X			
SI	103	P-103 VFD SPEED INDICATION	I-4				X
SK	103	P-103 VFD SPEED CONTROL	I-4			X	
YA	102A	P-102 VFD FAIL	I-4	X			
YA	102B	P-102 CONTROL POWER FAIL	I-4	X			
TAH	102	P-102 HI TEMP	I-4	X			
YI	102A	P-102 RUNNING	I-4	X			
HS	102C	P-102 RUN	I-4		X		
YI	102B	P-102 IN AUTO	I-4	X			
YI	102C	P-102 VFD IN BYPASS	I-4	X			
PAL	102	P-102 LOW SUCT PRESS S/D	I-4	X			
PAH	102	P-102 HI DISCH PRESS S/D	I-4	X			
ZLO	102	P-102 VALVE OPEN	I-4	X			
ZLC	102	P-102 VALVE CLOSED	I-4	X			
SI	102	P-102 VFD SPEED INDICATION	I-4				X
SK	102	P-102 VFD SPEED CONTROL	I-4			X	
YA	101A	P-101 VFD FAIL (FUT)	I-5	X			
YA	101B	P-101 CONTROL POWER FAIL (FUT)	I-5	X			
TAH	101	P-101 HI TEMP (FUT)	I-5	X			
YI	101A	P-101 RUNNING (FUT)	I-5	X			
HS	101C	P-101 RUN (FUT)	I-5		X		
YI	101B	P-101 IN AUTO (FUT)	I-5	X			
YI	101C	P-101 VFD IN BYPASS(FUT)	I-5	X			
PAL	101	P-101 LOW SUCT PRESS S/D	I-5	X			
PAH	101	P-101 HI DISCH PRESS S/D (FUT)	I-5	X			
ZLO	101	P-101 VALVE OPEN (FUT)	I-5	X			
ZLC	101	P-101 VALVE CLOSED (FUT)	I-5	X			

TAG #	LOOP #	DESCRIPTIONS	P&ID	I/O TYPE			
				DI	DO	AI	AO
SI	101	P-101 VFD SPEED INDICATION (FUT)	I-5				X
SK	101	P-101 VFD SPEED CONTROL (FUT)	I-5			X	
PI	220	ZONE 900 SUCTION PRESSURE	I-6			X	
PI	225A	ZONE 900 DISCHARGE PRESSURE 1	I-6			X	
PI	225B	ZONE 900 DISCHARGE PRESSURE 2	I-6			X	
ZLO	222	ZONE 900 PRV-122 OPEN	I-6	X			
ZLC	222	ZONE 900 PRV-222 CLOSED	I-6	X			
ZLO	223	ZONE 900 PRV-223 OPEN	I-6	X			
ZLC	223	ZONE 900 PRV-223 CLOSED	I-6	X			
YA	205A	P-205 RVSS FAIL	I-6	X			
YA	205B	P-205 CONTROL POWER FAIL	I-6	X			
TAH	205	P-205 HI TEMP	I-6	X			
YI	205A	P-205 RUNNING	I-6	X			
HS	205C	P-205 RUN	I-6		X		
YI	205B	P-205 IN AUTO	I-6	X			
YI	205C	P-205 AT SPEED	I-6	X			
PAL	205	P-205 LOW SUCT PRESS S/D	I-6	X			
PAH	205	P-205 HI DISCH PRESS S/D	I-6	X			
ZLO	205	P-205 VALVE OPEN	I-6	X			
ZLC	205	P-205 VALVE CLOSED	I-6	X			
YA	204A	P-204 RVSS FAIL	I-6	X			
YA	204B	P-204 CONTROL POWER FAIL	I-6	X			
TAH	204	P-204 HI TEMP	I-6	X			
YI	204A	P-204 RUNNING	I-6	X			
HS	204C	P-204 RUN	I-6		X		
YI	204B	P-204 IN AUTO	I-6	X			
YI	204C	P-204 AT SPEED	I-6	X			
PAL	204	P-204 LOW SUCT PRESS S/D	I-6	X			
PAH	204	P-204 HI DISCH PRESS S/D	I-6	X			
ZLO	204	P-204 VALVE OPEN	I-6	X			
ZLC	204	P-204 VALVE CLOSED	I-6	X			
YA	203A	P-203 VFD FAIL	I-7	X			
YA	203B	P-203 CONTROL POWER FAIL	I-7	X			
TAH	203	P-203 HI TEMP	I-7	X			
YI	203A	P-203 RUNNING	I-7	X			
HS	203C	P-203 RUN	I-7		X		
YI	203B	P-203 IN AUTO	I-7	X			

TAG #	LOOP #	DESCRIPTIONS	P&ID	I/O TYPE			
				DI	DO	AI	AO
YI	203C	P-203 VFD IN BYPASS	I-7	X			
PAL	203	P-203 LOW SUCT PRESS S/D	I-7	X			
PAH	203	P-203 HI DISCH PRESS S/D	I-7	X			
ZLO	203	P-203 VALVE OPEN	I-7	X			
ZLC	203	P-203 VALVE CLOSED	I-7	X			
SI	203	P-203 VFD SPEED INDICATION	I-7				X
SK	203	P-203 VFD SPEED CONTROL	I-7			X	
YA	202A	P-202 VFD FAIL	I-7	X			
YA	202B	P-202 CONTROL POWER FAIL	I-7	X			
TAH	202	P-202 HI TEMP	I-7	X			
YI	202A	P-202 RUNNING	I-7	X			
HS	202C	P-202 RUN	I-7		X		
YI	202B	P-202 IN AUTO	I-7	X			
YI	202C	P-202 VFD IN BYPASS	I-7	X			
PAL	202	P-202 LOW SUCT PRESS S/D	I-7	X			
PAH	202	P-202 HI DISCH PRESS S/D	I-7	X			
ZLO	202	P-202 VALVE OPEN	I-7	X			
ZLC	202	P-202 VALVE CLOSED	I-7	X			
SI	202	P-202 VFD SPEED INDICATION	I-7				X
SK	202	P-202 VFD SPEED CONTROL	I-7			X	
YA	201A	P-201 VFD FAIL	I-8	X			
YA	201B	P-201 CONTROL POWER FAIL	I-8	X			
TAH	201	P-201 HI TEMP	I-8	X			
YI	201A	P-201 RUNNING	I-8	X			
HS	201C	P-201 RUN	I-8		X		
YI	201B	P-201 IN AUTO	I-8	X			
YI	201C	P-201 VFD IN BYPASS	I-8	X			
PAL	201	P-201 LOW SUCT PRESS S/D	I-8	X			
PAH	201	P-201 HI DISCH PRESS S/D	I-8	X			
ZLO	201	P-201 VALVE OPEN	I-8	X			
ZLC	201	P-201 VALVE CLOSED	I-8	X			
SI	201	P-201 VFD SPEED INDICATION	I-8				X
SK	201	P-201 VFD SPEED CONTROL	I-8			X	
YI	301	P-301 RUNNING	I-8	X			
YI	302	P-302 RUNNING	I-8	X			
YA	301	P-300 FAIL	I-8	X			
YI	601	P-601 RUNNING	I-9	X			
YI	602	P-602 RUNNING	I-9	X			
YA	600	P-600 FAIL	I-9	X			
LAHH	600	P-600 HI LEVEL	I-9	X			
FI	124	ZONE 752 FLOW	I-9			X	

TAG #	LOOP #	DESCRIPTIONS	P&ID	I/O TYPE			
				DI	DO	AI	AO
FI	224	ZONE 900 FLOW	I-9			X	
LAL	402	SURGE TANK 2 LOW LEVEL ALARM	I-9	X			
LAH	402	SURGE TANK 2 HIGH LEVEL ALARM	I-9	X			
LI	402	SURGE TANK 2 LEVEL	I-9			X	
LAL	401	SURGE TANK 1 LOW LEVEL ALARM	I-9	X			
LAH	401	SURGE TANK 1 HIGH LEVEL ALARM	I-9	X			
LI	401	SURGE TANK 1 LEVEL	I-9			X	
YAL	402	COMPRESSOR 2 ALARM	I-9	X			
LAH	402	COMPRESSOR 2 LOW OIL ALARM	I-9	X			
YAL	401	COMPRESSOR 1 ALARM	I-9	X			
LAH	401	COMPRESSOR 1 LOW OIL ALARM	I-9	X			
ZAO	501	PS NORTH DOUBLE DOOR	I-10	X			
ZAO	502	PS W. DOOR OPEN	I-10	X			
ZAO	503	PS E. DOOR OPEN	I-10	X			
ZAO	504	PS/MCC DOOR OPEN	I-10	X			
ZAO	505	MCC ROOM DOOR OPEN	I-10	X			
ZAO	506	SWITCHGEAR ROOM DOOR OPEN	I-10	X			
ZAO	507	FLOW METER VAULT OPEN	I-10	X			
ZAO	508A	ZONE 752 PUMP 5 SKYLIGHT OPEN	I-10	X			
ZAO	508B	ZONE 752 PUMP 4 SKYLIGHT OPEN	I-10	X			
ZAO	508C	ZONE 752 PUMP 3 SKYLIGHT OPEN	I-10	X			
ZAO	508D	ZONE 752 PUMP 2 SKYLIGHT OPEN	I-10	X			
ZAO	508E	ZONE 752 PUMP 1 SKYLIGHT OPEN	I-10	X			
ZAO	509A	ZONE 900 PUMP 5 SKYLIGHT OPEN	I-10	X			
ZAO	509B	ZONE 900 PUMP 4 SKYLIGHT OPEN	I-10	X			
ZAO	509C	ZONE 900 PUMP 3 SKYLIGHT OPEN	I-10	X			
ZAO	509D	ZONE 900 PUMP 2 SKYLIGHT OPEN	I-10	X			

TAG #	LOOP #	DESCRIPTIONS	P&ID	I/O TYPE			
				DI	DO	AI	AO
ZAO	509E	ZONE 900 PUMP 1 SKYLIGHT OPEN	I-10	X			
ZAO	514	SEDA DR MAN GATE OPEN	I-10	X			
TI	510	PUMP ROOM TEMPERATURE	I-10			X	
TI	511	MCC ROOM TEMPERATURE	I-10			X	
LAH	512	PUMP ROOM FLOOD	I-10	X			
YI	520	GENERATOR RUNNING	I-10	X			
YI	521A	ATS FAULT	I-10	X			
YI	521B	ATS NORMAL POWER STATUS	I-10	X			
YI	521C	ATS GENERATOR POWER STATUS	I-10	X			
		Sub Total		148	10	18	6
		20% Spare		30	2	4	2
		Total		176	12	22	8

3.15 INSTRUMENT LIST

Tag #	Loop #	Description	P&ID	Spec	Instrument/ Calibrated Range	Process Range	Setpoint	Units	Notes
PIT	120	Zone 752 Suction Pressure	I-3	13334	0-150	20-100		psig	
PI	121	Zone 752 Suction Gauge	I-3	13334	0-160	20-100		psig	
PIT	125A	Zone 752 Discharge Pressure 1	I-3	13334	0-150	50-100		psig	
PIT	125B	Zone 752 Discharge Pressure 2	I-3	13334	0-150	50-100		psig	
PI	124	Zone 752 Discharge Gauge	I-3	13334	0-160	50-100		psig	
PSL	105	P-105 Low Suction Pressure switch	I-3	13335	10-150	20-100	20	psig	
PI	105A	P-105 Suction Pressure Gauge	I-3	13334	0-160	20-100		psig	
PSH	105	P-105 Discharge Pressure Switch	I-3	13335	10-150	50-100	95	psig	
PI	105B	P-105 Discharge Pressure Gauge	I-3	13334	0-160	50-100		psig	
PSL	104	P-104 Low Suction Pressure switch	I-3	13335	10-150	20-100	20	psig	
PI	104A	P-104 Suction Pressure Gauge	I-3	13334	0-160	20-100		psig	
PSH	104	P-104 High Discharge Pressure Switch	I-3	13335	10-150	50-100	95	psig	
PI	104B	P-104 Discharge Pressure Gauge	I-3	13334	0-160	50-100		psig	
PSL	103	P-103 Low Suction Pressure Switch	I-4	13335	10-150	20-100	20	psig	
PI	103A	P-103 Suction Pressure Gauge	I-4	13334	0-160	20-100		psig	
PSH	103	P-103 High Discharge Pressure Switch	I-4	13335	10-150	50-100	95	psig	
PI	10B	P-103 Discharge Pressure Gauge	I-4	13334	0-160	50-100		psig	
PSL	102	P-102 Low Suction Pressure Switch	I-4	13335	10-150	20-100	20	psig	
PI	102A	P-102 Suction Pressure Gauge	I-4	13334	0-160	20-100		psig	
PSH	102	P-102 High Discharge Pressure Switch	I-4	13335	10-150	50-100	95	psig	
PI	102B	P-102 Discharge Pressure Gauge	I-4	13334	0-160	50-100		psig	
PIT	220	Zone 900Suction Pressure	I-6	13334	0-150	20-100		psig	
PI	221	Zone 900Suction Gauge	I-6	13334	0-160	20-100		psig	
PIT	225A	Zone 900Discharge Pressure 1	I-6	13334	0-400	120-180		psig	
PIT	225B	Zone 900Discharge Pressure 2	I-6	13334	0-400	120-180		psig	

Tag #	Loop #	Description	P&ID	Spec	Instrument/ Calibrated Range	Process Range	Setpoint	Units	Notes
PI	224	Zone 900Discharge Gauge	I-6	13334	0-300	120-180		psig	
PSL	205	P-205 Low Suction Pressure Switch	I-6	13335	10-150	20-80	40	psig	
PI	205A	P-205 Suction Pressure Gauge	I-6	13334	0-160	20-80		psig	
PSH	205	P-205 High Discharge Pressure Switch	I-6	13335		165-185	175	psig	
PI	205B	P-205 Discharge Pressure Gauge	I-6	13334	0-300	130-170		psig	
PSL	204	P-204 Low Suction Pressure Switch	I-6	13335	10-150	20-80	40	psig	
PI	204A	P-204 Suction Pressure Gauge	I-6	13334	0-160	20-80		psig	
PSH	204	P-204 High Discharge Pressure Switch	I-6	13335	10-300	165-185	175	psig	
PI	204B	P-204 Discharge Pressure Gauge	I-6	13334	0-200	130-170		psig	
PSL	203	P-203 Low Suction Pressure Switch	I-7	13335	10-150	20-80	40	psig	
PI	203A	P-203 Suction Pressure Gauge	I-7	13334	0-160	20-80		psig	
PSH	203	P-203 High Discharge Pressure Switch	I-7	13335	10-300	165-185	175	psig	
PI	203B	P-203 Discharge Pressure Gauge	I-7	13334	0-20	130-170		psig	
PSL	202	P-202 Low Suction Pressure Switch	I-7	13335	10-150	20-80	40	psig	
PI	202A	P-202 Suction Pressure Gauge	I-7	13334	0-160	20-80		psig	
PSH	202	P-202 High Discharge Pressure Switch	I-7	13335	10-300	165-185	175	psig	
PI	202B	P-202 Discharge Pressure Gauge	I-7	13334	0-200	130-170		psig	
PSL	201	P-201 Low Suction Pressure Switch	I-8	13335	10-150	20-80	40	psig	
PI	201A	P-201 Suction Pressure Gauge	I-8	13334	0-160	20-80		psig	
PSH	201	P-201 High Discharge Pressure Switch	I-8	13335	10-200	165-185	175	psig	
PI	201B	P-201 Discharge Pressure Gauge	I-8	13334	0-200	130-170		psig	
LSL	300	P-301 Level Switch (Stop)	I-8	13325			9	inch	Float Switch, Pump Room sump
LSH	300	P-301 Level Switch (Start-Lead)	I-8	13325			24	inch	Float Switch, Pump Room sump
LSHH	300	P-301 Level Switch (Start-Lag)	I-8	13325			24	inch	Float Switch, Pump Room sump

SECTION 13314

IN-LINE FLOW MEASURING SYSTEMS

PART 1 – GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section is to provide an in-line flow measuring system which is in accordance with the CONSTRUCTION DOCUMENTS.

PART 2 – PRODUCTS

2.1 MAGNETIC LIQUID FLOW MEASURING SYSTEMS

A. General:

1. Magnetic flowmeter systems shall be of the low frequency electromagnetic induction type and produce a DC pulsed signal directly proportional to and linear with the liquid flow rate.

2. Compete zero stability shall be an inherent characteristic of the flowmeter system.

3. Each magnetic flow metering system shall include a metering tube, signal cable, transmitter and flowmeter grounding rings.

B. Metering Tube:

1. The metering tube shall be constructed of Type 316 stainless steel ANSI flange Class 300, have at least two diametrically opposed bullet-nosed self cleaning electrodes, a liner material recommended by the manufacturer for the meters intended service as described in these documents, a meter housing rated for NEMA 6 submergence conditions, and a meter coating consisting of epoxy painted finish.

2. The system shall use two grounding rings for a system ground.

3. All grounding shall conform to the manufacturer's requirements.

C. Transmitter:

1. The signal converter/transmitter shall use a DC pulse technique to drive flux-producing coils and convert the DC pulse signal form the tube to a standardized 4-20 mA signal.

2. The signal converter/transmitter shall have a six digit back lit indicator, be housed in a remotely mounted NEMA 4X enclosure, have integral zero return to provide a constant zero output signal in response to an external dry contact closure, an integral calibration self-test feature to verify proper operation of the electronics, high and low alarms and an automatic zero adjustment.

D. Calibration:

1. Each flow metering system shall be hydraulically calibrated at the facility which is traceable to the National Bureau of Standards.

2. The calibration procedure shall conform to the requirements of MIL-STD-45662A.

3. A real-time computer generated printout of the actual calibration data indicating apparent and actual flows at 20, 40, 60, 80, and 100% of the calibrated range shall be submitted to the RESIDENT ENGINEER at least 30 days before shipment of the meters to the Project site.

E. Performance: The flow metering system shall conform to the following requirements:

1. Output: 4-20 mA into 600 ohms minimum

2. Time Constant = 0.5 to 100 seconds; galvanic or optic isolation

3. Accuracy: 0.35% of flow rate from 10 to 100% full scale for velocities over 3 feet per second

4. Repeatability: 0.1% Full Scale

5. Environmental Limits: T = -40 to +160 degrees F

6. Power Consumption: 30 watts or less

F. The following magnetic flow measuring systems shall be provided:

Tag	Location	Size	Calibrated Range	Process Range	Liner Material	Electrode Material	NEMA Rating (Body/Transmitter)
FIT-124	Zone 900 Discharge Header	8"	0-3000 gpm	125-2500 gpm	Polyurethane	316 SST	NEMA6/NEMA4x
FIT-224	Zone 752 Discharge Header	12"	0-6000 gpm	200-4500 gpm	Polyurethane	316 SST	NEMA6/NEMA4x

G. Manufacturers, or equal:

1. Yokogawa
2. Fischer & Porter

PART 1 -- EXECUTION

1.1 GENERAL

A. Installation and testing of flow meters shall be in accordance with the requirements of Section 13300 - Instrumentation and Control.

B. See section 13301 – Instrumentation and Control Description paragraph 3.15 for Instrument list.

*** END OF SECTION ***

SECTION 13325

LEVEL DETECTION SWITCHES

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide all level detection switches, complete and operable, in accordance with the Contract Documents.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 13300 Instrumentation and Control

1.3 CONTRACTOR SUBMITTALS

A. Submittals shall be in accordance with Section 01300 - Submittals and Section 13300 - Instrumentation and Control.

PART 2 -- PRODUCTS

2.1 GENERAL

A. The requirements of Section 13300 - Instrumentation and Control apply to all the products indicated herein.

2.2 TIPPING FLOAT LEVEL SWITCHES

A. Tipping float level switches shall used for sump pump control. They shall consist of a moving float, mounting bracket, and a connecting cable which is anchored at the midpoint of a differential band. As the level rises and falls the float rights itself or inverts causing switching actions. The cable anchoring point shall be protected by strain relief. The hermetically sealed mercury free switches shall be SPDT with a minimum rating of 10 A at 120 VAC.

B. Tipping float level switches shall be, MJK Model 7030, or equal.

2.3 CAPACITANCE LEVEL SWITCHES

A. Capacitance level switches shall used for flood level control and surge tank control. They shall be suitable for detection of water and shall consist of a non metallic probe and relay if required. The probe shall include wall mounting bracket. The cable anchoring point shall be protected by strain relief. The contacts or supplied relay shall be SPDT with a minimum rating of 10 A at 120 VAC.

B. Capacitance level switches shall be FLOWLINE SWITCH-TEK LP15, GEMS SENSORS CAP-200 series, or equal.

PART 3 -- EXECUTION

3.1 GENERAL

A. Execution of level detection switches shall conform to the requirements of Section 13300 - Instrumentation and Control.

B. See section 13301 – Instrumentation and Control Description paragraph 3.15 for Instrument list.

*** END OF SECTION ***

SECTION 13334

PRESSURE MEASURING SYSTEMS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR, through the Instrumentation Supplier, shall provide pressure measuring systems, complete and operable, in accordance with the Contract Documents.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 13300 Instrumentation and Controls
2. Section 13335 Pressure Detection Switches
3. Section 15000 Piping Components

1.3 CONTRACTOR SUBMITTALS

A. Shop Drawings shall be submitted in conformance with the requirements of Section 01300 - Submittals and Section 13300 - Instrumentation and Control.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Electrical interface and code compliance shall conform to the requirements of Section 13300 - Instrumentation and Control.

2.2 ELECTRONIC PRESSURE TRANSMITTERS

A. Pressure transmitters shall consist of a ½-inch female NPT flange, process connector and connection, pressure snubber, amplifier unit, integral indicator, terminal box with cover, NEMA 4X, and conduit connections. The maximum overrange pressure limit shall be a minimum of 150% of the minimum range. Span shall be adjustable over a minimum of 100:1 range: External adjustments shall include zero and span. Damping shall be provided as an internal adjustment. All equipment shall be suitable for an ambient operating range of -40 to + 300 degrees F. All wetted parts shall be constructed of Type 316 stainless steel.

1. The integral indicator shall be calibrated in process units. Power supply shall be 24 VDC. Accuracy, including linearity and repeatability, shall be a plus or minus 0.075% of calibrated span. Transmitter shall comply to HART standard data and communication protocol.

B. Pressure transmitter shall be Rosemount 3051 or equal. Snubbers shall be Ashcroft Type 1112, or equal.

2.3 ELECTRONIC DIFFERENTIAL PRESSURE TRANSMITTERS

A. Electronic differential transmitters shall consist of a capsule assemble, bottom works, vent plug, drain plug, cover flange, silicone fill fluid, ½-inch female NPT process connector and connections, amplifier unit, integral indicator, terminal box with cover, 316L SST 3-valve manifold,. Static pressure rating shall be a minimum of 500 psig. The maximum overrange pressure limit shall be a minimum of 150% of the minimum range. Span shall be adjustable over a minimum of 5:1 range: External adjustments shall include zero and span. Damping shall be provided as an internal adjustment. All equipment shall be suitable for an ambient operating range of -40 to + 212 degrees F. All wetted parts shall be BUANA and constructed of Type 316 stainless steel. The integral indicator shall be calibrated in process units. Power supply shall be 24 VDC. Accuracy, including linearity and repeatability, shall be a plus or minus 0.2% of span. Transmitter shall comply to HART standard data and communication protocol.

B. Differential pressure transmitter shall be smar LD301 or equal.

2.4 PRESSURE GAUGES

A. Pressure gauges shall consist of a 4 ½ -inch dial with full size bourdon tube. Construction of all wetted parts shall be 316 stainless steel. Meter case shall be of non corroding phenol. All pressure gages shall include a 316 stainless steel pressure snubber to provide dampening.

B. Pressure gauges shall be Ashcroft Duragauge Type 1279 or equal. Snubbers shall be Ashcroft Type 1112, or equal.

PART 3 -- EXECUTION

3.1 GENERAL

A. Installation of pressure measuring systems shall be in accordance with the requirements of Section 13300 - Instrumentation and Control and Section 15000 - Piping Components.

B. See section 13301 – Instrumentation and Control Description paragraph 3.15 for Instrument list.

*** END OF SECTION ***

SECTION 13335

PRESSURE DETECTION SWITCHES

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide pressure detection switches, complete and operable, in accordance with the Contract Documents.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 13300 Instrumentation and Controls
2. Section 13334 Pressure Measuring Systems
3. Section 15000 Piping Components

1.3 CONTRACTOR SUBMITTALS

A. Submittals shall be in accordance with Section 01300 - Submittals and Section 13300 - Instrumentation and Controls

PART 2 -- PRODUCTS

2.1 BOURDON TUBE PRESSURE SWITCHES

A Pressure switches shall be bourdon tube type with snap action switches. Wetted materials shall be 316 stainless steel. Switch provided with two ½ -inch conduit connections. Switch assembly housing shall be a weatherproof enclosure. NEMA 4. Switch shall have a visible calibrated dial and on/off indication. CONTRACTOR shall select pressure transducer so that set point falls between 30 and 70 percent of maximum range. Approximate set point and, if applicable, reset point indicated on calibrated scales. Repeatability and sensitivity shall be 1.0 percent of operating range. Unless otherwise specified, switches nonadjustable deadband type.

B Pressure switches shall be Mercoid DSW or approved equal.

PART 3 -- EXECUTION

3.1 GENERAL

A. Installation of pressure detection switches shall be according to Section 13300 - Instrumentation and Control.

B. See section 13301 – Instrumentation and Control Description paragraph 3.15 for Instrument list.

*** END OF SECTION ***

SECTION 13344

TEMPERATURE MEASURING SYSTEMS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. General: The CONTRACTOR shall provide temperature measuring systems, complete and operable, in accordance with the Contract Documents.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 13300 Instrumentation and Controls
2. Section 15000 Piping Components

1.3 CONTRACT SUBMITTALS

A. Shop drawings shall be submitted in conformance with the requirements of Section 01300 - Submittals and Section 13300 - Instrumentation and Controls.

PART 2 -- PRODUCTS

2.1 TEMPERATURE MEASURING SYSTEMS

A. Temperature transmitter shall be a surface mounting, indicating, filled system unit in a suitable enclosure. A 4-20 mA dc output signal is required, current regulated to drive any load between 0 and 600 ohms. Power supply shall be 120 VAC 60 Hz. Ambient temperature compensation shall be provided at the transmitter.

PART 3 -- EXECUTION

3.1 GENERAL

A. Temperature measuring systems shall be executed according to Section 13300 - Instrumentation and Control.

B. See section 13301 – Instrumentation and Control Description paragraph 3.15 for Instrument list.

*** END OF SECTION ***

SECTION 13370

CONTROL PANELS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. General: The CONTRACTOR shall provide control panels, complete and operable, in accordance with the Contract Documents.

B. The provisions of this Section apply to local control panels provided in equipment systems specified in other sections unless indicated otherwise in those sections.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, also apply to the extent required for proper performance of this Work:

1. Section 11000 Equipment General Provisions
2. Section 13300 Instrumentation and Control
3. Section 13374 Control Panel Instrumentation
4. Section 16480 Motor Control Center

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated, the current editions of the following commercial standards apply to the Work of this Section:

1.	ASTM A36	Specification for Carbon Structural Steel
2.	ASTM A283	Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
3.	NEMA ICS-1-101	Industrial Control Systems
4.	SSPC-SP6	Specification for the Society for Protective Coating B Commercial Blast

1.4 CONTRACTOR SUBMITTALS

A. Shop drawings shall be submitted in accordance with Section 01300 - Submittals and Section 13300 - Instrumentation and Control.

B. Control Panel Engineering Submittal: The CONTRACTOR shall submit a control panel engineering submittal (CPES) for each control panel and enclosure provided under Division 13. The CPES shall completely define and document the construction, finish, layout, power circuits, signal and safety grounding circuits, fuses, circuit breakers, signal circuits, internally mounted instrumentation and SCADA system components, face plate

mounted instrumentation components, internal panel arrangements, and external panel arrangements. All panel drawings shall be "B" size, and all data sheets and manufacturer specification sheets shall be "A" size. The submittal shall be in conformance with NEMA Standard ICS-1-1.01, shall be submitted as a singular complete bound volume or multi-volume package and shall have the following content:

1. A complete index shall appear in the front of each bound volume. Panels shall be indexed by system or process area, and drawings and data associated with a panel shall be grouped together. All panel tagging and nameplate nomenclature shall be consistent with the requirements of the Contract Documents.

2. Scale construction drawings which define and quantify the type and gauge of steel to be used for panel fabrication, the ASTM A36 grade proposed for structural shapes and straps, panel door locks and hinge mechanisms, type of bolts and bolt locations for section joining and anchoring, details and proposed locations on the use of "Unistrut" members, stiffener materials and locations, electrical terminal box and outlet locations, electrical access locations, print pocket locations, writing board locations and lifting lug material and locations.

3. Scale physical arrangement drawings which define and quantify the physical groupings comprising control panel sections, auxiliary panels, subpanels, and racks. Cutout locations with nameplate identifications shall be indicated.

4. Front of panel layouts for all control panels.

5. Schematic/elementary diagrams depicting all control devices and circuits and their functions.

6. Wiring/connection diagrams locating and identifying electrical devices, terminals and interconnecting wiring. These diagrams shall show interconnecting wiring by lines, designate terminal assignments, and show the physical location of all electrical and control devices.

7. Interconnection diagrams locating and identifying all external connections between the control panel/control panel devices and associated equipment. These diagrams shall show interconnecting wiring by lines, designate terminal assignments, and show the physical location of all panel ingress and egress points.

8. Control sequence diagrams to portray the contact positions or connections required to be made for each successive step of the control action. Written descriptions explaining the control sequence diagrams and system operation shall be furnished.

9. Completed ISA-S20 data sheets for all instrumentation devices associated with each control panel, supplemented with manufacturer specification sheets which verify conformance to the requirements of the Contract Documents.

10. A bill of material which enumerates all devices associated with the control panel.

11. A priced listing of analog spare parts in conformance with Section 13300 - Instrumentation and Control.

1.5 SPARE PARTS AND SPECIAL TOOLS

A. Control panel spare parts selected by the RESIDENT ENGINEER and special tools shall be provided in accordance with Section 13300 - Instrumentation and Control.

B. All spare parts and special tools shall be submitted before startup commences, suitably wrapped and identified.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Environmental Suitability: All indoor control panels and instrument enclosures shall be suitable for operation in the ambient conditions associated with the locations designated in the Contract Documents. Heating, cooling, and dehumidifying devices shall be provided in order to maintain all instrumentation devices no less than 20% below the maximum rated environmental operating level, and at least 20% above the minimum rated environmental operating level. The CONTRACTOR shall provide all power wiring for these devices. Enclosures suitable for the environment shall be furnished.

B. The control panel controls shall be 120 VAC. Where the electrical power supply to the control panel is 208VAC 3- phase or 480 VAC 3-phase, as indicated, the control panel shall be provided with a control power transformer. Control conductors shall be provided in accordance with the indicated requirements.

C. The control panel shall be the source of power for any 120-VAC solenoid valves interconnected with the control panel. All equipment associated with the control panel shall be ready for service after connection of conductors to equipment, controls, and control panel.

D. The main feeder disconnect shall have a door-mounted handle unless otherwise indicated.

E. Control panels shall be housed in NEMA 12 enclosures with gasketed doors unless otherwise indicated. Control panels shall be either freestanding pedestal-mounted, or equipment skid-mounted, as indicated. Internal control components shall be mounted on an internal back-panel or side-panel as required.

F. Each source of foreign voltage shall be isolated by providing disconnecting or pull-apart terminal blocks or a disconnect operable from the control panel front. Each control panel shall be provided with identified terminal strips for the connection of all external conductors. Provide sufficient terminal blocks to connect 25% additional conductors for future use.

G. Motor starters, where required, shall be in accordance with Section 16480 - Motor Control Center. Each motor starter shall be provided with contact closures for motor overload, local indication, and remote alarm. All electrical components shall be of standard American manufacture.

H. Discrete outputs from the control panel shall be provided by electrically isolated contacts rated for 5 A at 120 VAC. Analog inputs and outputs shall be an isolated 4-20 mA, 2-wire signals with power supply.

I. Programmable Logic Controllers (PLCs) may be provided in lieu of relays if the programmable logic controllers match the PLCs provided under Section 13374 - Control Panel Instrumentation.

J. All control panel mounted devices shall be mounted a minimum of 3 feet above finished floor elevation. Provide all combination motor starters not furnished in a MCC but indicated in Section 11000 - Equipment General Provisions.

K. Painting: Control panels shall be thoroughly cleaned and sand blasted per Steel Structures Painting Council Specification SSPC-SP-6 (Commercial Blast) after which surfaces shall receive a prime coat of Amercoat 185 or equal 3-mils dry, for a total thickness of the complete system of 6 mils. The finished color of the outside surfaces shall be selected by the RESIDENT ENGINEER, unless otherwise indicated. The interior of the control panel, back-panel, and side-panel(s) shall have a white finish coat.

2.2 CONTROL PANELS

A. Materials:

1. Panel section faces shall be No. 10 gauge minimum thickness steel for free standing panels and No. 14 gauge minimum thickness steel for wall mounted or pedestal mounted panels. All materials shall be selected for levelness and smoothness.

2. Relay rack high density type panels shall use standard relay racks with No. 14 gauge steel frame and supports.

3. Structural shapes and strap steel shall comply with ASTM A283.

a. Bolting Material: Commercial quality carbon steel bolts, nuts and washers, shall be 2-inch diameter with UNC threads. Carriage bolts shall be used for attaching end plates. All other bolts shall be hex head machine bolts. All nuts shall be hot pressed hex, American Standard, heavy. Standard wrought washers shall be used for foundation bolts and attachments to building structures. All other bolted joints shall have SAE standard lock washers.

4. Construction: Dimensions shall be in accordance with vendor's requirements. Elevations and horizontal spacing shall be subject to RESIDENT ENGINEER's approval.

B. Fabrication:

1. End plates, top plates and top closure panels (to hung ceiling) shall be provided when required by the material requisition. End plates, top plates and top closure panels shall be removable with countersunk bolts to match panels. Top closure panels shall be provided in lengths which match the widths of standard panels, except that one top closure panel may extend across two 4-feet 6-inches wide or

five 2-feet wide standard panels. The vertical joints of these panels shall align with the vertical joints of the standard panels.

2. End closure or rear closure doors shall be provided where required. Such doors shall be flush fitting, gasketed, and be of the hinged lift-off type with lockable door handles. A common key shall be provided for all doors on one panel assembly. Removable access panels shall be provided with dished handle fasteners. Screw driver 1/4 turn or Dzus type fasteners are not acceptable.

   a. The flanged edges of all panels shall be straight and smooth. Corners shall be welded and ground smooth.

   b. The face of the panel shall be true and level after flanging.

   c. All panel cut-outs and holes may be cut or drilled by any standard method that does not cause deformation. Burrs shall be ground smooth.

   d. Adjacent panels shall be assembled with faces flush. Gaps or cracks shall not be visible from the front of the assembled instrument board.

   e. Stiffeners shall be welded to the back of panels as required to prevent panel deformation due to the weight of face mounted instruments.

   f. Panels shall be self-supporting as defined below.

C. Frameworks and Supports:

1. The rear of each panel section shall have a steel framework assembled to it for supporting conduit, wireways, switches, piping, and all instrument accessory items such as relay or terminal enclosures, transducers, pressure switches, valves, and air relays. The main framework shall be constructed of standard structural shapes. Special shapes such as "Unistrut" may be used for secondary supports. The framework shall neither interfere with instrument connections nor interfere with access needed for maintenance or adjustments.

2. The steel framework shall extend 2 feet 4 inches back from the panel face, or as indicated in the material requisition. Where indicated, individual adjustable leg supports shall be provided at the back of the framework so that the entire panel is self-supporting.

D. Preparation of Panel Surface:

1. The following requirements apply to the front and rear face of the panel, both sides and the edges of all flanges, and the periphery of all holes or cut-outs:

   a. All high spots, burrs, and rough spots shall be ground smooth.

   b. The surfaces shall be sanded or sandblasted to a smooth, clean bright finish.

   c. All traces of oil shall be removed with a solvent.

d. The first coat of primer shall be applied immediately.

E. Panel Finishing:

1. A thin coat primer surface shall be applied over the entire panel surface.

2. Wet sand, dry, and then quick glaze spot putty on the front of the panel only. Dry, then wet sand again and dry.

3. A primer surface shall be applied on the front of the panel only.

4. Wet sand to smooth clear finish, then dry.

5. At least two coats of air-dry, satin finish, lacquer enamel shall be applied over the entire surface. Color shall be as approved by RESIDENT ENGINEER.

6. Furnish two one-pint containers of air drying, matching paint for field touch-up of the panel face.

F. Instrument Finishing: The final coats applied to painted surface of instrument cases, doors, or bezels which are visible from the front of panels shall be manufacturer's standard unless otherwise indicated. Black japan or "crinkle" finishes on instrument cases are not acceptable.

G. Mounting of Instruments:

1. The panel vendor shall provide cut-outs and shall mount all instrument items indicated to be panel mounted, including any instruments indicated to be furnished by other vendors but installed in panel (if applicable).

2. The panel vendor shall also mount behind the panels other instrument accessory items as required for functionality or as indicated.

3. Equipment mounted at the rear of panel shall be installed to allow for commissioning adjustments, servicing requirements, and cover removal.

4. Spare space shall be kept clear of wiring to give maximum space for future additions.

H. Electrical Requirements:

1. Conduit, wireways, switches, wire, and electrical fittings shall be provided for all 115 V circuits to instruments and other electrical devices as required for a complete and operable installation.

2. Conduit, wireways, junction boxes, and fittings shall be provided for all signal wire, thermocouple, or resistance thermometer lead wire. Conduit or wireway runs shall include those required between temperature sensors and temperature transmitters and between the thermocouple wireway or junction box to instruments.

3. Each terminal connection shall have a plastic plate with a terminal and instrument tag number. All wiring shall be identified with stamped tubular wire and markers.

4. Freestanding panels shall be provided with switched 100-W incandescent back-of-panel lights. One light shall be provided for every 4 feet of panel width and shall be mounted inside and in the top of the back-of-panel area.

5. Freestanding panels shall be provided with a 15-A, 120-V, service outlet circuit within the back-of-panel area. The circuit shall be provided with 3-wire, 120-V, 15-A, duplex receptacles one for every 4 feet of panel width (one minimum per panel), spaced evenly along the back-of-panel area.

6. Wall mounted or pedestal mounted panels shall be so sized as to adequately dissipate heat generated by equipment mounted in or on the panel.

7. Wall mounted or pedestal mounted panels mounted outside or in unshaded areas shall be provided with thermostatically controlled heaters that maintain inside temperature above 40 degrees F.

8. A hand switch controlled 100-W incandescent light and a breaker protected 120-V, 15-A duplex receptacle shall be provided within each wall mounted or pedestal mounted panel.

9. Wiring methods and materials for all panels shall be in accordance with the NEC requirements for General Purpose (no open wiring) unless otherwise indicated.

10. Signal and Control Circuit Wiring:

    a. Wire type and sizes: Conductor shall be flexible stranded copper machine tool wire UL listed Type MTW, and shall be rated 600 V. Wires for instrument signal circuits and alarm input circuits shall be No. 14 AWG. All other wires, including shielded cables, shall be No. 16 AWG, minimum.

    b. Wire Insulation Colors: Conductors supplying 120-VAC power on the line side of a disconnecting switch shall have a black insulation for the ungrounded conductor. Grounded circuit conductors shall have white insulation. Insulation for ungrounded 120-VAC control circuit conductors shall be red. All wires energized by a voltage source external to control panels shall have yellow insulation. Insulation for all DC conductors shall be blue.

    c. Wire Marking: Each signal, control, alarm, and indicating circuit conductor connected to a given electrical point shall be designated by a single unique number which shall be shown on all shop drawings. These numbers shall be marked on all conductors at every terminal using white numbered wire markers which shall be plastic-coated cloth, Brady Type B-500 or equal or shall be permanently marked by heat-shrink plastic.

d. Flexible conduit is not acceptable except when specifically approved by the RESIDENT ENGINEER in writing.

e. Conduit fittings shall be Crouse-Hinds cast fittings or equal.

f. Splicing of wires in conduits is discouraged. If permitted, splicing shall be approved by the RESIDENT ENGINEER and splices shall be soldered or pressure type crimped.

g. For case grounding, panels shall be provided with a 1/4-inch by 1-inch copper ground bus complete with solderless connector for one No. 4 AWG bare stranded copper cable. The copper cable shall be connected to a system ground loop.

11. Electrical Locations:

a. When Contract Documents call for thermocouple actuated instruments, the thermocouple lead wire shall be installed without junction. The panel vendor shall provide dedicated empty conduits or wireways running from the instrument(s) to the top or bottom of the panel as called for in the material specifications or as otherwise required. Sizing of the conduit or wireway shall be in accordance with the capacity of the instrument(s).

b. Single case (no remote logic) annunciator units shall be installed at the top of panel and may be considered as a terminal box when top of panel wire entry is indicated. If bottom of panel entry is indicated, a terminal box shall be provided at the bottom of the panel and be wired to the annunciator unit. Terminals shall be identified with plastic marker strips.

c. Terminal boxes for incoming and outgoing signal leads shall be located at the top or bottom of the panel as indicated or as otherwise required.

12. Power Supply Wiring:

a. Unless otherwise indicated, all instruments, alarm systems, and motor controls shall operate on 115-V, 60-Hz circuits.

b. At a location near the top of the panel (or bottom), the panel fabricator shall provide terminal box connections for the main power supply entry.

c. Power supply switches for alarm units shall be 3-pole type, arranged to open both power circuits and alarm circuits. Each annunciator unit shall be equipped with a separate switch.

d. Instruments located on the same panel section and serving the same process unit may be connected to a common branch circuit from the power supply. The number of circuits depends on the circuit load as indicated. A 15-A, 2-pole circuit breaker shall be provided in each branch circuit. The circuit load shall not exceed 10 A. Different panel sections or different process units shall not use common branch circuits. When instruments are not equipped with integral fuses, fuses shall be

provided as required for the protection of individual instruments against fault currents. Fuses shall be mounted on the back of the panel in a fuse holder, and each fuse shall be identified by a service name tag. Fuses shall be as manufactured by Bussmann Manufacturing Division, Type KAW TRON or equal.

e. Each potentiometer type instrument, electronic transducer, controller, or analyzer shall have an individual disconnect switch. Disconnect switches shall have metal or plastic tags indicating instrument tag numbers. Individual plug and cord set power supply connections may be used without switches when indicated.

f. Where alarm units are single unit types, one switch may be used to disconnect not more than six alarm units located on the same or adjacent panels.

13. Alarm Wiring: The panel vendor shall provide all alarms including light cabinets, audible signal units, test and acknowledge switches, and remote logic units as indicated. Interconnecting wiring to panel mounted initiating devices shall also be wired by the panel vendor. The wiring from external initiating devices shall be provided by the installation CONTRACTOR. Where plug and cord sets are provided for component interconnection, the panel vendor shall harness and support the cables in neat and orderly fashion. Where separate wire is required, panel vendor shall install No. 16 AWG with THWN or THHN insulation between all components.

14. Signal Wiring:

a. Signal Wire - Non Computer Use:

(1) Signal wire shall be twisted pair or triads in conduit or troughs. Cable shall be constructed of No. 16 AWG copper signal wires with THWN or THHN insulation.

(2) Color code for instrument signal wiring shall be as follows:

Positive (+): Black
Negative (-): White

(3) Multiconductor cables where indicated shall consist of No. 16 AWG copper signal wires twisted in pairs, with 90-C, 600-V fault insulation. A copper drain wire shall be provided for the bundle with a wrap of aluminum polyester shield. The overall bundle jacket shall be PVC.

b. Signal Wire - Computer Use: Signal wires shall be similar to those for non-computer use, except each pair shall be triplexed with a copper drain wire and aluminum polyester tape shall be applied over the triplexed group. All cable shields, including thermocouple extension leads shall be terminated in the central control room at the computer system grounding

bus. Continuity of the shield shall be maintained throughout the cable runs.

c. Multi-conductor cables, wireways and conduit shall be sized to allow for 10% spare signal wire.

I. Labor and Workmanship: All panels shall be fabricated, piped and wired by fully qualified workmen who are properly trained, experienced, and supervised.

2.3 SCADA SYSTEM ENCLOSURES

A. Each SCADA system PLC and corresponding housing, I/O modules, power supply module(s), communication interface device(s), and peripheral equipment shall be mounted inside a NEMA 12 enclosure with a floor stand kit. All I/O wiring from the field shall enter from underneath the panel and terminated on terminal blocks in the lower portion of the enclosure. A nameplate shall be mounted on the outside of the door of the enclosure and be engraved with "PLC-X" where "X" is the number as shown on the Drawings. The PLC enclosure shall be 72 inches tall by 48 inches wide by 24 inches deep minimum. The enclosure height including stand kit shall not to exceed 72". Enclosures shall be as manufactured by Hoffman, or equal.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Preparation and Shipping:

1 Crate panels for shipment using a heavy framework and skids. The panel sections shall be cushioned to protect the finish of the instruments and panel during shipment. All instruments which are shipped with the panel shall further have suitable shipping stops and cushioning material installed to protect parts which could be damaged due to mechanical shock. Each separate panel unit shall be provided with removable lifting lugs to facilitate handling.

2 All shipments shall be by air ride van, unless otherwise indicated.

3 All control panel testing and inspection shall be performed before shipping.

B. Control panels shall be installed in accordance with Section 13300 - Instrumentation and Control.

3.2 CONTROL PANEL SIGNAL AND CONTROL CIRCUIT WIRING

A. Wiring Installation: All wires shall run in plastic wireways except for the following:

1 Field wiring.

2 Wiring between mating blocks in adjacent sections.

3 Wiring from components on a swing-out panel to components on a part of the fixed structure.

4 Wiring to panel-mounted components.

B. Wiring Runs: Wiring runs from components on a swing-out panel to other components on a fixed panel shall be made up in tied bundles. These bundles shall be tied with nylon wire ties, and shall be secured to panels at both sides of the "hinge loop" so that conductors are not strained at the terminals.

C. Wiring to Control Devices: Wiring to control devices on the front panels shall be tied together at short intervals with nylon wire ties and be secured to the inside face of the panel using adhesive mounts.

D. Wiring to Rear Terminals: Wiring to rear terminals on panel-mount instruments shall be in plastic wireways secured to horizontal brackets above or below the instruments in about the same plane as the rear of the instruments.

E. Shop drawings shall show conformance to the above wiring installation requirements.

F. Wire Marking: Each signal, control, alarm, and indicating circuit conductor connected to a given electrical point shall be designated by a single unique number which shall be shown on all shop drawings. These numbers shall be marked on all conductors at every terminal using white numbered wire markers which shall be plastic-coated cloth, or permanently marked heat-shrink plastic.

3.3 CALIBRATION, TESTING, AND INSTRUCTION

A. General: Calibration, testing, and instruction shall be performed in accordance with Section 13300 - Instrumentation and Control.

Inspection and Approval:

1. The panel fabricator shall conduct the following tests before shipment:

   a. All alarm circuits rung out to determine their operability.

   b. All electrical circuits checked for continuity and where applicable, operability.

   c. All nameplates checked for correct spelling and size of letters.

   d. Any other test required to place the panel in an operating condition.

2. The CONTRACTOR shall furnish all necessary testing devices and sufficient manpower to perform the tests required by the RESIDENT ENGINEER.

3. If the above tests have not been performed before shipment, the CONTRACTOR shall be liable for back charges by the RESIDENT ENGINEER for the extra time required for inspections.

4. Each control panel shall be tested in the field for functional operation after the connection of external conductors, and before equipment startup.

*** END OF SECTION ***

SECTION 13374

CONTROL PANEL INSTRUMENTATION

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide all control panel instrumentation, complete and operable, in accordance with the Contract Documents.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, also apply to the extent required for proper performance of this Work:

1. Section 13300 Instrumentation and Control
2. Section 13370 Control Panels
3. Section 11000 Equipment General Provisions

1.3 CONTRACTOR SUBMITTALS

A. Shop drawings, information, and data sheets shall be submitted in conformance with the requirements of Section 01300 - Submittals, Section 13300 - Instrumentation and Control and Section 13370 - Control Panels.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Current Technology: Control panel instruments shall be the most recent field-proven models marketed by the manufacturers at the time of submittal of the shop drawings unless otherwise required to match existing equipment.

B. Hardware Commonality: All panel mounted instruments shall have matching style and general appearance. Instruments performing similar functions shall be of the same type, model, or class, and shall be the product of one manufacturer.

C. Power Supplies: Power supplies shall conform with the requirements of Section 13300 - Instrumentation and Control.

2.2 PROGRAMMABLE LOGIC CONTROLLERS

A. The CONTRACTOR shall provide, program, test, calibrate, fully configure, and place into operation Programmable Logic Controllers (PLCs) as indicated herein.

1. The CONTRACTOR shall provide all necessary interconnecting cables, accessories, and appurtenances as indicated herein or as required for proper operation of the system. All major components of the system shall be the product of the same manufacturer. All equipment shall be capable of tolerating and capable of riding through a power interruption of 25 milliseconds or less without interruption of normal operation.

2. Construction: The PLC central processing unit (CPU) shall be of solid-state design. The CPU card shall be a Modicon Quantum Module type 140CPU65150 or equal Unity level processor. The controller shall be capable of operating in a hostile industrial environment with heat, electrical transients, RFI, vibration, temperatures up to 140 degrees F, and 95% humidity without fans, air conditioning, or electrical filtering.

3. Design: The PLC shall be furnished with I/O (input/output) points suitable for the interface with all field devices. The I/Os shall be 4-20 mA signals for analog inputs and outputs and shall be 24 VDC signals for discrete inputs and discrete outputs unless otherwise directed by the RESIDENT ENGINEER. The PLC shall provide internal fault analysis with a fail-safe mode and a local indicator on the PLC in the event of a fault in the PLC. When the PLC digital output is driving a load that exceeds its contact rating, provide interposing relays "ice-cube" type, form C, DPDT, 10A at 120 VAC contact rating, with silver cadmium oxide contacts or gold-plated contacts for low level signals. The relays shall be IDEC or Potter Brumfield.

   a. Central Processor: The central processor shall contain all the relays, timers, counters, shift registers, and sequencers necessary to perform the control functions. It shall be capable of interfacing sufficient discrete inputs, analog inputs, discrete outputs, and analog outputs to meet the requirements plus an additional 25% excess capacity. The power supply shall contain capacitors to provide orderly shutdown in the event incoming power does not meet specifications. If this occurs, the processor shall cease operation, forcing all outputs off. The processor shall have a key type memory protect switch to prevent unauthorized program changes.

   b. Memory: The programmable controller memory shall be Complementary Metal Oxide Semi-conductor (CMOS) based memory with battery backup and Electrically-Erasable Programmable Read-Only Memory (EEPROM) based memory. The CMOS memory shall be a minimum of 1200 words with sufficient battery backup to retain the program during power interruptions of up to 1 year. An indicator shall show the status of the batteries. A reference shall be available through the discrete outputs to alarm the operator that the batteries should be changed.

   c. The PLC shall be supplied with sufficient memory to implement the control function plus a reserve capacity of 25% of the total provided. This reserve capacity shall be totally free from any system use.

d. Controller: The program shall be standard IEC 61131-3 in Unity Pro XL. The custom PLC control application should be written in Derived Function Block DFB. City to provide current PLC control application as reference.. The PLC system shall be programmed by the Instrumentation Subcontractor to perform the indicated control and monitoring functions. Two documented copies of the operating program shall be furnished which shall allow direct, step-by-step, reloading of the system program. Each rung shall be annotated to describe the logic that takes place at the rung. Copies of this program shall be furnished in the format used in the contract diagrams for conventional relay control systems. These diagrams shall reflect equipment name designations used in the PLC as well as the contract diagram equipment name designations.

e. The PLC shall be Modicon TSX Quantum programmable controller. No substitutions will be accepted.

f. The PLC shall be supplied with an Ethernet card within the rack line up to communicate with the power monitors, generator, and pump motor VFDs . The Ethernet card shall be a Modicon Quantum Module type 140 NOE 771 11. An unmanaged industrial Ethernet switches shall be provided to connect all the Ethernet peripheral devices and connect to the PLC Ethernet card.

4. Input/Output: All I/O housings shall be of rugged construction with modules in place. Sufficient inputs and sufficient outputs shall be provided with the PLC to implement the control functions plus an I/O reserve capacity of 20% of the total provided. In addition, the PLC rack shall have an additional 30% space capacity for future use.

a. Discrete Inputs: Defined as contact closure inputs from devices external to the programmable logic controller module. Inputs shall be shielded from short time constant noise and 60 Hz pickup. Individual inputs shall be optically isolated for low energy common mode transients to 1500 V peak from user's wiring or other I/O. The PLC shall have LED lights to indicate a discrete input.

b. Discrete Outputs: Defined as contact closure outputs for ON/OFF operation of devices external to the programmable logic controller. The outputs shall be fused (typically 5 A at 115 VAC) with blown fuse indicator lights. The outputs shall be optically isolated from inductively generated, normal mode, and low energy, common mode transients to 1500 V peak. All outputs shall have LED lights to indicate output has been cycled ON by the controller.

c. Analog Inputs: Defined as analog inputs for 1 to 5 VDC or 4 to 20 mA DC signals, where an analog to digital conversion is performed and the digital result is entered into the processor. New inputs shall be provided for every scan.

5. Operator Interface Terminal (OIT)

a. Provide, program, test, fully configure, document, and place into operation Operator Interface Terminal (OIT) units for operator controls and monitoring functions as indicated herein. OIT controls, monitoring functions and displays shall be provided to meet the functional requirements shown on the process and instrumentation diagrams (P&IDs) and described in the Control Strategy section.

(1) The OIT shall be a panel-mounted electronic assemby that allows bi-directional communication with the PLC.

(2) The OIT shall have a minimum of 10.4 inches diagonal, 65536 color display with 640 by 480 pixel resolution, and touch screen capability. Each unit shall employ flash memory for storing the application specific symbols and data. Each unit shall be capable of handling up to 1024 x 1024 touch zone per screen display and a minimum of 25 screens. Each touch area shall provide audible feedback to the operator.

b. Graphics: An operator will monitor and control the system using a number of preconfigured graphic displays which represent the particular equipment and processes being controlled. Graphic displays shall be provided illustrating each process using symbols to represent equipment with process flow direction lines connecting the symbols. Symbols shall be used for pumps, motors, valves, and primary elements. The description shall be included adjacent to each discrete graphic symbol. The point description, current value, and engineering units shall be displayed adjacent to each analog graphic symbol. Device status colors for graphic symbols shall be red for energized, green for normal or not energized, purple for bad quality, and flashing yellow for alarm. Unacknowledged alarm messages shall flash. The operator shall be alerted to the most recent active alarm message which shall appear on every screen. Alarms that have been acknowledged, but are still active shall appear without flashing. Alarm acknowledge from the OIT shall also silence the external alarm horn, where provided. Acknowledged alarms shall automatically reset (removed from the alarm display) when the alarm condition is no longer active. All process lines, structures, and equipment shall be identified with the proper nomenclature. The P&IDs shall be used to help generate graphics displays. The graphic displays shall have the same look and feel as the sample screen shots provided in section 13301-3.16.

c. Displays: A complete set of each of the following OIT displays shall be provided. A minimum of 10 configured displays shall be provided:

(1) System overview graphic and main menu display.

(2) Detailed graphic displays showing all equipment monitored and controlled from the OIT.

(3) Faceplate displays for the following:

- Equipment START/STOP control, control mode selection, status indication, and FAULT alarming.
- Analog controller process variable indication, set point and output manipulation, and controller mode indication.
- Indication of continuous variables including measured process valves, flow totals, and elapsed time indications.

d. Process Trending Displays:

(1) Real-time Trends: Continuous plotting of variables as a function of time for up to 24 hours.

e. Alarm Summary Displays

f. Hardware Diagnostics Displays

g. Display Organization: Displays and items included on the displays shall be functionally organized and clearly labeled to allow convenient and efficient monitoring and control actions by an operator.

h. Display Access:

(1) The displays shall be configured to allow convenient access from one display to another. Detail displays shall be accessible from overview menu displays as well as from associated detail displays using FORWARD/BACKWARD key functions.

(2) Any display shall be accessible from any other display in a minimum of keystrokes but in all cases no more than three keystrokes or touch actions. All displays shall include an alarm indicating whenever any alarm condition occurs. The alarm summary display shall be accessible from any display by no more than one keystroke or touch action.

i. Communication: The unit shall communicate with two PLCs via Ethernet, Tierrasanta PLC and Via Donminique PLC. Communication driver software shall be provided with the configuration software.

j. Cables: Cables for connection of the OIT to the PLC, and to a personal computer shall be provided.

k. Manufacturer: The operator interface device shall be a Schneider Electric Magelis XBT GT. The display shall be a 10.4-inch VGA/TFT color. The model number shall be a XBT GT 5330. Software shall be Vijeo Designer.

6. Programming Unit: Programming shall be accomplished with a laptop PC programmer provided by the CONTRACTOR. The programmer is not required to be furnished to the RESIDENT ENGINEER. The programmer shall be capable of being directly plugged into the PLC system without the requirements of additional hardware. All programming, all monitoring, all searching, and all editing shall be accomplished with the programmer. These functions shall be capable of being done "off line" while the processor is not scanning. The programmer shall monitor the status of inputs, outputs, timers, counters, and coils. It shall have the capability to disable/force inputs, outputs, and all coils to simulate system operation. The programmer shall be of rugged construction and be portable, allowing it to be used in an industrial environment without special protection.

7. Seven Day Acceptance Test: After start-up has been completed, the System shall undergo a 7-day acceptance test. The System shall run continuously for 7 consecutive days. During this period, all System functions shall be exercised. Any System interruption and accompanying component, subsystem, or program failure shall be logged for the cause, time of occurrence and duration of each failure. A failure shall cause termination of the 7-day acceptance test. When the cause of a failure has been corrected, a new 7-day acceptance test shall be started.

8. Each time the CONTRACTOR's technician is required to respond to a System malfunction, a report shall be prepared which includes details on the nature of the complaint or malfunction and the resulting repair action required and taken.

9. Operations and Maintenance Information: The CONTRACTOR shall furnish 5 complete sets of operation and maintenance information in compliance with Section 01730 - Operations and Maintenance Information. The submittals shall include date, information drawings, etc., for the system, subsystem, and all components, and shall include names, addresses and telephone numbers of equipment suppliers, representatives, and repair facilities.

   a. A complete description shall be provided of the recommended operating procedures, maintenance procedures, and spare/replacement parts list for equipment items with catalog data, diagrams, and drawings or cuts describing the equipment.

   b. Each set shall include full size assembly and wiring diagrams documenting "as-built" conditions.

2.3 COMMUNICATIONS

A. General: The PLC shall communicate with the network monitor, portable computer, other RTUs and other devices on the SCADA system. All ports, modems, and other communications equipment shall be provided in accordance with the functional requirements of the system.

B. Environmental Conditions: The PLC shall be able to operate in environments with the following specifications:

   1. Temperature range: -3 to +70 deg. C.

2. Humidity: 95% at 40 deg. C.
3. Shock and Vibration: MIL 810C Spec.

C. Transmitter: The PLC shall meet the following transmitter requirements:

1.	Output Power (at antenna port):	5 Watts (+37DBm) max.
2.	Output Frequency:	928 to 929 MHz
3.	Stability:	+/-0.00005% from -40 to +70 degrees C (for both 12.5 KHz and 25 KHz channels)
4.	Output Impedance:	50 ohms
5.	Duty Cycle:	Continuous
6.	Frequency Response:	+1 to -3 DB, 20 to 3 KHz
7.	Time Out Timer:	Adjustable (2 to 30 seconds)
8.	AFC Circuit:	Built in

D. Receiver: The PLC shall meet the following receiver requirements:

1.	Sensitivity at the antenna port:	0.3 microvolts (-110 DBm), for 12 DB Sinad
2.	Frequency Stability:	+/-0.00005% from -3 to +70 degrees C (for both 12.5 and 25 KHz channels)
3.	Frequency Range:	952 to 953 MHz
4.	Selectivity:	>70dbm
5.	Desensitization:	-70 DB minimum (EIA)
6.	Rejection:	40db nominal
7.	AFC Circuit:	Built in
8.	Intermodulation (EIA):	-75 DB, minimum

E. Miscellaneous: The PLC shall meet the following general requirements:

1.	Input Power:	12 to 14 VDC Nominal
2.	Transient Protection:	2500 Volt Isolation on VF I/O; power supply, keying, and alarm circuits
3.	Data Rate:	4800 Baud

4.	Built in Modem:	4800 Baud Async Digital Interface. RS232 direct Interface: RTS/CTS time not to exceed 10 msecs
5.	Antenna Connection:	Type N, female
6.	Unit Housing:	Inside SCADA panel

2.4 ANTENNA

A. The Broadband Yagi Antenna shall be manufactured by SCALA, model TY-900, and shall meet the following specifications:

1.	Frequency Range:	925 to 960 MHz
2.	Gain:	10 DB, minimum
3.	Maximum Input Power:	150 Watts
4.	Lightning Protection:	Direct Grounding to mast
5.	Front to Back Ratio:	20 DB, minimum
6.	Connector:	Type N, Female
7.	Mounting Hardware:	Weatherproof clamp suitable for direct mount to 2 inch SCH, 40 steel pipe
8.	VSWR:	1.5:1 max (1.35:1 typ.)

2.5 LIGHTNING ARRESTOR

A. General: The lightning arrestor shall be Polyphaser, model IS-50NX-C2, and shall meet the following requirements:

1.	Max. Surge:	50KAmps IEEE 8/20 Waveform (based on IEEE Std. 28-1974 and ANSI C62.1)
2.	Turn on VDC:	60 V. Typical
3.	Turn On Time:	7ns after DC Threshold (based on 1 KV/nS waveform)
4.	Impedance:	50 Ohms
5.	Frequency Range:	900 to 1000 MHz
6.	VSWR:	<=1.1 to 1 over operating Bandwidth
7.	Insertion loss:	<=0.1DB over operating Bandwidth

8. Temperature Range: 60 to -30 degrees C.

B. Connections: The arrestor shall have male Type N connectors for the input and the output. The arrestor shall have a flange mounting arrangement to aid connection to ground. The arrestor shall be in a conductive, metallic enclosure.

C. Antenna Cable: The antenna cable shall be 1/2" foam dielectric, manufactured by Andrews Heliax, part number LDF5-50A. Two Andrew type L44PLU "N" male connectors.

2.6 SPARE PARTS

A. The following spare parts shall be provided:

1. One of each type I/0 cards used.
2. Two program back-up batteries.
3. Five of each type fuse used.
4. One box of program storage medium (i.e. tape, floppy disk).

2.7 DIGITAL PROCESS INDICATORS

A. General: Digital process indicators shall be self-contained instruments that display process signals directly in engineering units. Units shall be suitable for panel mounting and shall use a 3-1/2 digit LED display of no less than 0.5-inch height. The input signal to the digital process indicator shall be 4-20 mA DC or 1-5 VDC. The input sample rate of the unit shall be a minimum of 2 per second. The unit shall have an auto-zeroing feature and shall have provisions for field adjustable scaling and offset. Accuracy shall be ± 1 least significant digit. Input power to the digital indicator shall be 120 VAC, 60 Hz.

B. Manufacturers, or equal:

1. Digitec Corp.
2. Action Instruments Co.

2.8 INTEGRATORS AND TOTALIZERS

A. Electro-Mechanical Totalizers

1. Electro-mechanical totalizers shall be front panel mounting units with a minimum of seven non-resettable digits. Totalizers shall be approximately 2-inch high by 2-inch wide by 2-inch deep. Minimum character height shall be 0.150-inch.

2. Manufacturers, or equal:

a. Durant Series 7-Y
b. Kessler-Ellis Type MK

B. Totalizers, LCD

1. LCD totalizers shall be electronic type with a minimum of seven non-resettable digits. Counters shall be approximately 1-1/2-inch high by 2-inch wide by 3-inch deep and shall be suitable for front panel mounting. Minimum character height shall be 0.2 inches. Each electronic counter shall be battery-powered with a minimum 10 year battery replacement requirement.

2. Manufacturers, or equal:

a. Veeder-Root Model 799808

PART 3 -- EXECUTION

3.1 GENERAL

A. Execution requirements of Section 13300 - Instrumentation and Control and Section 13370 - Control Panels shall apply to this Section.

*** END OF SECTION ***

SECTION 13400

COMMUNICATIONS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The Work of this Section includes providing a complete and operational communication system between the Tierrasanta Pump Station and the existing Public Utility Department's Central Operations facility located at 2797 Caminito Chollas, San Diego, CA 92105. The system shall include interface hardware, modules, radio, communication bridges, and application software necessary for a communication network.

B. The Work, equipment, and services required by this Section shall be provided and furnished by the CONTRACTOR.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 01300 Submittals
2. Section 13300 Instrumentation and Control
3. Section 13370 Control Panels
4. Section 13374 Control Panel Instrumentation
5. Section 16050 Basic Electrical Materials and Methods

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. The Work of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego:

1. Uniform Fire Code
2. National Electrical Code

B. Except as otherwise indicated, the current editions of the following standards apply to the Work of this Section:

1.	ISA RP 55.1	Hardware Testing of Digital Process Computers
2.	NEMA ICS-6	Enclosures for Industrial Controls and Systems
3.	MIL Q STD 9858A	Quality Program Requirements
4.	MIL STD 2170	Reliability Prediction of Electronic Equipment
5.	IEEE 802.2	Reliability Prediction of Electronic Equipment
6.	SAMA PMC-32	Logical Link Control
7.	SAMA PMX-32.1	Process Instrumentation Reliability Terminology

1.4 CONTRACTOR SUBMITTALS

A. Shop drawings shall conform to the requirements of Section 01300 - Submittals.

1.5 ENVIRONMENTAL CONDITIONS

A. The communication systems shall be designed and constructed for operation under the following environmental conditions:

1. Equipment outdoors:

a. Temperature range: 40 through 105 degrees F
b. Thermal shock: two degree F per minute maximum
c. Relative humidity: 20 through 90%

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials: Products shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer.

B. Storage: Products shall be carefully stored in a manner recommended by the manufacturer in an area that is protected from the elements.

1.7 RECORD DRAWINGS

A. Accurate drawings of underground antenna cable locations shall be included on the record drawings in compliance with Section 01720 - Project Record Documents.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Where there is more than one item of similar equipment being furnished under this Section, all equipment of the same type shall be the product of a single manufacturer.

B. All components shall be the most recent field proven models marketed by their manufacturers at the time of submittal of the shop drawings unless otherwise indicated.

C. All instrumentation shall be suitable for operation in the ambient conditions at the equipment installation locations. Heating, cooling, and dehumidifying devices shall be incorporated with the outdoor instrumentation in order to maintain it within its rated environmental operating ranges. The CONTRACTOR shall provide all power wiring for these devices.

D. The CONTRACTOR shall coordinate the installation of the communication system with all applicable utility companies and regulatory agencies having jurisdiction to secure approvals and permits which are required.

2.2 RADIO TELEMETRY

A. Licensing and Surveying:

1. The OWNER has FCC licensing for the sites included in this project. The license allows the OWNER to operate 928-952 MHZ frequencies for multiple address systems (MAS). The equipment provided shall be suitable for use on the assigned frequencies.

2. In locations where there is no microwave path to one of the five MAS radio repeaters, a 902-928 MHZ microwave spread spectrum radio shall be provided to transmit to a remote SCADA location having a path to a repeater. Existing radios may be used to provide multiple paths.

3. Before installation of the radio equipment, the CONTRACTOR shall verify with the City that the radio paths are still reliable based on City's radio survey of the present terrain and structure conditions.

B. Transmission: RF transmitters shall be directly frequency modulated by a built-in digital modem from the digital data stream furnished by the central computer system. RF receivers shall provide a digital data stream to the central computer system. Each assembly shall be capable of transmitting and receiving data at a rate of 9600 baud over a 928-952 MHz FCC assigned channel.

C. Radio Transceiver at the Tierra Pump Station:

1. The radio at the Tierrasanta Pump Station shall be capable of interfacing with the PLC at the Tierrasanta pump station and the Via Dominique pump station and processing the data for both PLCs for transmission via the antenna system to the Repeater Site and to Cowles Mountain. The Contractor shall install the radio in the Tierrasanta PLC panel. The radio equipment and accessories shall be installed and supplied by the manufacturer. The radio shall be MDS series, model SD09MD-CES-NNSNN. There is no equal.

2. The units shall operate on 928-952 MHZ multiple address system as assigned by the FCC. Transmitter shall provide a minimum of RF output of 5 W. TX Frequency 928.03125/RX Frequency 952.03125.

3. Contractor shall provide and install all necessary cables and connections from the radio equipment to the PLC interface at the Tierrasanta pump station and Via dominque pump station. Proper power supply shall be provided.

4. Provide radio/antenna components as shown on the drawings.

5. Transceivers and associated equipment shall be designed to operate on 12 VDC. Each transceiver shall have a 12 VDC battery backup system (including a battery charger). The power backup system shall be capable of powering the radio and its associated equipment for a minimum of 8 hours. The battery backup system shall be isolated from the primary power. Upon primary power failure, the power shall be transferred to the backup system by use of relay contacts or diodes. Battery tapping of a 24 V power system to obtain 12 V is not acceptable

6. Each battery backup system shall include signals for low battery voltage condition and primary power failure. Batteries shall be designed for standby power use and sized to operate the load for the indicated time. Batteries shall be gel type lead dioxide with sealed construction, be capable of at least 200 charge-discharge cycles and have a service life of at least 3 years.

7. Battery chargers shall be designed to charge the type of battery furnished. The charger shall be automatic dual rate and produce the voltage and current recommended by the battery manufacturer to ensure maximum battery life.

D. Yagi Antenna System at the Tierrasanta Pump Station :

1. The Yagi antenna at the Tierrasanta Pump Station is a Scala TY-900. Antenna system shall be provided complete and functional for the intended use. System shall include antennas, mounting masts and hardware, grounding rods and accessories, and coaxial cables with connectors. Antenna heights shall be based on the radio survey and shall not exceed FCC limitations.

2. Antenna mounting components and hardware shall be hot-dip galvanized steel, stainless steel, or aluminum. Aluminum antennas or mounting components shall be anodized. Lightning suppressors shall be provided on antenna coaxial feed lines.

3. Antennas and antenna poles shall be mounted as indicated.

4. Antenna connections and openings shall be sealed and weatherproofed.

5. Antenna shall be suitable for use on the assigned radio frequency and shall have the gain required for reliable communications. The antennas for all remote sites shall be heavy duty YAGI type meeting the following requirements:

Frequency range	-	890 to 960 MHZ
Forward gain	-	12 Db
Front-to-back ratio	-	>20 Db
VSWR	-	<1.5 to 1.0 maximum
Polarization	-	Horizontal or Vertical
Impedance	-	50 ohms
Horizontal beamwidth	-	48 degrees (half power point)
Input power	-	100 W Maximum
Wind rating	-	150 mph survival (no ice)
Lighting protection	-	Direct ground
Input connector	-	N female

6. Antenna feed lines shall be 1/2-inch coax for remote sites. Feed lines shall be routed to radio transceivers through conduit or inside the antenna mast. Provide Andrew Superflex FSJ4-50B. Connectors shall be 1/2-inch male N, Andrew F4PNMV2-HC.

7. Transmission lines and the antenna system shall be grounded as indicated.

8. The lightning arrestor is a Polyphaser IS-50NX-C2.

2.3 NAMEPLATES, TOOLS AND SPARE PARTS

A. Tools: The Work includes all tools required to repair, calibrate, program, and maintain the equipment.

B. Test Equipment: It is intended that the diagnostic software furnished with the system shall be able to troubleshoot communications to the circuit board level and that local repairs will be limited to board replacement. Any special diagnostic tester required to perform troubleshooting to this level shall be furnished. A portable calibrator for the radio system shall be furnished.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. General: The CONTRACTOR shall employ installers who are skilled and experienced in the installation and connection of al the elements, accessories and assemblies of communication systems.

B. Access: All equipment shall be provided as indicated, or, if not indicated, so that it will be readily accessible for operation and maintenance. The ENGINEER reserves the right to require minor changes in equipment location before roughing in without any additional cost to the OWNER.

C. Review: The CONTRACTOR shall review the existing site conditions and examine all shop drawings for equipment in order to determine exact routing and final terminations for all wiring and cables. Exact routing shall be shown on the Record Drawings.

D. Installation and Connection: The CONTRACTOR shall install and connect al field-mounted components and assemblies and as recommended by the manufacturer and as indicated.

E. Conduits: In building interior locations, conduits shall be surface mounted on walls or ceilings wherever possible and parallel to building lines. Conduit shall not be routed on floors unless indicated otherwise. In exterior locations, conduit shall be routed below grade. Existing concrete or asphalt slabs shall be sawcut, conduit installed, and the cut repaired to original condition. Exposed conduit and raceway shall be installed perpendicular or parallel to building lines.

F. Final Checks: Upon completion of installation, The CONTRACTOR shall notify the Citys Telemetry, Power, and Contrls Group for final acceptance check. All systems furnished under this Contract shall be checked in the presence of a City representative from the Communications department. The final check of the communication systems shall be performed as an integral part of the system specified in Section 13300 - Instrumentation and Control.

3.2 FIELD TESTING

A. RF Equipment Testing: The following measurements shall be made, recorded and compared to normal reading on each RF assembly prior to system testing to ensure that all equipment meets published specifications:

1. Operating voltages
2. Transmitter frequency
3. Transmitter output power (at output of duplexer)
4. Transmitter deviation
5. Receiver local oscillator frequency
6. Receiver sensitivity (10 to -6 BER)

B. Testing: All systems furnished under this Contract shall be exercised through operational tests in the presence of the ENGINEER or City representative from the Telemetry, Power, and Contrls Group in order to demonstrate compliance with requirements. The testing of the communication system shall be performed in accordance with and as an integral part of the testing of the instrumentation and control specified in Section 13300 - Instrumentation and Control.

*** END OF SECTION ***

SECTION 13825

AUTOMATIC GATE EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. The automatic gate operator systems as shown complete and operable, in accordance with the Contract Documents.

1.2 SUBMITTALS

A. The following information shall be provided in accordance with Section 01300:

1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The RESIDENT ENGINEER shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

2. Manufacturer's specifications, literature, and published installation instructions for all equipment shall be submitted.

3. Shop drawings for bases and enclosures and layout drawings showing equipment locations and routing of interconnecting wiring shall be submitted prior to fabrication.

4. Wiring diagrams for the system shall be submitted.

5. Operation and maintenance instructions in accordance with Section 01730.

1.3 QUALITY ASSURANCE

A. The installing company shall be regularly engaged in the design, installation, and maintenance of automatic door and gate equipment, having successfully provided motor operators and control systems, similar to the types herein, which have a record of consistent, satisfactory performance, and shall have established service facilities, with qualified personnel and a stock of parts.

1.4 GUARANTEE

A. Furnish equipment manufacturer's standard warranties which extend beyond the Project guarantee of 1 year.

1.5 MAINTENANCE

A. Furnish maintenance during the Project warranty period of 1 year, beginning on the date of project substantial completion.

B. Maintenance shall be performed by the installing company.

C. Automatic gate systems maintenance shall include examination at least once each month and callback service. Cleaning and lubrication of gate operators at 6 months and 12 months of service shall be included.

D. Adjustments and lubrication of equipment pursuant to manufacturer's recommendations, and repaired and replacements necessitated by defects or by ordinary wear and tear shall be included.

PART 2 - PRODUCTS

2.1 SLIDING GATE

A. Installation of the sliding gate shall conform with SSPWC Subsection 304-3.3 and as indicated below.

B. The gate frame shall be fabricated with welded joints or rigid connectors. The fabric shall be rigidly attached to the frames. Frames shall be suitably braced and trussed.

C. Materials for the gate frame and fabric shall conform to the architectural details.

2.2 GATE OPERATORS

A. Heavy Duty Operators: LiftMaster, SL 585 Sliding or equal, 1/2-horsepower minimum, 120/208 volts, 1-phase, and shall be designed to open or close the gate in 30 seconds or less.

B. Operators shall be provided with the required appurtenances to interface with access control system.

2.3 OPERATING REQUIREMENTS- GATE ENTRANCE

A. The motorized entrance gate shall open upon any of the following events:

1. Card swipe at card reader control.

2. Momentary operation of key switch, location as indicated on the drawings for Fire Department access. Key for switch shall be contained inside Knox Box, location as indicated on drawings.

B. The motorized entrance gate shall close when the entering vehicle clears the safety clearance loops, photo eye, and after a pre-set amount of time for a vehicle to enter the facility.

C. If an obstruction is encountered while gate is moving, it shall stop until obstruction is removed. To preclude injury to persons, the operating force shall be limited while gate is between full open and closed positions.

D. In case of power outage, gate shall be operable manually by remote releasing of the inside operator mechanism.

E. The gate operator shall be monitored remotely for gate operation providing indication of the gate opening to the facility PLC and to the SCADA Central Control Center.

2.4 OPERATING REQUIREMENTS - GATE EXIT

A. The motorized gate exit shall open upon any of the following events:

1. Card swipe at card reader control.

2. The motorized entrance gates shall open when the exiting vehicle energizes the exit loop.

B. On an open commad, there will be a half second delay after the maglock relay is released before the motor starts.

C. The motorized gate shall close when the entering vehicle clears the safety clearance loops, photo eye, and after a pre-set amount of time for a vehicle to exit the facility.

D. If an obstruction is encountered while gate is moving it shall stop until obstruction is removed. To preclude injury to persons, the operating force shall be limited while gate is between full open and closed positions.

E. In case of power outage, gate shall be operable manually by releasing of the inside operator mechanism.

2.5 ANCILLARY MATERIALS

A. Materials for housings and equipment supports shall conform to requirements of Section 05500 – Miscellaneous Metals. Exposed parts shall be galvanized steel, stainless steel, or nonferrous.

B. Interconnecting wiring and raceway materials shall conform to requirements of Section 16050 – Basic Electrical Materials and Methods. Control equipment shall be housed in NEMA Type 3 and 4 enclosures, and shall be vandal-resistant.

C. Power supplies, interfacing electronic and electro-mechanical devices shall be standard products of the motor operator manufacturer.

D. Vehicle detector devices, maglock, and ground loops shall be provided by the manufacturer of the gate operator equipment.

1. Loop Wire: Standard copper with water- and oil-resistant thermoplastic insulation.

2. Pavement Sealer: 3M "Detector Loop Sealant", Preco Industries "Gold Label Flex", or equal, for use in existing pavement if necessary.

3. Vehicle detector device: Heavy duty, outdoor rated, retro reflective photo eye, 3-inch reflector, and mounting brackets.

4. Maglock: 600 pound, weather proof single magnetic gate lock completely sealed in stainless steel case, armored cable leads, power supply, and mountig brackets.

E. Brackets, bolts, nuts, washers and other rough hardware shall be stainless steel where exposed, and cadmium-plated where protected.

2.6 ACCESS CONTROLS (NOT USED)

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to the Electrical Drawings for the power source and the monitoring circuits.

B. Field verify the exact locations for the entrance and exit control stations with the Owner's representative prior to installation.

C. Control components and remote control circuits shall be interconnected to achieve a complete working system.

D. Wiring, except detector loops, shall be in raceways.

E. Detector loops shall be laid out in a neat, symmetrical pattern and the RESIDENT ENGINEER's review obtained before installation. Grooves shall be cut by saw. Wire shall be installed with concealed connections and the grooves sealed.

F. Equipment shall be secured neatly and firmly in place, cleaned, lubricated, and adjusted in perfect working order.

G. Operation shall be tested through 30 consecutive cycles, incorporating the control events in random order, within a period of one hour. Gates shall operate smoothly and consistently.

3.2 TRAINING

A. Provide a 2-hour operations and maintenance training session in accordance with Section 01664.

*** END OF SECTION ***

SECTION 14600

HOISTS AND CRANES, GENERAL

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The Work of this Section includes providing general requirements for hoists and cranes.

B. The CONTRACTOR shall furnish, install, and place in satisfactory operation the hoisting equipment and appurtenances complete with all necessary safety equipment, in accordance with the Contract Documents.

C. The CONTRACTOR shall furnish and install the tracks, ancillary steel, and appurtenances necessary for all monorail hoists and bridge cranes.

D. Crane and hoists shall be coated in accordance with Section 09800 - Protective Coating.

E. The Work of this Section requires that one manufacturer accept responsibility for furnishing the Work as indicated but without altering or modifying the CONTRACTOR's responsibilities under the Contract Documents. The Work additionally requires that the one manufacturer who accepts the indicated responsibilities shall manufacture the major components of the equipment.

F. The Work also includes coordination of design, assembly, testing and installation.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 09800 Protective Coating
2. Section 11000 Equipment General Provisions
3. Section 14605 Electric Monorail Systems

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the Work of this Section:

1.	AISC	Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings
2.	AGMA	American Gear Manufacturers Association
3.	ANSI B30.11	Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoists)

4.	ANSI B30.16	Portal, Tower, and Pillar Cranes
5.	ANSI MH 27.1	Specifications for Underhung Crane and Monorail Systems
6.	ASTM A 36	Specification for Structural Steel
7.	CMAA	Crane Manufacturer's Association of America
8.	MMA	Monorail Manufacturers Association
9.	NEC	National Electric Code
10.	NEMA	National Electrical Manufacturers Association
11.	UBC	Uniform Building Code

1.4 CONTRACTOR SUBMITTALS

A. Shop Drawings: The CONTRACTOR shall submit complete shop drawings of all hoist and crane equipment in accordance with the requirements of the Section 01300 - Submittals and Section 11000 - Equipment General Provisions. Shop drawings shall include all electrical requirements, weights, wheel loads, dimensions, and clearances required.

B. Operation and Maintenance Information: The CONTRACTOR shall furnish operations and maintenance information in accordance with the requirements of Section 01730 - Operations and Maintenance Information. The CONTRACTOR shall submit certification that equipment complies with the indicated requirements.

C. Tools: The CONTRACTOR shall supply one complete set of special wrenches or other special tools necessary for the assembly, adjustment, and dismantling of the equipment. All tools shall be of best quality and furnished in labeled tool boxes of suitable design.

D. Spare Parts: Each piece of equipment shall be furnished with one year's supply of lubricants, as well as spare parts as recommended by the manufacturer, such as bearings, drive belts, seals, washers, rings, and any other parts subject to wear or frequent replacement. All parts shall be properly labeled and identified with the name and number of the equipment to which they belong.

E. Certificate: The CONTRACTOR shall submit a certificate for load capacity for each crane or hoist.

1.5 QUALITY ASSURANCE

A. Inspection and Testing Requirements: After erection, the CONTRACTOR shall inspect and test all hoists and crane systems in the presence of the manufacturer's service representative, for proper operation and conformance with the Specifications.

B. Acceptance Criteria and Tolerances: The RESIDENT ENGINEER reserves the right to reject any equipment not conforming with the tolerances, deflections, and lateral stiffness indicated.

1.6 MANUFACTURER'S SERVICE REPRESENTATIVE

A. The CONTRACTOR shall have the equipment manufacturer for each piece of equipment provide the services of a trained, qualified representative for at least one day after the units are put in proper working order, or as otherwise indicated, for the purpose of inspecting the installation and instructing the OWNER's operating personnel. CONTRACTOR shall give the OWNER written notice of the proposed instruction period at least one week prior to the commencement of the instruction period.

PART 2 -- PRODUCTS

2.1 GENERAL

A. The CONTRACTOR shall furnish and install all hoist and crane equipment. Equipment of similar design shall be from the same manufacturer. The CONTRACTOR shall furnish equipment of sizes and dimensions that fit the spaces available in the building.

B. The capacity of each hoist and trolley shall be permanently marked in a conspicuous manner on the equipment. The wire rope reeving shall be of the two-part double, cross mounted or similar appropriate type, to provide a true, vertical lift without drift, unless otherwise indicated.

C. All hooks shall be safety type with latch.

D. Motors: Motors shall comply with the requirements of Section 16040 - Electric Motors.

E. The CONTRACTOR shall verify all dimensions and clearances in the field prior to erection and shall be responsible for the proper fitting and operation of the equipment.

F. Nameplates: Nameplates shall be permanently attached to the monorail hoist and trolley hoist assemblies. Capacity shall be stated in tons or pounds. Nameplates shall be clearly legible from the floor and shall contain manufacturer's name. Warning signs shall be provided in accordance with ANSI B30.16, Chapter 16-2, affixed to the bottom lift blocks or pendant controllers.

2.2 BASIC MATERIALS

A. All materials used must be new and of the best commercial grade. Where materials are not indicated, the CONTRACTOR shall have the manufacturer use the most suitable selection for the given application and environment.

2.3 PLANT FABRICATED ITEMS

A. All fabrication, assembly, and welding shall be carried out by factory-trained specialists and certified welders.

PART 3 -- EXECUTION

3.1 GENERAL REQUIREMENTS

A. All hoist and crane equipment shall be installed in strict accordance with the manufacturer's printed instructions and Section 11000 - Equipment General Provisions and the CONTRACTOR shall arrange to have all installation performed under the guidance of the manufacturer's field representative. The hoist and crane equipment shall comply with the requirements of State of California, Division of Occupational Safety and Health (DOSH).

3.2 WORKMANSHIP

A. The workmanship shall be in accordance with the referenced standards and codes.

3.3 INSTALLATION

A. Care shall be taken, that the structural integrity of beams, columns, walls, floors, and roofs will be maintained at all times.

3.4 TESTING

A. After completion of the Work, the CONTRACTOR shall test all hoist and crane equipment in the presence of the manufacturer's field representative, who shall certify in writing that the equipment meets all applicable standards and specifications and verify their rated load-carrying capacity.

B. The CONTRACTOR shall have the hoist and crane equipment examined by an authorized certificating agent and obtain the necessary certificate complying with the requirements of DOSH.

*** END OF SECTION ***

SECTION 14605

ELECTRIC MONORAIL SYSTEMS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall furnish and install electric monorail systems complete, in accordance with the CONSTRUCTION DOCUMENTS. Hoists shall be of the low headroom type, equipped for electric lift and travel, and they shall fit a standard I-beam.

1.2 SERVICES OF MANUFACTURER

A. The authorized manufacturer's representative shall be present at the site for not less than 1 day.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Requirement: The monorail hoist shall be controlled from a pendant pushbutton station and be furnished complete with all required safety devices and overload protection. The power supply shall be through a retractable cable reel with power cable. The rail shall be a standard I-beam with stops, securely anchored to the structure.

B. Construction: The monorail hoist shall be designed as follows:

1.	Hoist	-	2-HP motor, Single speed, rope-type, for parallel lug mounting from a geared trolley, with upper and lower limit switches to prevent over travel, (automatic reset type).
2.	Gear	-	Fully enclosed, oil lubricated spur gear.
3.	Drum	-	Steel, with machine-cut grooves and flanges, to accommodate entire cable in one layer.
4.	Bearings	-	Anti-friction type, lifetime pre-lubricated and sealed.
5.	Motor and Drum Shaft	-	Grease lubricated, with ball or roller bearings. Maximum 0.5 hp motor.
6.	Brakes	-	Mechanical load brake and separate electric motor brake, each adjustable and capable of supporting the full load.

7.	Power Cable	-	Of high strength plow steel, flexible, with min 5:1 safety factor, for maximum lift plus 2 wraps on drum.
8.	Load Block	-	Heavy-duty with ball bearing sheave and forged steel swivel hook with anti-friction bearings and safety spring latch.
9.	Motor	-	Totally-enclosed, single speed.
10.	Trolley	-	1/4-HP motor-driven, with 4 wheels, spur gear, magnetic brake, ball or roller bearings.

C. Capacity: Monorail and hoist shall have a capacity of 1 ton.

D. Controls: Control equipment shall be mounted in an enclosed compartment, with NEMA rating and shall include a transformer for a 120-V control circuit. The station shall be suspended from the control compartment and shall be provided with a supporting chain or cable to locate the station 3-feet above all operating floor levels.

E. Pendant Pushbutton Station: A pendant pushbutton station shall be provided, and shall have cast aluminum or a rubber-protected, corrosion-proofed metal case, pushbutton protectors, speed control buttons for all travel and hoisting directions, pilot light to indicate when system is energized, and switch to de-energize entire system. Pushbuttons shall be labeled and identified for motion control and compass direction of travel. The pendant shall be suspended from a minimum 3-foot long swiveling horizontal arm mounted on the trolley, with the bottom of the controller case 48-inches above the floor.

F. Limit Switches: The hoist shall be provided with suitable limit switches to stop the hoisting mechanism at the upper and lower limits of hook travel to prevent over travel of the hook and block, and an overload cutoff device capable of breaking the raising circuit at 110% of full load.

2.2 MANUFACTURERS

A. Electric monorail systems shall be supplied by one of the following, or equal:

1. Abell-Howe Company
2. ACCO Chain and Lifting Products Div. (Babcock Industries, Inc.)
3. American Monorail
4. Lift Tech International, Inc.
5. Thern, Inc., (Cal South Equipment Co.)
6. EDN Material Handling (Yale Hoists).

** END OF SECTION **

SECTION 15000

PIPING COMPONENTS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall furnish and install all piping systems shown and specified, in accordance with the requirements of the CONTRACT DOCUMENTS. Each system shall be complete with all necessary fittings, hangers, supports, anchors, seismic restraints, expansion joints, flexible connectors, valves, accessories, heat tracing, insulation, lining and coating, testing, disinfection, excavation, backfill and encasement, to provide a functional installation.

B. The piping shown in the CONTRACT DOCUMENTS is intended to define the general layout, configuration, routing, method of support, pipe size, and pipe type. The drawings are not pipe construction or fabrication drawings. It is the CONTRACTOR'S responsibility to construct all mechanical piping systems, to accommodate the specific equipment provided, and to provide and install all spools, spacers, adapters, connectors, and other appurtenances for a complete and functional system.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

B. The Work of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

1. Uniform Mechanical Code
2. Uniform Plumbing Code
3. Uniform Fire Code

C. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC) together with the latest adopted editions of the Regional and City of San Diego Supplement Amendments.

D. Commercial Standards: All equipment, products, and their installation shall be in accordance with the following standards, as applicable, and as indicated in each Section:

1. American Society for Testing and Materials (ASTM)
2. American National Standards Institute (ANSI)
3. American Society of Mechanical Engineers (ASME)
4. American Water Works Association (AWWA)
5. American Welding Society (AWS)
6. American Iron and Steel Institute (AISI)
7. National Fire Protection Association (NFPA)

E. The following standards have been referenced in this Section:

1	ANSI/ASME B1.20.1	Pipe Threads, General Purpose (inch)
2.	ANSI B16.5	Pipe Flanges and Flanged Fittings, NPS 1/2 through NPS 24
3.	ANSI/AWWA C207	Steel Pipe Flanges for Water Works Service, Sizes 4 in through 144 in.
4.	ANSI/AWS D1.1	Structural Welding Code B Steel
5.	ASTM A 36	Specification for Carbon Structural Steel
6.	ASTM A 283	Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
7.	ASTM A 285	Specification for Pressure Vessel Plates, Carbon Steel, Low- and Intermediate-Tensile Strength
8.	ASTM A 307	Specification for Carbon Steel Bolts and Studs, 60000 PSI Tensile Strength
9.	ASTM A 325	Specification for High-Strength Bolts for Structural Steel Joints
10.	ASTM A 563	Specification for Carbon and Alloy Steel Nuts
11.	ASTM D 2000	Classification System for Rubber Products in Automotive Applications
12.	ASTM/AWWA C219	Bolted, Sleeve-Type Couplings for Plain-End Pipe
13.	AWWA Manual M11	Steel Pipe - A Guide for Design and Installation

1.2 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall submit shop drawings and certificates, test reports, affidavits of compliance, of all piping systems for review in accordance with the requirements in Section 01300 - Submittals, and as indicated in the individual piping sections. The shop drawings shall include dimensions and details on pipe joints, fittings, fitting specials, harnessed joints, valves, and appurtenances, and shall include design calculations and material lists. The submittals shall include detailed layout, spool, or fabrication drawings which show all pipe spools, spacers, adapters, connectors, fittings, and pipe supports and seismic restraints necessary to accommodate the equipment and valves provided in a complete and functional system.

B. The CONTRACTOR shall submit information in compliance with Section 01730 - Operations and Maintenance Information, containing the following:

1. Manufacturer's product data.

2. Manufacturer's installation instructions.

3. Manufacturer's certification of compliance.

4. Statement from the pipe fabricator certifying that all pipe will be fabricated subject to a Quality Control Program.

5. Outline of Quality Control Program.

1.3 QUALITY ASSURANCE

A. Inspection: All pipe shall be subject to inspection at the place of manufacture. The CONTRACTOR shall notify the RESIDENT ENGINEER in writing of the date for the start of each phase of pipe production and the dates for the proof of design tests. The notification shall be given at least 14 days prior to the start of the pipe manufacture. During the manufacture of the pipe, the RESIDENT ENGINEER shall be given access to all areas where manufacturing is in progress and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.

B. Tests: Except where otherwise indicated, all materials used in the manufacture of the pipe shall be tested in accordance with the applicable specifications and standards. Welds shall be tested as indicated. The CONTRACTOR shall perform all tests at no additional cost to the OWNER. Copies of all test reports shall be furnished to the RESIDENT ENGINEER.

C. Welding Requirements: All welding procedures used to fabricate pipe shall be prequalified under the provisions of ANSI/AWS D1.1. Welding procedures shall be required for, but not necessarily limited to, longitudinal and girth or spiral welds for pipe cylinders, spigot and bell ring attachments, reinforcing plates and ring flange welds, and plates for lug connections.

D. Welder Qualifications: All welding shall be done by skilled welders, welding operators, and tackers who have had adequate experience in the methods and materials to be used. Welders shall be qualified under the provisions of ANSI/AWS D1.1 by an independent local, approved testing agency not more than 6 months prior to commencing Work on the pipeline. Machines and electrodes similar to those used in the Work shall be used in qualification tests. The CONTRACTOR shall furnish all material and bear the expense of qualifying welders at no increased cost to the OWNER.

1.4 MANUFACTURER'S SERVICE REPRESENTATIVE

A. Where the assistance of a manufacturer's service representative is advisable in order to obtain perfect pipe joints, supports, or special connections, the CONTRACTOR shall furnish such assistance at no additional cost to the OWNER.

1.5 MATERIAL DELIVERY, STORAGE, AND PROTECTION

A. All piping materials, fittings, valves, and accessories shall be delivered in a clean and undamaged condition and shall be stored off the ground to provide protection against oxidation caused by ground contact. All defective or damaged materials shall be replaced with new materials.

1.6 CLEANUP

A. After completion of the Work, all remaining pipe cuttings, joining and wrapping materials, and other scattered debris, shall be removed from the site by the Design/Builder. The entire piping system shall be handed over to the OWNER in a clean and functional condition.

PART 2 -- PRODUCTS

2.1 GENERAL

A. All pipes, fittings, and appurtenances shall be furnished in accordance with the requirements of the applicable Sections of Divisions 2 and 15 and this Section.

B. Pipe Supports: All pipes shall be adequately supported in accordance with the requirements of the CONSTRUCTION DOCUMENTS.

C. Lining: The thickness, application, and curing of pipe lining shall be in accordance with the requirements of the applicable Sections of Division 2, unless otherwise indicated.

D. Coating: The thickness, application, and curing of pipe coating shall be in accordance with the requirements of the applicable Sections of Division 2, unless otherwise indicated. Pipes installed above ground or in structures shall be field-painted in accordance with Section 09800 - Protective Coating.

E. Pressure Rating: All piping systems shall be designed for the maximum expected working pressure of the system as developed by the ENGINEER.

2.2 PIPE FLANGES

A. Flanges: Where the design pressure is 150 psi or less, flanges shall conform to either ANSI/AWWA C207 Class D or ANSI B16.5 150-pound class. Where the design pressure is greater than 150 psi, up to a maximum of 275 psi, flanges shall conform to either ANSI/AWWA C207 Class E, Class F, or ANSI B16.5 150-pound class. Where the design pressure is greater than 275 psi up to a maximum of 700 psi, flanges shall conform to ANSI B16.5 300-pound class. Flanges shall have flat faces and shall be attached with bolt holes straddling the vertical axis of the pipe unless otherwise shown. Attachment of the flanges to the pipe shall conform to the applicable requirements of ANSI/AWWA C207. Design (operating) pressures are indicated on the pipe schedule in the drawings.

B. Blind Flanges: Blind flanges shall be in accordance with ANSI/AWWA C207. All blind flanges for pipe diameters 12-inches and over shall be provided with lifting eyes in form of welded or screwed eye bolts.

C. Flange Coating: All machined faces of metal blind flanges and pipe flanges shall be coated with a temporary rust-inhibitive coating to protect the metal until the installation is completed.

D. Flange Bolts: All bolts and nuts shall conform to Section 05500 - Miscellaneous Metals. Studs and bolts shall extend through the nuts a minimum of 1/4-inch. All-thread studs shall be used on all valve flange connections, where space restrictions preclude the use of regular bolts.

E. NOT USED.

F. Insulating Flange Sets: Insulating flange sets shall be provided where shown on the Drawings. Each insulating flange set shall consist of an insulating gasket, insulating sleeves and washers and a steel washer. Insulating sleeves and washers shall be one piece when flange bolt diameter is 1-1/2 inches or smaller and shall be made of acetal resin. For bolt diameters larger than 1-1/2 inches, insulating sleeves and washers shall be two-piece and shall be made of polyethylene or phenolic. Steel washers shall be in accordance with ASTM A 325. Insulating gaskets shall be full-face.

G. Insulating Flange Manufacturers, or Equal:

1. Reflange by Taylor Forge, Houston, Texas
2. PSI Products, Inc., Gardena, California.

H. Flange Gaskets: Gaskets for flanged joints shall be full-faced, 1/16-inch thick compressed sheets of asbestos-free aramid fiber base, with nitrile binder and nonstick coating, suitable for temperatures to 700 degrees F, a pH of 1 to 11, and pressures to 1,000 psig. Blind flanges shall have gaskets covering the entire inside face of the blind flange and shall be cemented to the blind flange. Ring gaskets will not be permitted.

I. Flange Gasket Manufacturers, or Equal:

1. John Crane, Style 2160.
2. Garlock, Style 3000.

2.3 THREADED INSULATING CONNECTIONS

A. General: Threaded insulating bushings, unions, or couplings, as appropriate, shall be used for joining threaded pipes of dissimilar metals and for piping systems where corrosion control and cathodic protection are involved.

B. Materials: Threaded insulating connections shall be of nylon, Teflon, polycarbonate, polyethylene, or other nonconductive materials, and shall have ratings and properties to suit the service and loading conditions.

2.4 MECHANICAL-TYPE COUPLINGS (GROOVED OR BANDED PIPE)

A. General: Cast mechanical-type couplings shall be provided where shown. The couplings shall conform to the requirements of ANSI/AWWA C606. Bolts and nuts shall conform to the requirements of Section 05500 - Miscellaneous Metals. All gaskets for

mechanical-type couplings shall be compatible with the piping service and fluid utilized, in accordance with the coupling manufacturer's recommendations. The wall thickness of all grooved piping shall conform with the coupling manufacturer's recommendations to suit the highest expected pressure. To avoid stress on equipment, all equipment connections shall have rigid-grooved couplings, or harness sets in sizes where rigid couplings are not available, unless thrust restraint is provided by other means. The CONTRACTOR shall have the coupling Manufacturer's service representative verify the correct choice and application of all couplings and gaskets, and the workmanship, to assure a correct installation.

B. Manufacturers of Couplings for Steel Pipe, or Equal:

1. Victaulic Style 41 or 44 (banded, flexible).
2. Victaulic Style 77 (grooved, flexible).
3. Victaulic Style 07 or HP-70 (grooved, rigid).

C. Manufacturers of Ductile Iron Pipe Couplings, or Equal:

1. Victaulic Style 31 (flexible or rigid grooving), furnished with flush seal gaskets.

D. Manufacturers of Couplings for PVC Pipe, or Equal:

1. Victaulic Style 775, furnished with radius cut or standard roll grooved pipe ends.

2.5 SLEEVE-TYPE COUPLINGS

A. Construction: Sleeve-type couplings shall be provided where indicated on the Drawings, in accordance with ANSI/AWWA C219 unless otherwise indicated on the Drawings, and shall be of steel with steel bolts, without pipe stop, and shall be of sizes to fit the pipe and fittings. The middle ring shall be not less than 1/4-inch in thickness and shall be either 5 or 7-inches long for sizes up to and including 30-inches and 10-inches long for sizes greater than 30-inches, for standard steel couplings, and 16-inches long for long-sleeve couplings. The followers shall be single-piece contoured mill section welded and cold-expanded as required for the middle rings. They shall be of sufficient strength to accommodate the number of bolts necessary to obtain adequate gasket pressures without excessive rolling. The shape of the follower shall be of such design as to provide positive confinement of the gasket. Bolts and nuts for buried couplings shall be Type 316 stainless steel. Bolts and nuts for exposed couplings shall conform to the requirements of Section 05500 - Miscellaneous Metals and shall be coated in accordance with Section 09800 - Protective Coating. Buried sleeve-type couplings shall be fusion bonded epoxy lined and coated at the factory in accordance with AWWA C213, and shall also receive a petrolatum/wax tape coating in accordance with Section 09800 - Protective Coating.

B. Pipe Preparation: The ends of the pipe, where indicated, shall be prepared for flexible steel couplings. Plain ends for use with couplings shall be smooth and round for a distance of 12-inches from the ends of the pipe, with outside diameter not more than 1/64-inch smaller than the nominal outside diameter of the pipe. The middle ring shall be tested by cold-expanding a minimum of one percent beyond the yield point, to proof-test the weld to the strength of the parent metal. The weld of the middle ring shall be subjected to air test for porosity.

C. Gaskets: Gaskets for sleeve-type couplings shall be rubber-compound material that will not deteriorate from age or exposure to air under normal storage or use conditions. Gaskets for wastewater and sewerage applications shall be Buna "N," grade 60, or equivalent suitable elastomer. Gaskets shall be immune to attack by impurities normally found in water or wastewater. All gaskets shall meet the requirements of ASTM D 2000, AA709Z, meeting Suffix B13 Grade 3, except as noted above. All gaskets shall be compatible with the piping service and fluid conveyed. The rubber in the gasket shall meet the following specifications:

1. Color - Jet Black.
2. Surface - Nonblooming.
3. Durometer Hardness - 74 □ 5.
4. Tensile Strength - 1,000 psi minimum.
5. Elongation - 175 percent minimum.

D. Insulating Couplings: Where insulating couplings are required, both ends of the coupling shall have a wedge-shaped gasket which assembles over a rubber sleeve of an insulating compound in order to obtain insulation of all coupling metal parts from the pipe.

E. Restrained Joints: Sleeve-type couplings on pressure lines shall be harnessed unless thrust restraint is provided by other means. Harnesses shall conform to the requirements of the appropriate reference standard, to the requirements specified herein, or to the Drawings.

1. Joint Harnesses for Sleeve-Type Couplings on Steel Water Pipelines: Bolts and stud materials shall conform to ASTM A307, Grade B. Nuts shall conform to ASTM A563, Grade A, heavy hex. Lug material shall conform to one of the following: ASTM A36; ASTM A283 Grade B, Grade C, or D; or ASTM A285, Grade C. Lug dimensions shall be as shown in AWWA Manual M11. Lugs shall be Type P for pipe from 6- through 10-inch diameter, and Type RR for pipe 12-inch diameter and larger.

2. End Thrust: Joint harnesses shall be designed to accommodate the system's design working pressure of plus a surge allowance factor of 50% of the working pressure.

3. Coating of Joint Harnesses: Coatings for joint harnesses shall conform to Section 09800 - Protective Coating. Buried joint harnesses shall be coated with a petrolatum/wax tape coating in accordance with Section 09800 - Protective Coating.

F. Manufacturers, or Equal:

1. Dresser, Style 38.
2. Ford Meter Box Co., Inc., Style FC1 or FC3.
3. Smith-Blair, Style 411.

2.6 FLEXIBLE CONNECTORS

A. Flexible connectors shall be installed in all piping connections to engines, compressors, and other vibrating equipment, and where shown on the Drawings. Flexible connectors for service temperatures up to 180 degrees F shall be flanged, reinforced Neoprene or Butyl spools, rated for a working pressure of 40 to 150 psi, or reinforced, flanged duck and rubber, as best suited for the application, unless otherwise shown. Flexible connectors for service temperatures above 180 degrees F shall be flanged, braided stainless steel spools with inner, annular, corrugated stainless steel hose, rated for minimum 150 psi working pressure, unless otherwise shown on the Drawings. The connectors shall be 9 inches long, face-to-face flanges, unless otherwise shown on the Drawings. The final material selection shall be approved by the manufacturer. The CONTRACTOR shall submit to the CONTRUCTION MANAGER manufacturer's shop drawings and calculations.

2.7 EXPANSION JOINTS

A. All piping subject to expansion and contraction shall be provided with sufficient means to compensate for such movement, without exertion of undue forces to equipment or structures. This may be accomplished with expansion loops, bellow-type expansion joints, or sliding-type expansion joints. Expansion joints shall be of stainless steel, monel, rubber, or other materials, best suited for each individual service. The CONTRACTOR shall submit to the RESIDENT ENGINEER detailed calculations and manufacturer's shop drawings, guaranteeing satisfactory performance of all proposed expansion joints, piping layouts showing all anchors and guides, and information on materials, temperature and pressure ratings.

2.8 PIPE THREADS

A. All pipe threads shall be in accordance with ANSI/ASME B1.20.1

PART 3 -- EXECUTION

3.1 GENERAL

A. All pipes, fittings, and appurtenances shall be installed in accordance with the requirements of Divisions 2 and 15. The lining manufacturer shall take full responsibility for the complete, final product and its application. All pipe ends and joints at screwed flanges shall be epoxy-coated, to assure continuous protection.

*** END OF SECTION ***

SECTION 15020

PIPE SUPPORTS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide pipe supports, seismic restraints, hangers, guides, and anchors, complete, in accordance with the requirements of the Contract Documents.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 05500 Miscellaneous Metals
2. Section 09800 Protective Coating
3. Section 15000 Piping Components

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Applicable commercial standards are defined in Section 15000 - Piping Components.

B. The following standards have been referenced in this Section:

1.	ANSI/ASME B31.1	Power Piping
2.	ASTM A123	Specifications for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

1.4 CONTRACTOR SUBMITTALS

A. General: Submittals shall be in accordance with Section 01300 - Submittals and Section 15000 - Piping Components.

B. Shop Drawings: Shop drawings shall include the following information:

1. Pipe supports, restraints, hangers, anchors, and guides

PART 2 -- PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Code Compliance: All piping systems and pipe connections to equipment shall be properly anchored and supported to prevent undue deflection, vibration, dislocation due to seismic events and line pressures, and stresses on piping, equipment, and structures. All supports and parts thereof shall conform to the requirements of ANSI/ASME B31.1 -

Power Piping, except as supplemented or modified below. Supports for plumbing piping shall be in accordance with the latest edition of the applicable plumbing code or local administration requirements.

B. Structural Members: Wherever possible, pipes shall be supported from structural members. Where it is necessary to frame structural members between existing members, such supplementary members shall be provided at no additional cost to the OWNER. All supplementary members shall be in accordance with the requirements of the building code and the American Institute of Steel Construction and shall be acceptable to the RESIDENT ENGINEER.

C. Pipe Hangers: Pipe hangers shall be capable of supporting the pipe in all conditions of operation, allowing free expansion and contraction of the piping, and preventing excessive stress on equipment. All hangers shall have a means of vertical adjustment after erection. Hangers shall be designed to prevent becoming disengaged by any movement of the supported pipe. Hangers subject to shock, seismic disturbances, or thrust imposed by the actuation of safety valves, shall include hydraulic shock suppressors. All hanger rods shall be subject to tensile loading only.

D. Hangers Subject to Horizontal Movements: At hanger locations where lateral or axial movement is anticipated, suitable linkage shall be provided to permit such movement. Where horizontal pipe movement is greater than 1/2-inch, or where the hanger rod deflection from the vertical is greater than 4 degrees from the cold to the hot position of the pipe, the hanger rod and structural attachment shall be offset in such a manner that the rod is vertical in the hot position.

E. Spring-Type Hangers: Spring-type pipe hangers shall be provided for piping subject to vibration or vertical expansion and contraction, such as engine exhausts and similar piping. All spring-type hangers shall be sized to the manufacturer's printed recommendations and the loading conditions encountered. Variable spring supports shall be provided with means to limit misalignment, buckling, eccentric loading, or to prevent overstressing of the spring, and with means to indicate at all times the compression of the spring. Supports shall be capable of accommodating at least four times the maximum travel due to thermal expansion.

F. Thermal Expansion: Wherever expansion and contraction of piping is expected, a sufficient number of expansion loops or joints shall be provided, together with the necessary rolling or sliding supports, anchors, guides, pivots, and restraints permitting the piping to expand and contract freely in directions away from the anchored points. All components shall be structurally suitable to withstand all loads imposed.

G. Riser Supports: Where practical, risers shall be supported on each floor with riser clamps and lugs, independent of the connected horizontal piping.

H. Freestanding Piping: Free-standing pipe connections to equipment such as chemical feeders and pumps shall be firmly attached to steel frames fabricated from angles, channels, or I-beams anchored to the structure. Exterior, free-standing overhead piping shall be supported on fabricated pipe stands consisting of pipe columns anchored to concrete footings, with horizontal, welded steel angles and U-bolts or clamps securing the pipes.

I. Materials of Construction:

1. General: All pipe support assemblies, including framing, hardware, and anchors, shall be steel construction, galvanized after fabrication, unless otherwise indicated.

2. Submerged Supports: All submerged piping, as well as piping, conduits, and equipment in hydraulic structures within 24-inches of the water level, shall be supported with support, assemblies, including framing, hardware, and anchors, constructed of Type 316 stainless steel, unless otherwise indicated.

3. Corrosive Areas: All piping in chemical and corrosive areas shall be supported with support assemblies, including framing, hardware, and anchors, constructed of Type 316 stainless steel or FRP, unless otherwise indicated.

J. Point Loads: Any meters, valves, heavy equipment, and other point loads on PVC, FRP, and other plastic pipes, shall be supported on both sides, according to manufacturer's recommendations to avoid undue pipe stresses and failures. To avoid point loads, all supports on PVC, FRP, and other plastic piping shall be equipped with extra wide pipe saddles or galvanized steel shields.

2.2 SUPPORT SPACING

A. Supports for piping shall be spaced to prevent excessive sag, bending, and shear stresses in the piping, with special consideration given where components such as flanges and valves impose concentrated loads. Pipe support spacing shall not exceed the maximum spans in the tables below. For temperatures other than ambient temperatures and for other piping materials or wall thicknesses, the pipe support spacings shall be modified in accordance with the pipe manufacturer's recommendations. Vertical supports shall be provided to prevent the pipe from being overstressed from the combination of all loading effects.

1. Support Spacing for Schedule 40 and Schedule 80 Steel Pipe:

Nominal Pipe Diameter (inches)	Maximum Span (feet)
2	6
3/4 and 1	8
1-1/4 to 2	10
3	12
4	14
6	17
8 and 10	19
12 and 14	23
16 and 18	25
20 and 22	30

2. Support Spacing for Welded Fabricated Steel Pipe:

Maximum Spans (feet) for Pipe Supported in Minimum 120 Degree Contact Saddles

Nominal Pipe Diameter (inches)	Wall Thickness B inches									
	3/16	1/4	5/16	3/8	7/16	1/2	5/8	3/4	7/8	1
24	33	37	41	43	45	47				
26	34	38	41	44	46	48				
28	34	38	41	44	47	49				
30	34	38	42	45	48	49				
32	34	39	42	45	48	50				
34	35	39	42	46	48	50				
36	35	39	43	46	49	51	55			
38	35	39	43	46	49	51	55			
40	35	40	43	47	49	52	56			
42	--	40	43	47	50	52	56			
45	--	40	44	47	50	53	57			
48	--	40	44	47	50	53	58	61		
51	--	41	44	48	51	53	58	62		
54	--	41	44	48	51	54	58	62		
57	--	41	44	48	51	54	59	63		
60	--	41	45	48	52	54	59	63	67	70
63	--	41	45	49	52	55	60	64	67	71
66	--	41	45	49	52	55	60	64	68	71
72	--	41	45	49	52	55	61	65	69	72
78	--	41	45	49	53	56	61	66	69	73
84	--	41	46	50	53	56	62	66	70	74
90	--	41	46	50	53	56	62	67	71	74
96	--	42	46	50	54	57	62	67	71	75

a. For steel pipe sizes not presented in this table, the support spacing shall be designed so that the stress on the pipe does not exceed 5,000 psi. Maximum deflection of pipe shall be limited to 1/360th of the span and shall be calculated by using the formula:

$$L = [(7500tD)/(32t + D)]^{0.5}$$

where: t = Thickness (inches)
D = Diameter (inches)
L = Maximum span (feet)

3. Support Spacing for Ductile-Iron Pipe:

Nominal Pipe Diameter (inches)	Maximum Span (feet)
All diameters	Two supports per pipe length or 10 feet (one of the 2 supports located at joint)

4. Support Spacing for Copper Tubing:

Nominal Pipe Diameter (inches)	Maximum Span (feet)
1/2 to 1-1/2	6
2 to 4	10
6 and greater	12

5. Support Spacing for Schedule 80 PVC Pipe:

Nominal Pipe Diameter (inches)	Maximum Span (at 100 degrees F) (feet)
1/2	4
3/4	4.5
1	5
1-1/4	5.5
1-1/2	5.75
2	6.25
3	7.5
4	8.25
6	10
8	11
10	12.25
12	13.25

6. Support Spacing for Schedule 80 Polypropylene Pipe:

Nominal Pipe Diameter (inches)	Maximum Span (at 100 degrees F) (feet)
1/2	3
3/4	3.5

Nominal Pipe Diameter (inches)	Maximum Span (at 100 degrees F) (feet)
1	3.75
1-1/4	4
1-1/2	4.25
2	4.5
3	5.5
4	6
6	7.25
8	8
10	8.75
12	9.5

7. Support Spacing for Fiberglass Reinforced Plastic (FRP) Pipe:

Nominal Pipe Diameter (inches)	Maximum Span (at 100 degrees F) (feet)
2	8.8
3	10
4	11
6	12.7
8	13.4
10	14
12	15.4
14	16.2
16	17.3
18 and greater	18

2.3 MANUFACTURED SUPPORTS

A. Stock Parts: Designs shall exemplify good engineering practice and use stock or production parts. Such parts shall be locally available, new, of best commercial quality, designed and rated for the intended purpose.

B. Manufacturers, or equal:

1. Bergen-Paterson Pipesupport Corp., Woburn, MA
2. Grinnell Corp., Exeter, PA
3. Tripac
4. Pipeline Products
5. Tolco

2.4 COATING

A. Galvanizing: Unless otherwise indicated, all fabricated pipe supports other than stainless steel or non-ferrous supports shall be blast-cleaned after fabrication and hot-dip galvanized in accordance with ASTM A 123 - Specifications for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

B. Other Coatings: Other than stainless steel or non-ferrous supports, all supports shall receive protective coatings in accordance with the requirements of Section 09800 - Protective Coating.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. General: All pipe supports, seismic restraints, hangers, brackets, anchors, guides, and inserts shall be fabricated and installed in accordance with the manufacturer's printed instructions and ANSI/ASME B31.1 - Power Piping. All concrete inserts for pipe hangers and supports shall be coordinated with the form work.

B. Appearance: Pipe supports and hangers shall be positioned to produce an orderly, neat piping system. All hanger rods shall be vertical, without offsets. Hangers shall be adjusted to line up groups of pipes at the proper grade for drainage and venting, as close to ceilings or roofs as possible, and without interference with other work.

3.2 FABRICATION

A. Quality Control: Pipe hangers, supports, and seismic restraints shall be fabricated and installed by experienced welders and fitters, using the best welding procedures available. Fabricated supports shall be neat in appearance without sharp corners, burrs, and edges.

*** END OF SECTION ***

SECTION 15030

PIPE IDENTIFICATION SYSTEMS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide identification for all exposed piping and valves, in accordance with the requirements of the Contract Documents.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 09800 Protective Coating
2. Section 15000 Piping Components
3. Section 15100 Valves, General
4. Divisions 2, 11, 13, 15, as applicable

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Applicable commercial standards conform to the requirements of Section 15000 - Piping Components.

B. The following standards are referenced in this Section:

1. ANSI A13.1 Scheme for the Identification of Piping Systems

1.4 CONTRACTOR SUBMITTALS

A. All submittals shall be in strict accordance with the requirements of Sections 01300 - Submittals and Section 15000 - Piping Components.

B. The CONTRACTOR shall submit samples of all types of identification devices to be used in the Work.

C. Before fabrication starts, the CONTRACTOR shall submit a list of suggested wording for all valve tags.

PART 2 -- PRODUCTS

2.1 IDENTIFICATION OF PIPING

A. Identification of all exposed pipe shall be accomplished by color-coding with bands and by lettering as specified in Part 3 herein and in Section 09800 - Protective Coating. Color bands shall either be painted directly upon the pipe or shall be pressure-sensitive adhesive-backed vinyl cloth or plastic tape.

B. Each pipe identification shall consist of two color-coded bands, a printed label identifying the name of the pipe, and a flow arrow to indicate direction of flow in the pipe. All labels shall be preprinted on pressure-sensitive adhesive-backed vinyl cloth or plastic tape. Arrows shall be die-cut of the same type of material as the labels.

C. Letter sizes and colors for lettering, arrows, and background shall conform to ANSI A13.1.

D. Preprinted identification devices shall be as manufactured by W.H. Brady Co.; Seton Nameplate Corp.; or equal.

2.2 EXISTING IDENTIFICATION SYSTEMS

A. In installations where existing piping identification systems have been established, the CONTRACTOR shall continue to use the existing system. Where existing identification systems are incomplete, the CONTRACTOR shall utilize the existing system as far as practical and supplement with the specified system. The objective is to fully identify all new piping, valves, and appurtenances to the level specified herein.

2.3 IDENTIFICATION OF VALVES AND SHORT PIPE LENGTHS

A. Identifying devices for valves and the sections of pipe that are too short to be identified with color bands, lettered labels, and arrows shall be identified with metal or plastic tags as indicated.

B. Metal tags shall be of stainless steel with embossed lettering. Plastic tags shall be of solid black plastic laminate with white embossed letters. All tags shall be designed to be firmly attached to the valves or short pipes or to the structure immediately adjacent to such valves or short pipes.

PART 3 -- EXECUTION

3.1 GENERAL

A. All labels and identification tags shall be installed in accordance with the manufacturer's printed instructions, and shall be neat and uniform in appearance. All such tags or labels shall be readily visible from all normal working locations.

3.2 VALVE TAGS

A. Valve tags shall be permanently attached to the valve or structure by means of two stainless steel bolts or screws.

B. The wording on the valve tags shall describe the exact function of each valve, e.g.,"REW THROTTLING", "RW-PUMP SHUT-OFF," etc.

3.3 PIPE IDENTIFICATION

A. Each pipe shall be identified at intervals of 20 feet, and at least one time in each room. Piping shall also be identified at a point approximately within 2 feet of all turns, ells, valves, and on the upstream side of all distribution fittings or branches. Sections of pipe that are too short to be identified with color bands, lettered labels, and directional arrows shall be tagged and identified similar to valves.

B. Pipe identification shall consist of 4 elements, i.e., 2 color bands, a lettered label, and a directional label. The bands shall be arranged so that the lettered label and the directional arrow is placed between the 2 bands.

3.4 IDENTIFICATION SCHEDULE

A. Application of identifying devices shall conform to the following color codes.

Fluid Abbreviation	Function and Identification	Identification Color
A	Compressed air	blue
CD	Chemical drain and vent	orange
CLS	Chlorine solution	orange
CV	Chlorine vent & detection line	yellow
EE	Engine exhaust	aluminum
EWR	Engine cooling water return	blue
EWS	Engine cooling water supply	blue
FOR	Fuel oil return	orange
FOS	Fuel oil supply	orange
FSP	Fire protection sprinkler system	red
IA	Instrument air	aluminum
LO	Lube oil	orange
LSP	Landscape sprinkler system	blue
NG	Natural gas	yellow
OF	Overflow	blue
PD	Plant Drain	blue
PW	Potable water	green
REW	Reclaimed water	blue
RW	Raw water	blue
RWL	Rain water leader	blue
SA	Sample lines	blue
SC	Spare chemical	orange
SD	Sanitary drains and vents	blue
SDR	Storm drain	blue

Fluid Abbreviation	Function and Identification	Identification Color
SPD	Sump pump discharge	blue
SS	Sanitary sewer	blue
SUC	Structure underdrain collector	blue
UW	Utility water (nonpotable water)	blue
V	Vacuum	aluminum
WLO	Waste lube oil	orange

*** END OF SECTION ***

SECTION 15050

VIBRATION ISOLATION

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The Work of this Section includes providing vibration isolation systems for mechanical equipment. Additional vibration isolation system requirements may be included in individual equipment sections.

B. The Work also includes coordination of design, assembly, testing and installation.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 11000 Equipment General Provisions

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. The Work of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

1. Uniform Mechanical Code

B. Except as otherwise indicated, the current editions of the following commercial standards apply to the Work of this Section:

1.	ANSI A58.1	Minimum Design Loads for Buildings and Other Structures
2.	ASHRAE CH 52	1987 Handbook, HVAC Systems and Applications, Sound and Vibration Control

1.4 CONTRACTOR SUBMITTALS

A. The following shall be submitted in compliance with Section 01300 - Submittals and Section 11000 - Equipment General Provisions:

1. Static and dynamic deflections, weights, isolator locations, and flexible connector design information.

2. Information on spring deflections and diameters, compressed spring heights and solid spring heights.

3. Curb mounted base seal and wind resistance details.

4. Scale drawing of Type D mounting hanger showing the 30 degree arc capability.

5. Seismic restraint load deflection curves.

6. Qualifications of the engineer who will perform the vibration isolation design.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Mounting Requirements: Unless the equipment incorporates unit construction using an integral rigid frame or is indicated otherwise, each item of mechanical equipment, along with its drive unit, shall be mounted on a rigid steel and concrete base. Cast iron bases are not permitted when equipment is furnished with a vibration isolation system. Where indicated, the equipment, including the base, shall be mounted on or suspended from vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the supporting structure. Vibration isolation available internally in the equipment will not be considered equivalent and shall not be provided in lieu of the vibration isolation indicated. Normally provided internal vibration isolators shall be replaced with rigid supports in such cases. Vibration isolators shall be selected in accordance with unit weight distribution to produce reasonably uniform deflections at each support. Unless otherwise indicated, bases, isolators, and deflections shall be as indicated in Table 27, ASHRAE CH 52.

B. Design Requirements: The CONTRACTOR shall cause all vibration isolation systems, including the isolators, seismic restraints, and flexible connectors between the isolated equipment and associated piping, ducting and/or electrical work, to be designed by an engineer qualified in this type of work. This provision, however, shall not be construed as relieving the CONTRACTOR of his overall responsibility for the work. The CONTRACTOR shall submit the engineer's qualifications prior to starting the vibration isolation design. Flexible connectors shall be provided by the manufacturer of the mechanical equipment item in accordance with the recommendations of the vibration isolation system engineer.

C. Seismic Restraints:

1. General: Restraint devices shall be designed in accordance with the latest building code for seismic zone 4 and geotechnical report recommendations, whichever is greater. Design lateral forces shall be distributed in proportion to the mass distribution of the equipment.

2. Floor Mounted Equipment:

a. Equipment and appurtenances floor mounted on spring or pad type vibration isolators, except for curb mounted equipment, shall be provided with seismic snubbers. Equipment shall receive four all-directional restraint snubbers. The capacity of snubbers, at 3/8-inch deflection, shall be 3 to 4 times the load at the adjacent equipment mount.

b. Restraint assembly for floor mounted equipment shall consist of welded steel interlocking assemblies welded or bolted securely to the equipment or the equipment bases and the supporting structure. Restraint assembly surfaces which engage under seismic motion shall be lined with a resilient elastomer, 3/4-inches thick. Restraints shall be field adjustable and be positioned for 1/4-inch clearance both vertically and horizontally or clearance as required to prevent interference during normal operation, stopping, or starting.

3. Curb Mounted Equipment: Seismic restraints for equipment mounted on vibration isolation curbs shall consist of slack stainless steel cables designed to provide restraint in the four primary horizontal directions.

4. Suspended Equipment: Restraint assembly for suspended equipment, piping, or ductwork shall consist of plow steel cable attached to steel thimbles with neoprene sleeve all specifically designed for cable service and securely fastened to the equipment or the equipment base and the building structure. Cables shall be sized with a minimum safety factor of 2. Cables shall be installed to prevent excessive seismic motion but not engage during normal operation, starting or stopping.

2.2 BASES

A. Curb Mounted Bases: Curb mounted equipment where vibration isolation is required, principally shall be mounted on vibration isolation bases that fit over the curb and under the isolated equipment. The extruded aluminum top and bottom members shall contain cadmium-plated springs having a 1-inch minimum deflection with 50 percent additional travel to solid. Spring diameters shall be no less than 0.8 times the spring height at rated load. Wind resistance shall be provided by means of resilient snubbers in the corners with a minimum clearance of 1/4-inch so as not to interfere with spring action except in high winds. The weather seal shall consist of continuous closed cell sponge materials both above and below the base and a waterproof flexible neoprene connection duct joining the outside perimeter of the aluminum members. Foam or other contact seals are unacceptable at the spring cavity closure. Caulking shall be kept to a minimum.

B. Type I Bases: Type I bases shall be fabricated from structural steel. The baseplate shall extend under the equipment and drive train components so that any leakage is contained within the baseplate. All pipe joints and flange faces shall be within the drain rim collection area. The rim of the baseplate shall be sloped at least 1:120 toward the driven equipment end, where a tapped drain opening at least 2-inch shall be located to effect complete drainage.

1. Design and construction of the baseplate shall provide sufficient structural stiffness to limit process equipment shaft displacement to 0.003-inch (as measured on a dial indicator) when maximum permissible loads are applied.

2. Mounting pads shall be provided for all drive train components. The pads shall be larger than the foot of the mounted equipment to allow leveling of the baseplate without removal of the equipment. The pads shall be fully machined flat and parallel. Corresponding surfaces shall be in the same plane within 0.002 in/ft of distance between the pads.

3. The baseplate shall be provided with lifting lugs for at least a four-point lift. Lifting the baseplate, complete with all equipment mounted, shall not permanently distort or otherwise damage the baseplate or the machinery mounted on it.

4. Jackscrews shall be provided adjacent to each and every foundation bolt hole. Jackscrews shall be a minimum of 6-inches long.

5. Axial equipment positioning jackscrews shall be provided for all drive train components weighing more than 500 lb to facilitate longitudinal adjustment.

6. The underside of the fabricated baseplate beneath driver and driven equipment supports shall be welded to reinforcing cross members and the members shall be shaped to positively lock into the grout. All welding shall be continuous. Stitch welding on the top of baseplates is unacceptable.

2.3 VIBRATION ISOLATION MOUNTINGS

A. Type A Mountings: Type A mountings shall be double deflection neoprene mountings having a minimum static deflection of 0.35-inches. All metal surfaces shall be neoprene covered to avoid corrosion and shall have friction pads both top and bottom so that they need not be bolted to the floor. Bolt holes and anchor bolts shall be provided where required to resist lateral migration. Resilient washers and bushings shall be provided to prevent contact between the bolts and the equipment support bases. On equipment such as small vent sets, steel rails shall be used above the mountings to compensate for the overhang.

B. Type B Mountings: Type B mountings shall be free-standing spring type isolators laterally stable without any housing and complete with 1/4-inch neoprene acoustical friction pads between the base and the support. Mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 times the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50 percent of the rated deflection. Mountings shall be hot-dip galvanized steel.

C. Type C Mountings: Type C mountings shall be Type B mountings with a housing having vertical limit stops to prevent spring extension when weight is removed. Type C mountings shall be provided for equipment with operating weight different from the installed weight and equipment exposed to the wind. The housing shall serve as blocking during erection and shall be located between the supporting steel and roof or the grillage and dunnage as indicated. The installed and operating heights shall be the same. A minimum clearance of 1/2-inch shall be maintained around restraining bolts and between the housing and the spring to prevent interference with the spring action. Limit stops shall be out of contact during normal operations. Mountings shall be hot-dip galvanized steel.

D. Type D Mountings: Type D mountings shall be steel hangers which contain a steel spring and a 0.3-inch deflection neoprene element in series. The neoprene element shall be molded with a rod isolation bushing which passes through the hanger box. Spring diameters and hanger box lower hole sizes shall be of sufficient size to permit the hanger rod to swing through a 30 degree arc before contacting the hole. Springs shall have a minimum additional travel to solid equal to 50 percent of the rated deflection.

E. Type E Mountings: Type E mountings shall be double deflection cork and rubber sandwich pads consisting of a high-density cork layer permanently bonded to top and bottom layers of corrugated oil-resistant synthetic rubber. The corrugated design shall allow deflection to increase with load and shall form a nonskid surface to resist lateral migration of the equipment. Bolt holes and anchor bolts shall be provided where required to resist migration. Resilient washers and bushings shall be provided to prevent contact between the bolts and the equipment support bases.

2.4 MANUFACTURERS

A. Products of the type indicated shall be manufactured by one of the following, or equal:

1. Consolidated Kinetics Corporation
2. Korfund Dynamics
3. Mason Industries, Inc.
4. Cooper B-Line

PART 3 -- EXECUTION

3.1 INSTALLATION

A. General: Vibration isolators and equipment shall be installed in accordance with the manufacturer's written instructions.

B. Flexible connectors shall be provided by the manufacturer of the mechanical equipment item in accordance with the recommendations of a qualified vibration isolation system engineer.

3.2 FIELD INSPECTION

A. The vibration isolation manufacturer, or his qualified representative, shall provide such supervision as is necessary to assure correct installation and adjustment of the isolators and seismic restraints. Upon completion of the installation and after the system is put into operation, the manufacturer or his representative shall make a final inspection and submit his report in writing certifying the correctness of installation and compliance with shop drawings.

*** END OF SECTION ***

SECTION 15100

VALVES, GENERAL

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide all valves, operators, and appurtenances, complete and operable, in accordance with the Contract Documents. This Section applies to all valves and valve operators except where otherwise indicated. Valves and operators in particular locations may require a combination of units, sensors, limit switches, and controls as indicated in other Sections.

B. Unit Responsibility: A single manufacturer shall be made responsible for coordination of design, assembly, testing, and furnishing of each valve; however, the CONTRACTOR shall be responsible to the OWNER for compliance with the requirements of each valve section. Unless indicated otherwise, the responsible manufacturer shall be the manufacturer of the valve.

C. Single Manufacturer: Where two or more valves of the same type or size are required, the valves shall be furnished by the same manufacturer.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 09800 Protective Coating
2. Section 11000 Equipment General Provisions
3. Section 15000 Piping Components
4. Section 15101 Valve and Gate Operators
5. Section 15104 Butterfly Valves
6. Section 15113 Air release and Vacuum Valves
7. Section 15114 Pressure Regulating Valves
8. Section 15117 Pump Control Valves

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC) together with the latest adopted editions of the Regional and City of San Diego Supplement Amendments.

B. Except as otherwise indicated, the current editions of the following standards apply to the Work of this Section:

1. ANSI/ASME B16.1 Cast Iron Pipe Flanges and Flanged Fittings

2.	ANSI/ASME B16.5	Pipe Flanges and Flanged Fittings
3.	ANSI/ASME B16.47	Large Diameter Steel Flanges: NPS 26 through NPS 60
4.	ANSI/ASME B1.20.1	Pipe Threads (Inch), General Purpose
5.	ANSI/ASME B31.1	Power Piping
6.	ASTM A36	Standard Specification for Carbon Structural Steel
7.	ASTM A48	Standard Specification for Gray Iron Castings
8.	ASTM A126	Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
9.	ASTM A216	Standard Specification for Steel Castings, Carbon Suitable for Fusion Welding for High Temperature Service
10.	ASTM A351	Standard Specification for Steel Castings, Austenitic, Austenitic-Ferric (Duplex), and Pressure-Containing Parts
11.	ASTM A395	Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures
12.	ASTM A515	Standard Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate and Higher Temperature Service
13.	ASTM A536	Standard Specification for Ductile Iron Castings
14.	ASTM A743	Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion-Resistant, for General Purposes
15.	ASTM B61	Standard Specification for Stream or Valve Bronze Castings
16.	ASTM B62	Standard Specification for Composition Bronze or Ounce Metal Castings
17.	ASTM B148	Standard Specification for Aluminum-Bronze Sand Castings
18.	ASTM B584	Specification for Copper Alloy Sand Castings for General Applications

19.	ANSI/AWWA C210	Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
20.	ANSI/AWWA C217	Cold-Applied Petrolatum Tape and Petroleum Wax Tape Coatings fro the Exterior of Special Sections, Connections, and Fittings for Buried Steel Water Pipelines
21.	ANSI/AWWA C550	Protective Epoxy Interior Coatings for Valves and Hydrants
22.	SSPC SP 2	Hand Tool Cleaning
23.	SSPC SP 5	Joint Surface Preparation White Metal Blast Cleaning
24.	MSS SP25	Standard Marking Systems for Valves, Fittings, Flanges, and Unions

1.4 CONTRACTOR SUBMITTALS

A. General: Submittals shall be furnished in accordance with Section 01300 - Submittals.

B. Shop Drawings: Shop drawings shall contain the following information:

1. Manufacturer's product data including catalog cuts.

2. Valve name, size, Cv factor, pressure rating, identification number (if any), and specification section number.

3. Complete information on valve operator, including size, Manufacturer, model number, limit switches, and mounting.

4. Cavitation limits for all control valves.

5. Assembly drawings showing part nomenclature, materials, dimensions, weights, and relationships of valve handles, handwheels, position indicators, limit switches, integral control systems, needle valves, and control systems.

6. Data in accordance with Section 16040 - Electric Motors for electric motor-operated valves.

7. Complete wiring diagrams and control system schematics.

8. A schedule of valves to be labeled, indicating in each case the valve location and the proposed wording for the label.

9. Manufacturer's certification that products comply with the indicated requirements.

10. Manufacturer's certification that epoxy coatings have been factory tested and comply with the indicated requirements.

11. Manufacturer's literature for flange gaskets, including compression calculation on gaskets for plastic valves and fittings.

C. The following shall be provided in compliance with Section 01730 - Operations and Maintenance Information:

1. Manufacturer's installation and operating instructions.
2. Manufacturer's maintenance procedures.
3. List of special tools.
4. Schedule of valves indicating valve identification and location.

D. Spare Parts List: A spare parts list shall be provided with information for each valve assembly.

E. Factory Test Data: Where indicated, signed, dated, and certified factory test data for each valve requiring certification shall be submitted before shipment of the valve. The data shall also include certification of quality and test results for factory-applied coatings.

PART 2 -- PRODUCTS

2.1 PRODUCTS

E. General: Valves shall be of the size, type, and capacity indicated on the Drawings or in the Specifications. All valves shall be new and of current manufacture. All shut-off valves 6-inches in diameter and larger shall have operators with position indicators. Buried valves shall be provided with operating devices in accordance with Section 15101 - Valve and Gate Operators. Where chains would interfere with passageways, a chain hook shall be mounted on a permanent structure to maintain the passageway clear to a minimum height of 80 inches for the full passage width.

F. Valve Operators: Unless otherwise indicated, valve operators shall be in accordance with Section 15101 - Valve and Gate Operators.

G. Protective Coating: Protective coatings for buried and exposed valves shall be provided in accordance with Section 09800 - Protecive Coating. Wet interior surfaces of all ferrous valves of diameters 4 inches and larger shall be coated in accordance with Section 09800 - Protective Coating. Flange faces of valves shall not be epoxy coated but shall be coated with a temporary rust-inhibitive coating to protect the metal until the installation is complete.

H. Valve Labeling: Except when such requirement is waived in writing, a label shall be provided on all valves 4-inches and larger. The label shall be of 1/16-inch plastic or stainless steel, minimum 2-inches by 4-inches in size, as indicated in Section 15030 - Piping Identification Systems, and shall by permanently attached to the valve or on the wall adjacent to the valve as directed by the RESIDENT ENGINEER.

I. NOT USED

J. Valve Marking: All valve bodies shall be permanently marked in accordance with MSS SP25 - Standard Marking Systems for Valves, Fittings, Flanges, and Unions.

2.2 MATERIALS

A. General: All materials shall be suitable for the intended application. Materials not specified shall be high-grade standard commercial quality, free from all defects and imperfections that might affect the serviceability of the product for the purpose for which it is intended. Unless otherwise specified, valve bodies shall conform to the following requirements:

1. Cast Iron: Cast iron valve bodies shall be of close-grained gray cast iron, conforming to ASTM A48, Class 30, or to ASTM A126.

2. Ductile Iron: Ductile iron valve bodies shall conform to ASTM A536 or to ASTM A395.

3. Steel: Steel valve bodies shall conform to ASTM A216, Grade WCB or to ASTM A515, Grade 70.

4. Bronze: Bronze valve bodies shall conform to ASTM B62, and valve stems not subject to dezincification shall conform to ASTM B584.

5. Stainless Steel: Stainless steel valve bodies and trim shall conform to ASTM A351, Grade CF8M, or shall be Type 316 stainless steel.

2.3 VALVE CONSTRUCTION

A. Bodies: Valve bodies shall be cast, forged, or welded of the materials indicated, with smooth interior passages. Wall thicknesses shall be uniform in agreement with the applicable standards for each type of valve, without casting defects, pinholes, or other defects that could weaken the body. All welds on welded bodies shall be performed with approved welding procedures and procedure qualifications. All welders shall be certified. Welds shall be ground smooth. Valve ends shall be as indicated, and be rated for the maximum temperature and pressure to which the valve will be subjected. The flanges of valves shall comply with Section 15000 - Piping Components.

B. Bonnets: Valve bonnets shall be clamped, screwed, or flanged to the body and shall be of the same material, temperature, and pressure rating as the body. The bonnets shall have provision for the stem seal with the necessary glands, packing nuts, or yokes.

C. Stems: Valve stems shall be of the materials indicated, or, if not indicated, of the best commercial material for the specific service, with adjustable stem packing, O-rings, Chevron V-type packing, or other suitable seal. Where subject to dezincification, bronze valve stems shall conform to ASTM B 62, containing not more than 5% of zinc or more than 2% of aluminum, with a minimum tensile strength of 60,000 psi, a minimum yield strength of 40,000 psi, and an elongation of at least 10% in 2-inches as determined by a test coupon poured from the same ladle from which the valve stems are poured. Where dezincification is not a problem, bronze conforming to ASTM B584 may be used.

D. Internal Parts: Internal parts and valve trim shall be as indicated for each individual valve. Where not indicated, valve trim shall be of Type 316 stainless steel or other best suited material.

E. Nuts and Bolts: All nuts and bolts on valve flanges and supports shall be in accordance with Section 05500 - Miscellaneous Metals.

2.4 GASKETS FOR PLASTIC VALVES AND FITTINGS

A. The CONTRACTOR shall provide gaskets specifically designed for plastic valves and fittings that will develop a complete seal within the structural tolerances of the plastic flanges.

2.5 VALVE ACCESSORIES

A. All valves shall be furnished complete with the accessories required to provide a functional system.

2.6 NOT USED

PART 3 -- EXECUTION

3.1 VALVE INSTALLATION

A. General: All valves, operating units, stem extensions, valve boxes, and accessories shall be installed in accordance with the manufacturer's written instructions and as indicated. All gates shall be adequately braced to prevent warpage and bending under the intended use. Valves shall be firmly supported to avoid undue stresses on the pipe.

B. Access: All valves shall be installed with easy access for operation, removal, and maintenance and to avoid interference between valve operators and structural members, handrails, or other equipment.

C. Valve Accessories: Where combinations of valves, sensors, switches, and controls are indicated, assemble and install such items so that all systems are compatible and operating properly. The relationship between interrelated items shall be clearly noted on shop drawing submittals.

*** END OF SECTION ***

SECTION 15101

VALVE AND GATE OPERATORS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide valve and gate operators and appurtenances, complete and operable, in accordance with the Contract Documents. The Work also includes coordination of design, assembly, testing and installation. The provisions of this Section shall apply to all valves and gates, except where otherwise indicated in the Contract Documents.

B. Unit Responsibility: A single manufacturer shall be made responsible for furnishing the Work and for coordination of design, assembly, testing, and installation of the Work of each type of valve and gate; however, the CONTRACTOR shall be responsible to the OWNER for compliance with the requirements of each valve and gate section. Unless otherwise indicated, the single manufacturer shall be the manufacturer of the valve or gate. Where two or more valve or gate operators of the same type or size are required, the operators shall all be produced by the same manufacturer.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 15100 Valves, General
2. Section 16040 Electric Motors
3. Section 16050 Basic Electrical Materials and Methods

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC) together with the latest adopted editions of the Regional and City of San Diego Supplement Amendments.

B. Except as otherwise indicated, the current editions of the following apply to the Work of this Section:

1.	ANSI/AWWA C500	Gate Valves for Water and Sewerage Systems
2.	ANSI/AWWA C540	Power-Actuating Devices for Valves and Sluice Gates
3.	NFPA/NEC NFPA 70	National Electrical Code (as applicable)
4.	ANSI/NEMA	National Electrical Manufacturers Association (As Applicable)

SECTION 15250

PIPE AND EQUIPMENT INSULATION

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The Work of this Section includes providing pipe and equipment insulation for cold and hot piping, exhausts, flues, and equipment, to prevent heat loss or heat gain and injury to personnel upon contact.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 09800 Protective Coating
2. Section 15000 Piping Components
3. Division 2 and 15

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. The Work of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego:

1. Uniform Building Code
2. Uniform Mechanical Code
3. Uniform Plumbing Code
4. Uniform Fire Code
5. ASHRAE Guide
6. State of California Energy Conservation Regulations

B. Except as otherwise indicated, the current editions of the following apply to the Work of this Section:

1. Federal Standards:

FEDSPEC L-P-535E	Plastic Sheet (Sheeting) "Plastic Strip" Poly (Vinyl Chloride) and Poly (Vinyl Chloride-Vinyl Acetate), Rigid
FEDSPEC HH-I-558B(3)	Insulation, Blocks, Boards, Blankets, Felt Sleeving (Pipe and Tube Covering), and Pipe Fitting Covering, Thermal (Mineral Fiber, Industrial Type)

2. Commercial Standards:

ASTM B 209	Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C 533	Specification for Calcium Silicate Block and Pipe Thermal Insulation
ASTM C 547	Specification for Mineral Fiber Preformed Pipe Insulation
ASTM E 84	Test Method for Surface Burning Characteristics of Building Materials

1.4 CONTRACTOR SUBMITTALS

A. Shop drawings of all thermal insulation, with the manufacturer's data on materials, coverings, jackets, and finish, shall be submitted in compliance with Section 01300 - Submittals and Section 15100 - Piping Components.

1.5 QUALIFICATIONS

A. Installer: The installer of pipe and equipment insulation shall be an authorized installer of the manufacturer.

PART 2 -- PRODUCTS

2.1 GENERAL

A. The CONTRACTOR shall insulate surfaces as indicated on the Drawings.

B. All components of the insulation, including covering, mastics and adhesives shall have a flame-spread rating of not over 25, and a smoke development rating of not over 50. Ratings shall be as established by tests in accordance with ASTM E 84 and Federal Specification standards L-P-535E and HH-I-558B. The integrated insulation assemblies shall also conform to the above specifications. Insulation shall be applied in strict accordance with the manufacturer's instructions.

2.2 BASIC MATERIALS

A. Standard Insulation: Standard insulation shall be employed for process, hot water, piping and equipment with surface temperatures up to 850 degrees F. Pipe insulation and jacketing shall be applied to piping where indicated, and shall include fittings, flanges and valves. Pipe insulation shall be molded-type pipe covering, made of fibrous glass with a minimum k-factor of 0.23 at 75 degrees F mean temperature. Unless otherwise indicated, the insulation thickness shall be as follows:

Surface Receiving Installation	Minimum Thickness of Insulation (inches)
Hot water pipes (domestic):	1
Hot and chilled water process pipes:	
6 inches and smaller	1-1/2
8 inches and large	2
Manufactured equipment	as recommended by manufacturer

B. Insulation shall have a factory-applied white fire-retardant vapor-barrier jacket of kraft paper and aluminum foil laminated together and reinforced with fiber glass yarn. Fittings and valves shall be covered with the same material as the pipe, cut in segments to fit snugly without open spaces, held in place with copper wire or cement, and then covered with the same jacketing material as the pipe. Insulated fittings adjacent to vapor-barrier insulation shall be sealed with an acceptable vapor-barrier cement before installation of the finish jacket. Pipe insulation and vapor-barrier shall be continuous through hangers and supports. Insulation shall be coordinated with the pipe hangers and supports and where insulation protection shields are provided the top half section of pipe insulation at support locations shall be of the same specified density, and the bottom half insulation segments provided between the pipe and the insulation protection shields shall have a density of not less than 6 lb/cu ft. All insulation shall be covered with smooth aluminum weatherproof metal or plastic preformed jacketing with a factory-attached moisture barrier. The jacket for the fittings shall consist of precision-formed smooth-sided sections and shall be sized to cover and protect the insulated fitting. Each section shall be manufactured from aluminum or PVC, in accordance with ASTM B209 and Federal Standard L-P-535E, and all joints shall be sealed with silicon mastic or solvent welding, to provide a continuous air and weathertight joint. Strapping shall be 1/2-inch wide, Type 3003 aluminum or stainless steel.

C. High Temperature Insulation: High temperature insulation shall be employed for engine exhaust pipes, flues, and similar pipes and equipment with surface temperatures up to 1200 degrees F. The high temperature insulation shall consist of 4-inch thick calcium silicate or similar pre-molded blocks in accordance with ASTM C 533 and Federal Specification HH-I-558B(3) with a minimum k-factor of 0.14, in two layers of 2-inch thickness, each, with staggered joints, all applied over a 3/4-inch high metal rib lath. The inner layer shall be suitable for 1200 degrees F, and the second layer for 1000 degrees F. All bends, voids, joints, fittings and other parts of the piping system shall be filled with insulating cement. Aluminum lagging with preformed aluminum fittings shall be banded to the insulation in a similar fashion as specified for standard insulation. Allowance shall be made for thermal expansion.

2.3 MANUFACTURERS

A. Insulation of the type indicated shall be manufactured by one of the following, or equal:

1. Armstrong World Industries, Inc.
2. Certain-Teed Corporation

3. Manville
4. Owens-Corning Fiberglas Corp.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. All insulation shall be installed by a manufacturer's certified insulation CONTRACTOR in strict accordance with the manufacturer's written recommendations.

*** END OF SECTION ***

SECTION 15990

TESTING, ADJUSTING, AND BALANCING

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The Work of this Section includes furnishing the following Work by a specialist company, hereinafter referred to as the Specialist:

1. Testing, adjusting, and balancing of air systems.
2. Measurement of final operating condition of HVAC systems.
3. Sound measurement of operating equipment.
4. Vibration measurement of operating equipment.

1.2 NOT USED

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. The Work of this Section shall comply with the current edition of the Uniform Mechanical Code as adopted by the City of San Diego.

B. Except as otherwise indicated, the current editions of the following apply to the Work of this Section:

1.	AABC	National Standards for Field Measurement and Instrumentation, Total System Balance
2.	ASHRAE Systems Handbook:	Chapter 34, Testing, Adjusting and Balancing
3.	NEBB	Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems

1.4 CONTRACTOR SUBMITTALS

A. The following shall be submitted in compliance with Section 01300 - Submittals:

1. Name of the Specialist and documentation of qualifications within 15 working days after award of Contract.

2. Before starting Work, draft reports indicating adjusting, balancing, and equipment data required.

3. Draft copies of final report for review before final acceptance of project.

4. Detailed procedures, agenda, sample report forms and copy of AABC or NEBB National Project Performance Guaranty before starting Work.

1.5 OPERATIONS AND MAINTENANCE INFORMATION

A. The following shall be included in compliance with Section 01730 - Operations and Maintenance Information:

1. Final reports, letter size, complete with index page and indexing tabs, with cover identification at front end including set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

1.6 REPORT FORMS

A. Reports shall be prepared on AABC National Standards for Total System Balance or NEBB forms.

B. Reports shall be submitted to the RESIDENT ENGINEER before requesting final payment.

C. Forms shall include the following information:

1. Title Page:
Company name
Company address
Company telephone number
Project name
Project location
Specialist's Project Engineer
Project RESIDENT ENGINEER
Project CONTRACTOR
Project altitude

2. List of Instruments and Measurement Devices Used by the Specialist:
Instrument
Manufacturer
Model
Serial number
Range
Calibration date

3. Air Moving Equipment:
Location
Manufacturer
Model
Supply air flow, specified and actual
Return air flow, specified and actual
Outside air flow, specified and actual
Total static pressure (total external), specified and actual
Inlet pressure
Discharge pressure
Fan RPM

4. Return Air/Outside Air Data:
   Identification/location
   Design air flow
   Actual air flow
   Design return air flow
   Actual return air flow
   Design outside air flow
   Actual outside air flow
   Outside air temperature

5. Electric Motors:
   Manufacturer
   HP/BHP
   Phase, voltage, amperage; nameplate, actual, no load
   RPM
   Service factor
   Starter size, rating, heater elements

6. V-Belt Drive:
   Identification/location
   Required driven RPM
   Driven sheave, diameter and RPM
   Belt, size and quantity
   Motor sheave, diameter and RPM
   Center to center distance, maximum, minimum, and actual

7. Duct Traverse:
   System zone/branch
   Duct size
   Area
   Design velocity
   Design air flow
   Test velocity
   Test air flow
   Duct static pressure
   Air temperature
   Air correction factor

8. Air Distribution Test Sheet:
   Air terminal number
   Room number/location
   Terminal type
   Terminal size
   Area factor
   Design velocity
   Design air flow
   Test (final) velocity
   Test (final) air flow
   Percent of design air flow

9. Flow Measuring Station:
   Identification/station
   Location
   Size
   Manufacturer
   Model
   Design flow rate
   Design pressure drop
   Actual/final pressure drop
   Actual/final flow rate
   Station calibrated setting

10. Sound Level Report:
    Location
    Octave bands - equipment off
    Octave bands - equipment on

11. Duct Leak Test:
    Description of ductwork under test
    Duct design operating pressure
    Duct test static pressure
    Duct capacity, air flow
    Maximum allowable leakage duct capacity times leak factor
    Test apparatus
    Blower
      Orifice, tube size
      Orifice size
      Calibrated
    Test static pressure
    Test orifice differential pressure
    Leakage

1.7 RECORD DRAWINGS

A. The Specialist shall accurately record actual locations of flow measuring stations on the Record Drawings.

1.8 QUALIFICATIONS

A. The Specialist shall be company specializing in the adjusting and balancing of systems indicated in this Section with minimum one successfully performing project completed within the recent past certified by AABC or NEBB.

1.9 SEQUENCING AND SCHEDULING

A. The Specialist shall:

1. Sequence Work to start after installation of systems and schedule completion of Work before Substantial Completion of Project.

1.10 COORDINATION

A. A conference shall be convened one week before starting Work of this Section.

PART 2 -- PRODUCTS (Not Used)

PART 3 -- EXECUTION

3.1 EXAMINATION

A. The Specialist shall, before starting Work, verify that systems are complete and operable.

B. The Specialist shall ensure the following:

1. Equipment is operable and in safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place; and where required, install temporary filters in addition to final filters.
5. Duct systems are clean of debris.
6. Fan rotation is correct.
7. Dampers are in place and open.
8. Coil fins have been cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage has been minimized.

C. The Specialist shall:

1. Report any defects or deficiencies noted during performance of services to RESIDENT ENGINEER.
2. Promptly report abnormal conditions in mechanical systems or conditions which prevent system balance.
3. If, for design reasons, system cannot be properly balanced, report as soon as observed.

4. Acknowledge in writing that beginning of Work means acceptance of existing conditions.

3.2 PREPARATION

A. The Specialist shall:

1. Provide instruments required for testing, adjusting, and balancing operations; and make instruments available to RESIDENT ENGINEER to facilitate spot checks during testing.

2. Provide additional balancing devices as required.

3.3 INSTALLATION TOLERANCES

A. The Specialist shall:

1. Adjust air handling systems to ± 5% for supply systems and ±10% for return and exhaust systems from quantities indicated.

3.4 ADJUSTING

A. The Specialist shall:

1. Ensure that recorded data represents actually measured, or observed, condition.

2. Permanently mark settings of dampers and other adjustment devices and set and lock memory stops.

3. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

4. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to indicated settings.

5. At final inspection, recheck random selections of data recorded in report; and recheck points or areas as selected and witnessed by the RESIDENT ENGINEER. A maximum of one recheck at two locations will be required.

B. Total system balance shall be performed in accordance with AABC National Standards for Field Measurement and Instrumentation, Total System Balance or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

3.5 AIR SYSTEM PROCEDURE

A. The Specialist shall:

1. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.

2. Make air quantity measurements in ducts by Pitot tube traverse of entire cross section area of duct.

3. Measure air quantities at air inlets and outlets.

4. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

5. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels; and control volume by duct internal devices such as dampers and splitters.

6. Vary total system air and branch air quantities by damper regulation.

7. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

8. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan with allowance for 50% loading of filters.

9. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

10. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

3.6 TESTING, ADJUSTING AND BALANCING SCHEDULE

A. The Work of this Section includes testing, adjusting and balancing as indicated on the Testing, Adjusting and Balancing Schedule.

Testing, Adjusting and Balancing Schedule
System associated with AC-01
System associated with AHU-01

*** END OF SECTION ***

SECTION 16040

ELECTRIC MOTORS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide electric motors, accessories, and appurtenances, complete and operable, in accordance with the Contract Documents. The provisions of this Section apply to all electric motors.

1.2 RELATED SECTIONS

A. The Work of the following Section applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 16050 Basic Electrical Materials and Methods
2. Division 11

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the Work of this Section:

1.	ANSI/NEMA MG 1	Motor and Generator
2.	ANSI/NEMA MG12.53	Motor Testing
3.	ANSI/IEEE 112	Standard Test Procedure for Polyphase Induction Motors and Generators
4.	IEEE 43	Recommended Practice for Testing Resistance of Rotating Machinery
5.	IEEE 841	Recommended Practice for Chemical Industry Severe-Duty Squirrel Cage Induction Motors
6.	IEEE RP-841	Recommended Practice for Chemical Industry Severe Duty Squirrel Cage Induction Motors

1.4 CONTRACTOR SUBMITTALS

A. Shop Drawings and Catalog Data: Submit shop drawings and catalog data submittals in accordance with Section 01300 - Contractor Submittals.

B. Motor Data: Complete motor data shall be submitted in the shop drawings for driven machinery. Motor data shall include:

1. Machine name and specification number of driven machine.

2. Name of the motor manufacturer.

3. Motor type or model and dimension drawing. Include motor weight.

4. Nominal horsepower.

5. NEMA design.

6. Enclosure.

7. Frame size.

8. Winding insulation class and temperature rise class.

9. Voltage, phase and frequency ratings.

10. Service factor.

11. Full load current at rated horsepower for application voltage.

12. Full load speed.

13. Guaranteed minimum full load efficiency. Also provide nominal efficiencies at 1/2, 3/4, and full load.

14. Type of thermal protection or over temperature protection.

15. Wiring diagram for devices such as motor temperature protection, or as applicable.

16. Bearing data, with recommended lubricants for relubricatable type bearings.

17. Power factor at 1/2, 3/4 and full load.

PART 2 -- PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Identical Motors: Electric motors driving identical machines shall be identical.

B. Maximum Motor Loading: Maximum motor loading shall in all cases be equal to nameplate horsepower rating or less, exclusive of service factor and as verified with the approved submittal data of the driven machinery.

C. Minimum Motor Horsepower: All motors shall be sized to carry continuously all loads which may be imposed through their full range of operation. The motor horsepower shall be not less than the estimated minimum specified for each driven machine. If the estimated minimum horsepower specified is not adequate to satisfy the foregoing restrictions or any other requirements of these Specifications, the motor with the required horsepower shall be supplied at no additional cost to the OWNER. In addition, any changes caused by increase in motor horsepower shall be made by the Contractor at no additional cost to the OWNER; such changes may involve circuit breakers, magnetic starters, motor feeder conductors, conduit sizes, etc.

D. Exempt Motors: Motors which are for valve operators, submersible pumps, or motors which are an integral part of standard manufactured equipment, i.e., non-NEMA mounting, common shaft with driven element, part of domestic or commercial use apparatus may be excepted from these Specifications to the extent that such variation reflects a necessary condition of motor service or a requirement of the driven equipment.

2.2 DESIGN REQUIREMENTS

A. General: All electric motors shall comply with ANSI/NEMA MG 1 - Motor and Generator.

B. NEMA Design: Electric motors shall be NEMA Design B, (except as indicated in Equipment Specifications for motors controlled for variable speed operation and other special motors,) constant speed squirrel-cage induction motors having normal starting torque with low starting current. In no case shall starting torque or breakdown torque be less than the value in ANSI/NEMA MG 1. Motors shall be suitable for the starting method indicated on the Electrical Drawings.

C. Motor Voltage Ratings: Motors shall have voltage ratings in accordance with the following, unless otherwise indicated:

1. Motors below 1 ½ hp shall be rated 115 V, single-phase, 60-Hz. Dual voltage motors rated 115/230 V, 115/208 V, or 120-240 V are acceptable, provided all leads are brought out to the conduit box.

2. Motors 1 ½ hp and larger shall be rated 460 V, 3-phase, 60-Hz, as required and as indicated. Dual voltage motors rated 230/460 V or 208/230/460 V are acceptable, provided all loads are brought out to the conduit box.

D. Insulation: All three-phase motors shall be furnished with Class F insulation, rated to operate at a maximum ambient temperature of 104 degrees F and at the altitudes where the motors will be installed and operated, without exceeding Class B temperature rise limits stated in ANSI/NEMA MG 1-12.42. Single phase motors shall have Class F insulation with temperature rise not to exceed the insulation class.

E. Motors in Nonhazardous Areas: Motors 50 hp or smaller located in nonhazardous areas shall be totally enclosed, fan cooled. Motors larger than 50 hp and up to 200 hp located in nonhazardous areas shall be open drip-proof (ODP). Motors larger than 200 hp shall be WP-I or WP-II. All motors shall have a service factor of 1.15.

F. Motors in Hazardous Areas: Motors for use in hazardous areas shall have enclosures suitable for the classification shown on the Drawings. Such motors shall be UL listed and stamped as such.

G. Motors 15 hp and larger shall have space heaters. Space heaters shall be 120 VAC, 100 Watts minimum.

H. High Efficiency Motors:

1. Motors with a nameplate rating of 1 hp and above shall be "high efficiency" units. Motors shall be stamped with the efficiency on the nameplate with the caption "NEMA Nominal Efficiency" or "NEMA Nom. Eff." Such motors shall have efficiencies determined by the test as set forth in ANSI/IEEE 112-Standard Test Procedure for Polyphase Induction Motors and Generators, Method B.

2. Efficiency Index: Efficiency index, nominal efficiency, and minimum efficiency shall be defined in accordance with ANSI/NEMA MG 12.53 - Motor Testing; these values shall be stated in the shop drawing submittal.

3. High efficiency motors shall conform to the guaranteed minimum, full-load efficiency requirement presented in the schedule at the end of this Section.

I. Inverter Duty Motors:

1. Motors for use with adjustable frequency controllers shall be inverter duty motors specifically designed for inverter service for the speed range and load torque characteristic required by the associated driven equipment. Inverter duty motors shall be specifically certified compatible with the adjustable frequency controller and driven equipment, as specified in Section 11000 Unit Responsibility.

2. Motors for use with adjustable frequency controllers shall not exceed NEMA MG 1, Class B temperature rise when operating over the specified speed range on the adjustable frequency controllers specified in Section 11033 with the specified load speed/torque characteristic.

3. Inverter duty rated motors shall have 4:1 turndown with variable torque motor controllers or constant torque motor controllers rating designed to operate from 25% of base speed to base speed continuously with full load current and torque without exceeding the Class F insulation with B temperature rise.

4. Torque requirement for greater turndown and slower speed applications is a custom design; refer to the driven equipment specification for additional requirements. Inverter duty rated motors shall be designed to operate over the speed or frequency range specified.

5. Motor insulation shall be designed to meet 2000-volt peak at a minimum of 0.1 microsecond rise time which exceeds the NEMA MG 1, Part 31: 1600-volt peak requirement for the 460 volt motors.

6. Provide inverter duty motors with NEMA Type 2 over-temperature protection as specified in NEMA MG 1-12. Provide motor mounted and motor powered winding temperature device with a 5-ampere normally open and normally closed output contacts at the motor terminal box for monitoring by the adjustable frequency controller and shutdown where the temperature exceed 165 degree-Centigrade.

7. Inverter duty motors shall have electrically insulated bearings or shall be equipped with a shaft-grounding unit mounted on the fan housing with stub shaft extended from the motor shaft. Larger motors, using the shaft-grounding unit, shall be equipped with two brushes, totally enclosed, and sealed against environmental contamination.

2.3 ACCESSORY REQUIREMENTS

A. General: Horizontal motors 3 hp and larger, and all vertical motors, shall have split-type cast metal conduit boxes. Motors other than open drip-proof shall be gasketed. Motors less than 3 hp shall have the manufacturer's standard conduit boxes.

B. Lifting Devices: All motors weighing 265 pounds or more shall have suitable lifting eyes for installation and removal.

C. Special Requirements: Refer to individual equipment specifications for special requirements such as motor winding thermal protection, multispeed windings, etc.

D. Grounding Lugs: Provide motor grounding lug suitable to terminate ground wire, sized as indicated on the Drawings.

E. Nameplate: All motors shall be fitted with a permanent, stainless steel nameplate indelibly stamped or engraved with NEMA Standard motor data, in conformance with NEMA MG-1-10.40.

F. Power Factor Correction Capacitors: The motor manufacturer shall furnish for installation by the CONTRACTOR power factor correction capacitors for each motor 10 hp and larger, and started with FVNR, FVR, FVNR-AT (auto-transformer) or FVTS (two-speed, high speed winding corrected) starters only. Motors started with solid state starters or VFDs shall not have capacitors. The capacitors shall be fused, with internal resistors, suitably enclosed for mounting adjacent to the starter, MCC, or the motor, and sized to improve power factor to not less than 95% at full load. Size shall be as recommended by the motor manufacturer. The capacitors shall be wired to the motor

starter output terminals. Dielectric fluid shall be non-PCB, biodegradable and non-flammable.

2.4 MOTOR THERMAL PROTECTION

A. Single Phase Motors: All single-phase 120, 208, or 230 V motors shall have integral thermal overload protection or shall be inherently current limited.

B. Thermostats: Motors 250 hp and below shall be provided with snap action, bi-metallic, temperature-actuated switch. Thermostats shall be provided with one normally closed contact. The thermostat switch point shall be precalibrated by the manufacturer.

2.5 MOTOR BEARINGS

A. General: Bearings shall conform to the provisions of Section 11000 - Equipment General Provisions, except as supplemented or modified by the requirements of this Specification.

B. Bearing Life: All motors greater than 2 hp shall have bearings designed for a minimum rated L-10 life of 10 years or 100,000 hours, whichever comes first.

C. Fractional Horsepower: Fractional horsepower through 2-hp motors shall be furnished with Lubricated-for-Life ball bearings.

D. Horizontal Motors Over 2 Horsepower: Motors larger than 2 hp shall be furnished with relubricatable ball bearings.

E. Vertical Motors Over 2 Horsepower: Vertical motors larger than 2 hp shall be furnished with relubricatable ball, spherical, roller, or plate type thrust bearings. Lubrication shall be per manufacturer's recommendation for smooth operation and long life of the bearings.

2.6 MANUFACTURERS

A. The CONTRACTOR's designated equipment supplier shall have the responsibility to select and supply suitable electric motors for the driven equipment. The choice of motor manufacturer shall be subject to review by the RESIDENT ENGINEER. Such review will consider the future availability of replacement parts and compatibility with driven equipment. Acceptable manufacturers include the following, or equal:

1. U.S. Motors.
2. Reliance Electric.
3. Louis Allis (Division of Magnetek, Inc.)
4. Marathon Electric Manufacturing Co.
5. Siemens Energy & Automation, Inc.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Motor installation shall be performed in accordance with the motor manufacturer's written recommendations and the written requirements of the manufacturer of the driven equipment.

B. Electrical work involving connections, controls, switches, and disconnects, shall be as indicated in Division 16.

C. Capacitors shall be connected to the output terminals of the motor starter. Motor overload elements shall be adjusted downwards to reflect the reduction in line current resulting from power factor correction.

3.2 FACTORY TESTING

A. Motors rated 100 hp and larger shall be factory tested in conformance with ANSI/IEEE 112, IEEE 43 - Recommended Practice for Testing Resistance of Rotating Machinery, and NEMA MG-2. Test reports shall include heat run, performance, bearing (temperature, noise), locked rotor, speed torque, no-load saturation, surge, and megohmmeter/dielectric absorption ratio. Test report shall indicate test procedure and instrumentation used to measure and record data. Test report shall be certified by the motor manufacturer's test personnel and be submitted.

3.3 FIELD TESTING

A. The CONTRACTOR shall perform the following field tests:

1. Inspect each motor installation for any deviation from rated voltage, phase or frequency; or improper installation.

2. Visually check for proper phase and ground connections. Verify that multivoltage motors are connected for proper voltage.

3. Check winding and bearing temperature detectors and space heaters for functional operation.

4. Test for proper rotation before connection to the driven equipment.

5. Test insulation (megger test) of all new as well as reused motors in accordance with NEMA MG-1. Test voltage shall be 1000 VAC plus twice the rated voltage of the motor.

High Efficiency Motor Guaranteed Minimum Efficiency Requirements at Full Load

OPEN DRIP-PROOF (ODP)								
	3600 RPM		1800 RPM		1200 RPM		900 RPM	
HP	Nom. Effic.	Min. Effic.	Nom. Effic.	Min. Effic.	Nom. Effic.	Min. Effic.	Nom. Effic.	Min. Effic.
1.0	--	--	82.5	80.0	77.0	74.0	72.0	68.0
1.5	80.0	77.0	82.5	80.0	82.5	80.0	75.5	72.0
2.0	82.5	80.0	82.5	80.0	84.0	81.5	85.5	82.5
3.0	82.5	80.0	86.5	84.0	85.5	82.5	86.5	84.0
5.0	85.5	82.5	86.5	84.0	86.5	84.0	87.5	85.5
7.5	85.5	82.5	88.5	86.5	88.5	86.5	88.5	86.5
10.0	87.5	85.5	88.5	86.5	90.2	88.5	89.5	87.5
15.0	89.5	87.5	90.2	88.5	89.5	87.5	89.5	87.5
20.0	90.2	88.5	91.0	89.5	90.2	88.5	90.2	88.5
25.0	91.0	89.5	91.7	90.2	91.0	89.5	90.2	88.5
30.0	91.0	89.5	91.7	90.2	91.7	90.2	91.0	89.5
40.0	91.7	90.2	92.4	91.0	91.7	90.2	90.2	88.5
50.0	91.7	90.2	92.4	91.0	91.7	90.2	91.7	90.2
60.0	93.0	91.7	93.0	91.7	92.4	91.0	92.4	91.0
75.0	93.0	91.7	93.6	92.4	93.0	91.7	93.6	91.0
100.0	93.0	91.7	93.6	92.4	93.6	92.4	93.6	92.4
125.0	93.0	91.7	93.6	92.4	93.6	92.4	93.6	92.4
150.0	93.6	92.4	94.1	93.0	93.6	92.4	93.6	92.4
200.0	93.6	92.4	94.1	93.0	94.1	93.0	93.6	92.4

TOTALLY ENCLOSED - FAN COOLED (TEFC)								
	3600 RPM		1800 RPM		1200 RPM		900 RPM	
HP	Nom. Effic.	Min. Effic.	Nom. Effic.	Min. Effic.	Nom. Effic.	Min. Effic.	Nom. Effic.	Min. Effic.
1.0	--	--	80.0	77.0	75.5	72.0	72.0	68.0
1.5	78.5	75.5	81.5	78.6	82.5	80.0	75.5	72.0
2.0	81.5	78.5	82.5	80.0	82.5	80.0	82.5	80.0
3.0	82.5	80.0	84.0	81.5	84.0	81.5	81.5	78.5
5.0	85.5	82.5	85.5	82.5	85.5	82.5	84.0	81.5
7.5	85.5	82.5	87.5	85.5	87.5	85.5	85.5	82.5
10.0	87.5	85.5	87.5	85.5	87.5	85.5	87.5	85.5
15.0	87.5	85.5	88.5	86.5	89.5	87.5	88.5	86.5
20.0	88.5	86.5	90.2	88.5	89.5	87.5	89.5	87.5
25.0	89.5	87.5	91.0	89.5	90.2	88.5	89.5	87.5
30.0	89.5	87.5	91.0	89.5	91.0	89.5	90.2	88.5
40.0	90.2	88.5	91.7	90.2	91.7	90.2	90.2	88.5
50.0	90.2	88.5	92.4	91.0	91.7	90.2	91.0	89.5
60.0	91.7	90.2	93.0	91.7	91.7	90.2	91.7	90.2
75.0	92.4	91.0	93.0	91.7	93.0	91.7	93.0	91.7
100.0	93.0	91.7	93.6	92.4	93.0	91.7	93.0	91.7
125.0	93.0	91.7	93.6	92.4	93.0	91.7	93.6	92.4
150.0	93.0	91.7	94.1	93.0	94.1	93.0	93.6	92.4
200.0	94.1	93.0	94.5	93.6	94.1	93.0	94.1	93.0

*** END OF SECTION ***

SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide electrical and appurtenant Work necessary for a complete and operable electrical system, in accordance with the CONSTRUCTION DOCUMENTS.

B. The CONTRACTOR shall make all field connections and terminations to all motors, switchgear, panels, control equipment and devices, instruments, and to all vendor-furnished packaged equipment. The requirements of this Section shall apply to all electrical items indicated in Division 16 unless otherwise indicated.

C. The CONTRACTOR shall provide all materials and incidentals required to complete the electrical work. Typical materials which may be incidentals are terminal lugs not furnished with vendor-supplied equipment, compression connectors for cables, splices, junction and terminal boxes, and all control wires required by vendor-furnished equipment to interconnect with other equipment all specifically indicated on the Contract Documents.

D. All concrete work required for encasement, installation, or construction of the Work specified in Division 16 shall be 3000-psi concrete; provided, that the following exceptions and supplementary requirements shall apply:

1. Consolidation of encasement concrete around duct banks shall be by hand puddling, and no mechanical vibration shall be permitted.

2. A workability admixture shall be used in encasement concrete, which shall be a hydroxylated carboxylic acid type in liquid form. Admixtures containing calcium chloride shall not be used.

3. Concrete for encasement of conduit or duct banks shall contain an integral red-oxide coloring pigment in the proportion of 8 pounds per cubic yard of concrete.

E. The equipment shall meet the seismic requirements in 11000 - Equipment General Provisions.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Codes and Standards:

1. NEC National Electrical Code,

B. Government Standards:

1.	FS W-C-596E/GEN(1)	Connector, Plug, Receptacle and Cable Outlet, Electrical Power
2.	FS W-S-896E/GEN(1)	Switches, Toggle (Toggle and Lode), Flush Mounted (ac)
3.	FS WW-C-563	Electrical Metallic Tubing (EMT)
4.	FS WW-C-581D, E	Conduit, Metal, Rigid, and Intermediate; and Coupling, Elbow, and Nipple, Electrical Conduit: Steel, Zinc Coated

C. Commercial Standards:

1.	ANSI C80.1	Zinc Coated, Rigid Steel Conduit, Specification for
2.	ANSI C80.4	Fittings for Rigid Metal Conduit and Electrical Metallic Tubing, Specifications for
3.	ANSI/UL 467	Grounding and Bonding Equipment, Safety Standard for
4.	ASTM B3	Soft or Annealed Copper Wire
5.	ASTM B8	Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, and Soft
6.	ASTM B33	Specification for Timed Soft or Annealed Cooper Wire for Electrical Purposes
7.	ICEA S-61-402	Thermoplastic - Insulated Wire and Cable
8.	ICEA S-66-524, NEMA WC7	Cross-Linked, Thermosetting, Polyethylene Wire and Cable
9.	ICEA S-68-516, NEMA WC8	Ethylene Propylene Rubber Insulated Wire and Cable
10.	NEMA 250	Enclosures for Electrical Equipment (1,000 volts maximum)
11.	NEMA PB-1	Panelboards
12.	NEMA VE-1	Ventilated Cable Tray
13.	UL 6	Rigid Metal Electrical Conduit

14.	UL 44	Rubber - Insulated Wire and Cable.
15.	UL 514	Electrical Outlet Boxes and Fittings
16.	UL 886	Electrical Outlet Boxes and Fittings for Use in Hazardous Locations
17.	UL 1072	Medium Voltage Cable, Type MV-90

D. All equipment furnished by the CONTRACTOR shall be listed by and shall bear the label of Underwriters' Laboratories, Incorporated (UL), or of an independent testing laboratory acceptable to the local code-enforcement agency having jurisdiction.

E. In addition to other regulatory requirements, the Work of this Section shall comply with the requirements of the current edition of the Standard Specifications for Public Works Construction (SSPWC) Subsection 209-1, together with the latest adopted editions of the Regional and City of San Diego Supplement Amendments.

F. The construction and installation of all electrical equipment and materials shall comply with all applicable provisions of the OSHA Safety and Health Standards (29CFR1910 and 29CFR1926, as applicable), State Building Standards, and applicable local codes and regulations.

1.3 PUBLIC UTILITIES REQUIREMENTS

A. The CONTRACTOR shall contact the San Diego Gas and Electric Company (SDG&E) and verify compliance with their requirements before construction begins.

B. Electrical service shall be provided and paid for by CONTRACTOR as indicated by the Contract Documents.

C. The CONTRACTOR shall verify, furnish, pay for and install all service conduits, fittings, transformer pad, grounding devices, and all service wires not furnished by the serving utility.

D. The CONTRACTOR shall verify with the utility the exact location of each service point and type of service, and shall pay all charges levied by the serving utilities without additional cost to the OWNER.

1.4 PERMITS AND INSPECTION

A. The CONTRACTOR shall obtain SDG&E permits and pay for inspection fees as indicated in the Contract Documents.

B. The CONTRACTOR shall pay for any service charges required by the utility company for connection, disconnections and activation.

1.5 SUBMITTALS

A. Shop Drawings and Catalog Data: The CONTRACTOR shall submit shop drawings and catalog data submittals in accordance with Section 01300 – CONTRACTOR Submittals.

B. Material Lists: The CONTRACTOR shall submit complete material lists for the Work of this Section. Such lists shall state the manufacturer and brand name of each item or class of material. The CONTRACTOR shall submit shop drawings for all grounding work not specifically indicated.

C. Shop Drawing Content: Shop drawings are required for materials and equipment listed in other Sections. Shop drawings shall provide sufficient information to evaluate the suitability of the proposed material or equipment for the intended use, and for compliance with these Specifications. The following shall be included:

1. Front, side, rear elevations and top views with dimensional data.

2. Location of conduit entrances and access plates.

3. Component data.

4. Connection diagrams, terminal numbers, wire numbers, internal wiring diagrams, conductor size, and cable numbers.

5. Method of anchoring, seismic requirement; weight.

6. Types of materials and finish.

7. Nameplates.

8. Temperature limitations, as applicable.

9. Voltage requirement, as applicable.

10. Front and rear access requirements.

D. Catalog Data: Catalog data shall be submitted to supplement all shop drawings. Catalog cuts, bulletins, brochures, or the like or photocopies of applicable pages thereof shall be submitted for mass produced, noncustom manufactured material. These catalog data sheets shall be stamped to indicate the project name, applicable Specification section and paragraph, model number, and options. This information shall be marked in spaces designated for such data in the stamp.

E. Materials and Equipment Schedules: The CONTRACTOR shall furnish within 30 days, a complete list of all materials, equipment, apparatus, and fixtures proposed for use. The list shall include type, sizes, names of manufacturers, catalog numbers, and such other information required to identify the items.

F. Manuals: The CONTRACTOR shall furnish manuals as part of the shop drawing submittals under "Manuals" in Section 01300 – CONTRACTOR Submittals.

G. Record Drawings: In addition to the record drawings as a part of the record drawing requirements the CONTRACTOR shall show depths and routing of all duct bank concealed below grade electrical installations.

1.6 QUALITY ASSURANCE

A. Field Control of Location and Arrangement: The Drawings diagrammatically indicate the desired location and arrangement of outlets, conduit runs, equipment, and other items. The CONTRACTOR shall determine the exact locations in the field based on the physical size and arrangement of equipment, finished elevations, and other obstructions. Locations shown on the Drawings, however, shall be adhered to as closely as possible.

B. Equipment Locations: All conduit and equipment shall be installed in a manner to avoid all obstructions and to preserve head room and keep openings and passageways clear. Lighting fixtures, switches, convenience outlets, and similar items shall be located within finished rooms, as shown. Where the Drawings do not indicate exact locations, such locations shall be obtained from the RESIDENT ENGINEER Where equipment is installed without instruction and must be moved, it shall be moved without additional cost to the OWNER.

C. Workmanship: All materials and equipment shall be installed in accordance with printed recommendations of the manufacturer which have been reviewed by the RESIDENT ENGINEER. The installation shall be accomplished by workmen skilled in this type of work and installation shall be coordinated in the field with other trades so that interferences are avoided.

D. Quality of Work: All Work, including installation, connection, calibration, testing, adjustment, and paint touchup, shall be accomplished by qualified, experienced personnel working under continuous, competent supervision. The completed installation shall display competent work, reflecting adherence to prevailing industrial standards and methods.

E. Protection of Equipment and Materials: The CONTRACTOR shall furnish adequate means for and shall fully protect all finished parts of the materials and equipment against damage from any cause during the progress of the Work and until acceptable by the RESIDENT ENGINEER.

F. Protection: All materials and equipment, both in storage and during construction, shall be covered in such a manner that no finished surfaces will be damaged, marred, or splattered with water, foam, plaster, or paint. All moving parts shall be kept clean and dry.

G. Damaged Materials and Equipment: The CONTRACTOR shall replace or have refinished by the manufacturer, all damaged materials or equipment, including face plates of panels and switchboard sections, at no expense to the OWNER.

H. Tests: The CONTRACTOR shall perform all tests required by the RESIDENT ENGINEER or other authorities having jurisdictions. All such tests shall be performed in the presence of the RESIDENT ENGINEER. The CONTRACTOR shall furnish all necessary testing equipment and pay all costs of tests, including all replacement parts and

labor necessary due to damage resulting from damaged equipment or from test and correction of faulty installation. The following testing shall be accomplished:

1. Testing for the ground resistance value under "Grounding," below.

2. Insulation resistance tests under "Wire and Cable," below.

3. Operational testing of all equipment furnished and/or connected in other Sections of Division 16, including furnishing of support labor for testing.

I. Standard test reports for mass-produced equipment shall be submitted along with the shop drawing for such equipment. Test reports on testing specifically required for individual pieces of equipment shall be submitted for review prior to final acceptance of the project.

J. Any test failure shall be corrected in accordance with the industry practices and in a manner satisfactory to the RESIDENT ENGINEER.

1.7 AREA DESIGNATIONS

A. General: For purposes of delineating electrical enclosure and electrical installation requirements of this project, certain areas have been classified in the Contract Documents as defined below. Electrical installations within these areas shall conform to the referenced code requirements for the area involved.

B. General Purpose Indoor Locations: Electrical work installed in areas which are not otherwise specifically classified shall be "General Purpose." Workmanship and enclosures shall comply with the general requirements of these Specifications. Electrical enclosures shall be NEMA Type 1 and raceway shall be rigid galvanized steel (GRS) conduit unless indicated otherwise elsewhere in this specification.

C. Outdoor and Damp Locations: In outdoor locations, raceway shall be rigid galvanized steel (GRS) conduit; entrances shall be threaded; and fittings shall have gasketed covers. Provisions shall be made to drain the fitting or conduit system. Threaded fastening hardware shall be stainless steel. Raceway supports such as hanger rods, clamps, and brackets shall be stainless steel. Attachments or welded assemblies shall be galvanized after fabrication. Instruments and control cabinets, and panel enclosures shall be NEMA 4X enclosure shall be stainless steel. Switchboard and motor control centers shall be weatherproof NEMA Type 3R. Enclosures shall be mounted 1 inch from walls to provide an air space. Locations which are indoors and 2 feet below grade elevation or which are classified as damp locations on the Drawings shall have electrical installations which conform to the requirements for outdoor locations. "Damp locations" shall include pipe galleries, tunnels, and basements. All rooms housing liquid handling equipment are also classified as damp locations regardless of grade elevation.

D. Splash Locations: Areas shown as splash proof shall have electrical installations as described for "outdoor locations."

E. Corrosive Locations: Corrosive locations shall have stainless steel threaded hardware; all other electrical hardware, fittings, and raceway systems shall be PVC-coated. Raceway supports such as hanger rods, clamps, and brackets shall be stainless steel. Electrical enclosures shall be NEMA Type 4X stainless steel. Corrosive locations shall include meter vaults, and valve structures.

1.8 CLEANUP

A. Cleaning of Materials and Equipment: In addition to the clean-up requirements of Section 01700 - Contract Closeout, all parts of the materials and equipment shall be thoroughly cleaned. Exposed parts shall be thoroughly clean of cement, plaster, and other materials. All oil and grease spots shall be removed with a nonflammable cleaning solvent. Such surfaces shall be carefully wiped and all cracks and corners scraped out. Paint touchup shall be applied to all scratches on panels and cabinets. Electrical cabinets or enclosures shall be vacuum cleaned before final acceptance.

B. Cleaning of the Site: During the progress of the Work, the CONTRACTOR shall clean the premises and leave the premises and all portions of the site free of debris.

1.9 DEMOLITION AND RELATED WORK

A. Demolition Work: The CONTRACTOR shall perform all electrical demolition work as indicated.

1. Electrical equipment and components, terminal and relay cabinets, MCCs, shall be returned to the OWNER in an orderly fashion to a designated location on the site.

2. Wire, conduit, junction boxes, fittings, supports and miscellaneous hardware removed as part of the demolition work shall not be reused and shall be returned to the OWNER.

3. Wires and/or conduits that need to be extended shall be terminated in a new terminal box with terminal strips. Terminal box shall be properly sized by the CONTRACTOR. In outdoor installation, the terminal box shall be NEMA 4X. Wires and terminals shall be properly identified before disconnection and after reconnection.

4. Wiring in conduits located in or under slabs shall be removed. The conduit shall be plugged level with the floor where practical. In other cases, the conduit shall be cut three inches below the finished floor and the area shall be resurfaced.

5. Openings in walls and platforms created by the removal of conduit or electrical equipment shall be patched with materials similar to those in surrounding work areas or as required to provide proper sealed conditions as reviewed and accepted by the RESIDENT ENGINEER.

6. Electrical demolition shall be as shown on the Drawings or as required by the Specifications.

7. The CONTRACTOR shall exercise due care in the removal of the equipment made surplus by this project so as not to impair its resale value or reuse. The OWNER has the right to salvage any wire or other electrical equipment removed from the project.

B. Installation of New Equipment in Existing Structures:

1. Installation of certain new equipment and devices is required in existing structures. For this phase of the Work, the CONTRACTOR shall remove existing equipment or devices, install new equipment as indicated, remove existing conductors from existing raceways, and pull new conductors in existing raceways, reconnect existing conductors or furnish and install new conduit and wires.

2. The CONTRACTOR shall visit the site before bidding and carefully examine existing installation so that its proposal will reflect all the Work necessary to provide a complete installation so that the resulting installation will function as required. Include in the bid price all costs of labor and materials necessary to complete installations.

C. Installation of Temporary Equipment:

1. To facilitate continuous operation of existing equipment, temporary equipment shall be provided where indicated. The CONTRACTOR shall submit installation and connection details for review and acceptance. Temporary installations shall be provided at no additional cost to the OWNER.

2. All cables, conduits, and fittings used in temporary connections shall not be reused to install permanent connections. Salvaged items shall be returned to the OWNER.

D. Plant Monitoring Power and Control Shutdowns:

1. Existing plant operation shall be continued during this demolition and expansion process. The CONTRACTOR shall carefully examine all Work to be done in, on, or adjacent to existing equipment. Work shall be scheduled, subject to the OWNER's approval, to minimize required plant shutdown time. The CONTRACTOR shall submit a written request, including sequence and duration of activities to be performed during plant shutdown.

2. The CONTRACTOR shall perform all switching and safety tagging required for plant shutdown or to isolate existing equipment. In no case shall the Contractor begin any Work in, on, or adjacent to existing equipment without written authorization of the RESIDENT ENGINEER.

E. Modifications to Existing Electrical Facilities:

1. The CONTRACTOR shall provide all modifications or alterations to existing electrical facilities required to successfully install and integrate the new electrical equipment. All modifications to existing equipment, panels, or cabinets shall be made in a professional manner with all coatings repaired to match existing.

Modifications to existing electrical facilities required for a complete and operating system shall be made at no additional cost to the OWNER. Extreme caution shall be exercised in digging trenches in order not to damage existing underground utilities. Cost of repairs of damages caused during construction shall be the CONTRACTOR's responsibility.

2. The CONTRACTOR shall verify all available existing circuit breakers in lighting panels for their intended use as required by the Drawings. At no additional cost to the OWNER, the CONTRACTOR shall verify the available space in substation switchboards to integrate new power circuit breakers.

PART 2 -- PRODUCTS

2.1 GENERAL

A. All equipment and materials shall be new, shall be listed by UL, and shall bear the UL label where UL requirements apply. All equipment and materials shall be the products of experienced and reputable manufacturers in the industry. Similar items in the project shall be products of the same manufacturer. All equipment and materials shall be of industrial grade and standard of construction; shall be of sturdy design and manufacture; and shall be capable of reliable, trouble-free service.

2.2 GROUNDING

A. General: All components of the grounding electrode system shall be manufactured in accordance with UL 467 and shall conform to the applicable requirements of NEC Article 250.

B. Grounding Cable: The System Ground Conductor shall be soft-drawn, bare annealed copper, concentric stranded, as specified. The minimum sizes shall be as follows, where American Wire Gage (AWG) conductor sizes are not shown or specified:

5 kV-480V transformers	2/0 or 4/0 AWG
480V switchgear	2/0 or 4/0 AWG
480V switchboards	2/0 or 4/0 AWG
480V MCC and	2/0 or 4/0 AWG
Lighting & Power panels	2 AWG
Exposed metal cabinets	2 AWG
Electrical equipment	2 AWG
Buildings and enclosure	2 AWG
Motors 25 hp to 250 hp	2 AWG
Motors 1 hp to 25 hp	6 AWG

C. Ground Connections: Ground connections shall be exothermic weld by Cadweld of Erico Products for embedded installation, or Burndy Hyground System using irreversible compression-type connectors for exposed aboveground installation.

1. Manufacturers of grounding materials shall be Copperweld, Blackburn, Burndy, or equal.

2.3 UNDERGROUND DUCTS AND MANHOLES

A. General: Where an underground distribution system is required, it shall be comprised of multiple runs of single bore nonmetallic ducts, concrete encased, with steel reinforcing bars, with underground manholes and pullboxes. When nonmetallic ducts are required, they shall be rigid Schedule 40 PVC for concrete encasement.

1. Manholes and pullboxes shall be of precast concrete. Concrete construction shall be designed for traffic loading.

   a. Covers shall be traffic type, except as shown otherwise. Manholes and pullbox covers designated as "HV" covers shall be identified as "High Voltage Electric," "P" shall be identified as "Secondary Electric," "C" as "Control" and "S" as "Signal." All covers shall be watertight after installation.

   b. Manholes and pullboxes shall be equipped with pulling-in irons opposite and below each ductway entrance.

   c. Manholes shall have concrete covers with 30-inch diameters lids. All covers and lids shall be bolted to cast-in-place frames with corrosion resistant hardware. Frames shall be factory-primed; covers shall be galvanized steel and shall have lifting handles.

2. Manholes and pullboxes shall have cable supports so that each cable is supported at 3-foot intervals within the manhole or pullbox. Cable supports and racks shall be fastened with galvanized bolts and shall be fabricated of fiber glass or galvanized steel. Porcelain insulators for cable racks shall be provided.

3. Manholes and pullboxes shall be Brooks, Quikset, U.S. Precast, or equal.

B. Concrete Envelope: The concrete envelope shall have compression strength of 3000 psi.

2.4 RACEWAYS

A. General: Raceway shall be manufactured in accordance with UL and ANSI standards and shall bear UL label as applicable.

B. Galvanized Rigid Steel (GRS) Conduit:

1. Rigid steel conduits and fittings shall be full weight, mild steel, hot-dip galvanized and zinc bichromate coated inside and outside after galvanizing.

2. Rigid steel conduit shall be manufactured in accordance with UL Standard No. 6 and ANSI C80.1.

3. Rigid steel conduit shall be manufactured by Triangle PWC, Republic Steel, or equal.

C. Rigid Nonmetallic Conduit: Rigid nonmetallic conduit shall be Schedule 40 PVC.

1. Nonmetallic conduits and fittings shall be UL listed, sunlight-resistant, and rated for use with 90 degrees C conductors.

2. Nonmetallic conduits and fittings shall be manufactured by Carlon, Condux, or equal.

D. Electrical Metallic Tubing: Not allowed.

E. Flexible Metallic Conduit: Flexible metallic conduit shall be fabricated from galvanized interlocked steel strip. Liquid-tight flexible metallic conduit shall have extruded PVC covering over the flexible steel conduit. For conduit sizes 3/4 inch through 1-1/4 inches, flexible conduits shall have continuous built-in copper ground conductor. Flexible conduit shall be American Brass, Anaconda, Electroflex, or equal. Explosion-proof flexible conduits shall be used for Class I, Div. 1, Group C&D areas.

F. PVC-Coated Raceway: PVC-coated raceway system shall conform to Federal Specification WW-C-581E, ANSI C80.1, and to UL specifications.

1. The zinc surfaces of the conduits and fittings shall remain intact and undisturbed on both the inside and the outside of the conduit through the preparation and application processing.

2. A PVC coating shall be bonded to the galvanized outer surface of the conduit. The bond between the PVC coating and the conduit surface shall be greater than the tensile strength of the plastic.

3. The thickness of the PVC coating shall be a minimum of 40 mils.

4. A PVC jacketed coupling shall be furnished with each length of conduit. A PVC sleeve equal to the OD of the conduit shall extend 1-1/2 inches from each end of coupling.

5. PVC-coated conduits shall be as manufactured by Robroy, Occidental (OCCAL), or equal.

2.5 WIRE AND CABLE

A. General: All conductors, including ground conductors, shall be copper. Insulation shall bear UL label and the manufacturer's trademark, type, voltage and temperature rating, and conductor size. Wire and cable shall be products of American, Rome Cable, Okonite, Houston, or equal.

B. Control Cables: All control cables shall be rated for 600 V and shall meet the following requirements:

1. Control wires shall consist of No. 14 gage stranded copper conductors and shall be XHHW rated for 90 degrees C at dry locations and 75 degrees C at wet locations.

2. Control wires at panels and cabinets shall be machine tool grade type MTW, UL approved, rated for 90 degrees C at dry locations.

3. Multiconductor control cable shall be rated at 600 V and shall consist of No. 14 gauge stranded copper conductors, individually insulated with a minimum of 20 mils of polyethylene, 10 mils full color coded PVC jacket over each insulated conductor, a polyester tape over assembly, and an overall PVC jacket. Multiconductor cable shall be identified by either ICEA color coding or ink imprinting. Multiconductor cables may be used in conduits or cable trays as required by the Drawings. Multipull taped control conductor assemblies may be used in conduits as approved by the RESIDENT ENGINEER.

C. Instrumentation Cables: Shielded instrumentation cables shall be rated at 600 V and shall comply with the following requirements:

1. Individual shielded cable shall consist of twisted 2 or 3 No. 16 gauge, stranded, color coded, tinned-coated copper in accordance with ASTM B 33 - Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes and B 8 - Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, and Soft. Color coding shall be black-clear, or black-red-clear.

2. Insulation thickness shall be 32 mils of polyethylene, insulated with 2.3 mils 100% aluminum foil/polyester shield and No. 18 stranded tinned copper drain wire, all under a 32 mil PVC jacket. The shield shall be continuous and shall be grounded only at the receiving end, or as indicated.

3. Multi-individual shielded pair or triad instrumentation cable shall consist of individual shielded and twisted pair copper conductors with ethylene-propylene insulation, and No. 18 AWG tinned stranded copper drain wire, an overall aluminum mylar shield and an overall chloro-sulfonated polyethylene compound jacket. The cables shall be suitable for cable tray installation and shall be flame retardant.

4. Thermocouple Extension: Extension cable shall be provided for the type of thermocouple circuit indicated. Conductors shall be 16 AWG, solid allow, with 15 mils of 90 degree C flame-retardant polyvinylchloride insulation, twisted and covered with 100% 2.35 mil aluminum polyester tape and a 20 AWG, 7-strand, tinned-copper drain wire and a 35 mil, flame-retardant PVC jacket overall. Cable shall be listed for cable tray installation.

D. Building Wire and Cable: Building wires and cables shall be rated at 600 V and shall meet the following requirements:

1. Building wire shall be single conductor copper cable listed by UL as Type THHN/THWN rated 75 degrees C in wet locations and 90 degrees C in dry locations.

2. Building wire No. 8 AWG and larger shall be stranded; size No. 10 AWG and smaller shall be solid or stranded.

3. No wire smaller than No. 12 AWG shall be used unless specifically indicated.

E. Portable (Welding) Generator Cable: Not used.

F. Portable (SOOW) Generator Auxiliary Cable: Not used.

G. Cable Terminations: Cable terminations shall be in accordance with the following:

1. Compression connectors shall be Burndy "Hi Lug", Thomas & Betts "Shure Stake", or equal. Threaded connectors shall be split bolt type of high strength copper alloy.

2. Spring connectors (wire nuts) shall be 3M "Scotch Lok," "Ideal Wing Nuts", or equal.

3. Preinsulated fork tongue lugs shall be "Thomas & Betts" RC Series, Burndy, or equal.

4. General purpose insulating tape shall be Scotch No. 33, Plymouth "Slip-knot", or equal. High temperature tape shall be polyvinyl by Plymouth, 3M, or equal.

5. Epoxy resin splicing kits shall be 3M Scotchcoat 82 Series, Burndy Hy Seal, or equal.

2.6 PULL AND JUNCTION BOXES

A. General: Outlet, switch, pull and junction boxes for flush-mounting in general purpose locations shall be one-piece, galvanized, pressed steel. Ceiling boxes for flush-mounting in concrete shall be galvanized, pressed steel.

B. Surface Mounted Boxes: Outlet, switch, pull and junction boxes where surface mounted in exposed locations shall be cast ferrous boxes with mounting lugs, zinc or cadmium plating, and enamel finish. Surface mounted boxes in concealed locations may be pressed steel.

C. Corrosive Locations: Control station, pull and junction boxes, including covers, for installation in corrosive locations shall meet the NEMA 4X requirements and shall be stainless steel or fiber glass-reinforced polyester and shall be furnished with mounting lugs.

D. Cast and Pressed Steel Boxes: All cast boxes and pressed steel boxes for flush mounting in concrete shall be fitted with cast, malleable box covers and gaskets. Covers for pressed steel boxes shall be one-piece pressed steel, cadmium plated, except that boxes for installation in plastered areas and finished rooms shall be stainless steel over plaster rings. Stainless steel plates shall be Sierra S-line, Hubbell, or equal. Cast boxes shall be as manufactured by Crouse-Hinds, Appleton, or equal.

2.7 CONDUIT FITTINGS

A. General: Fittings shall comply with the same requirements as the raceway with which they will be used. Fittings having a volume less than 100 cubic inches for use with rigid steel conduit shall be cast or malleable nonferrous metal. Such fittings larger than one inch shall be "mogul size." Fittings shall be of the gland ring compression type.

Covers of fittings, unless in "dry" locations, shall be closed with gaskets. Surface-mounted cast fittings, housing wiring devices in outdoor and damp locations, shall have mounting lugs.

B. Insulated Bushings: Insulated bushings shall be molded plastic or malleable iron with insulating ring, similar to O-Z Type A and B, equivalent types by Thomas & Betts, Steel City, Appleton, O-Z/Gedney, or equal.

C. Insulated Grounding Bushings: Insulated grounding bushings shall be malleable iron with insulating ring and with ground lug, such as O-Z Type BL, equivalent types by T & B, Steel City, O-Z/Gedney, or equal.

D. Erickson Couplings: Erickson couplings shall be used at all points of union between ends of rigid steel conduits which cannot be coupled. Running threads and threadless couplings shall not be used. Couplings shall be 3-piece type such as Appleton Type EC, equivalent types such as manufactured by T & B, Steel City, O-Z/Gedney, or equal.

E. Liquid-Tight Fittings: Liquid-tight fittings shall be similar to Appleton Type ST, equivalent types such as manufactured by Crouse-Hinds, T & B, O-Z/Gedney, or equal.

F. Hubs: Hubs for threaded attachment of steel conduit to sheet metal enclosures, where required, shall be similar to Appleton Type HUB, equivalent types such as manufactured by T & B, Myers Scrutite, or equal.

G. Transition Fittings: Transition fittings to mate steel to PVC conduit, and PVC access fitting, shall be as furnished or recommended by the manufacturer of the PVC conduit.

H. Sealed Fittings: Sealing fittings are required in conduit runs entering corrosive areas and elsewhere as shown. Sealing fittings shall be Appleton Type EYS, O-Z Type FSK, or equal. Sealing compound shall not be poured in place until electrical installation has been otherwise accepted.

I. Expansion Fittings: Expansion fittings shall be installed wherever a raceway crosses a structural expansion joint. Such fittings shall be expansion and deflection type and shall accommodate lateral and transverse movement. Fittings shall be O-Z/Gedney Type "DX," Crouse Hinds "XD," or equal. These fittings are required in metallic and nonmetallic raceway installations. When the installation is in a nonmetallic run, a 3-foot length of rigid conduit shall be used to connect the nonmetallic conduit to the fitting.

2.8 WIRING DEVICES

A. General: All wiring devices shall be a product of a single manufacturer and shall conform to applicable NEMA Standards for UO series. Devices shall be as manufactured by Hubbell, Sierra, Pass & Seymour, or equal. General purpose duplex receptacles and toggle switch handles shall be brown everywhere except in finished rooms, where they shall be ivory. Special purpose receptacles shall have a body color as shown. Receptacles and switches shall conform to Federal Specifications W-C-596E and W-S-896E, respectively.

1. Receptacles:

a. General purpose duplex receptacles shall be grounding type, 125-volt, ac, 20-amperes, NEMA Configuration 5-20R, such as Hubbell 5252, or equal.

b. Convenience receptacles for installation in outdoor and corrosive areas shall be NEMA 5-20R configured and shall have stainless steel or nickel plated parts and plastic parts of melamine.

(1) Receptacles at outdoor locations shall be UL-approved for weatherproof locations with plug inserted. These shall be Crouse-Hinds, Hubbell, Pin and Sleeve Series, or equal.

(2) Receptacles at damp or dry locations shall be Crouse-Hinds DS 23G, Pyle National N-1, or equal.

(3) Receptacles at corrosive locations shall be Hubbell 52CM62 15 A, 53CM62 20 A, or equal.

c. Ground fault interrupter (GFI) receptacles shall be NEMA 5-20R configured and shall mount in a standard outlet box. Units shall trip at 5 mA of ground current and shall comply with NEMA WD-1-1.10 and UL 943. GFI receptacles shall be capable of individual as well as "downstream" operation. GFI receptacles shall be Hubbell GF 5252, or equal.

d. The 240-V duplex receptacles shall be 2-pole, 3-wire, grounding type, 250-VAC, 20-A, NEMA Configuration 6-20R, such as Hubbell 5462 gray, or equal.

e. Single 30-A receptacles shall be 2-pole, 3-wire, grounding type, 125-VAC, 30-A, NEMA Configuration 5-30R, such as Hubbell 9308, or equal.

f. All 480-V, 60-A, 3-phase receptacle outlets shall be 60-A, 3-wire, 4-pole, 600-V, weatherproof with spring door, such as Crouse-Hinds Catalog No. AREA 6424, Hubbell Hubbellock No. 26410 for receptacle and No. 26419 for plug, or equal. One matching plug shall be furnished loose.

g. All 480-V, 30-A, 3-phase receptacle outlets shall be 30-A, 3-wire, 4-pole, 600-V, weatherproof with spring door such as Crouse-Hinds Catalog No. AREA 3423, Bryant Cat. 7223FR, Russell Stoll No. JRFA6344, Hubbell No. 22CM427 for receptacle and No. 21CM4158 for plug, or equal. One matching plug shall be furnished loose.

2. Switches:

a. Switches at outdoor locations shall be Crouse-Hinds DS 128, Mackworth Rees Style 3845, Joy Flexitite, or equal.

b. Switches at damp locations shall be Mackworth Rees Style 3496, Joy Flexitite, or equal.

c. Switches at dry locations shall be Crouse-Hinds DS 32G, Pyle National SCT-10k, or equal.

d. Toggle switches shall conform to the following table, or equal:

	Hubbell No.	Bryant No.	Hubbell No.	Bryant No.
Single Pole	1221 (brown)	4901 (brown)	1221I (ivory)	4901I (ivory)
Three Way	1223	4903	1223I	4903I
Momentary	1556	4821	1556I	4821I
Four Way	1224		1224I	

2.9 CABINETS AND ENCLOSURES

A. General: All electrical cabinets and enclosures housing control relays and terminal blocks shall be manufactured in accordance with NEMA Publications 250, UL Standards 50 and 508.

1. Relay or control, and terminal cabinets shall be NEMA 4X stainless steel enclosures. Sizes shown on the Drawings are minimum. Provide sufficient terminal blocks to terminate 25% more conductors than are shown. Interiors of cabinets shall be finished white including internal back mounting plate.

2. Floor standing NEMA 4X enclosures shall be Type 304 stainless steel, 12-gauge, with oil-resistant door gaskets, stainless steel screws and clamps on the three sides of the door. Wall-mounted type construction shall be 14 gauge, Type 304 stainless steel.

B. Wiring of Cabinets: Wiring of terminal cabinets, control or relay cabinets shall be accomplished with stranded copper conductor rated for 600 V and UL listed as Type MTW. Wires for annunciator and indication circuits shall be No. 16 AWG. All others shall be No. 14 AWG. Color coding shall be as specified elsewhere in this Section. Incoming wires to terminal or relay cabinets shall be terminated on a master set of terminal blocks. All wiring from the master terminals to internal components shall be factory-installed and shall be contained plastic wireways having removable covers. Wiring to door-mounted devices shall be extra flexible and anchored to doors using wire anchors cemented in place. Exposed terminals of door-mounted devices shall be guarded to prevent accidental personnel contact with energized terminals.

C. Terminal Blocks: All terminal block requirements shall be as manufactured by WAGO with cage clamp, Phoenix, or equal.

D. Nameplates: Nameplate engraving shall be as shown or as directed by the RESIDENT ENGINEER. Characters shall be uniform block style not smaller than 1/8-inch. Nameplates shall be secured using cadmium plated steel or other corrosion resistant screws. Adhesive alone is not acceptable.

E. Testing: Each relay or control and terminal cabinets shall be completed, assembled, wired, and tested at the factory. Test shall be in accordance with the latest UL and NEMA Standards. All cabinets shall bear UL label, as applicable.

2.81 DISCONNECT SWITCHES

A. Disconnect Switches: Unfused disconnect switches shall be externally operated with quick-make/quick-break mechanisms. The handle shall be interlocked with the switch cover by means of a defeatable interlock device. The switch shall be padlockable in the "off" position. Switches shall have nameplates stating manufacturer, rating, and catalog number. Heavy-duty switches shall have arc suppressors, pin hinges, and shall be horsepower rated at 600 V. All switches rated at 50 A or larger shall have auxiliary contact for remote status indication. Heavy-duty switches shall be provided for all motor circuits above 3 horsepower. In smaller motor circuits switches shall be general duty.

Fused disconnect switches where indicated shall be provided with fuses UL Class RK-1 with time delay, bussmann type LPS-RK, Shawmut Type A6D-R, or equal. Fused switches shall be UL listed for application to a system having an available short circuit current 65,000amps rms symmetrical. Provide fuse mountings that reject Class H fuses and accept only the currnt-limiting fuss specified. Fused disconnect switches shall have the same reqquirements as unfused disconect switches.

B. Ratings: Switch rating shall match the horsepower requirements of the load at the particular voltage if not otherwise shown.

C. Enclosures: Switch enclosure shall be NEMA 4X Type 304 stainless steel, and shall be as manufactured by Square D, Westinghouse, or equal.

2.92 ELECTRICAL IDENTIFICATION

A. Nameplates: Nameplates shall be fabricated from white-letter, black-face laminated plastic engraving stock, Formica type ES-1, or equal. Each shall be fastened securely, using fasteners of brass, cadmium plated steel, or stainless steel, screwed into inserts or tapped holes, as required. Engraved characters shall be block style of adequate size to be read easily at a distance of 6 feet with no characters smaller than 1/8-inch high.

B. Conductor and Equipment Identification: Conductor and equipment identification devices shall be either imprinted plastic-coated cloth marking devices such as manufactured by Brady, Thomas & Betts, or equal, or shall be heat-shrink plastic tubing, imprinted split-sleeve markers cemented in place, or equal.

C. Identification Tape: Identification tape for protection of buried electrical installation shall be a 6-inch wide red polyethylene tape imprinted "CAUTION - ELECTRIC UTILITIES BELOW."

2.103 LIGHTING AND POWER PANELBOARDS

A. General: Panelboards shall be dead front factory assembled. Panelboards shall comply with NEMA PB-1 as well as the provisions of UL 50 and 67. Panelboards used for service equipment shall be UL labeled for such use. Lighting panelboards shall be rated for 120/208-V 3-phase operation or 120/240-V for single phase operation as shown.

1. Interiors shall have solderless, anti-turn connectors and shall be constructed so that branch circuit breaker can be replaced without disturbing adjacent units or resorting to field drilling and tapping. Bus bars and connecting drops shall be copper. Neutral bar shall be full-sized and shall have one terminal screw for each branch circuit; main bus bar shall be full-sized for entire length. Spaces shown shall have cross connections for the maximum sized device that can be fitted.

2. Panelboard box shall be galvanized code grade steel with knockouts, and shall have removable end walls. All boxes or panelboard enclosures shall have gray baked enamel finish.

B. Lighting Panelboards:

1. Cabinets for building panels shall be 20-inch wide minimum, with 4-inch minimum side gutters and 5-inch minimum top and bottom gutters. Panelboard trim shall be the same size as cabinet on surface-mounted panels and 3/4-inch larger all around than cabinet of flush-mounted panels. Doors in trim shall have typed circuit directory and pocket with protective clear plastic sheet. All trim and cabinets of surface-mounted panels in general purpose areas shall be phosphate treated, primed and finished with baked enamel, panels of flush mounted panels shall be finished to match surrounding wall color.

2. The number of circuit breakers and the ampere ratings shall be in accordance with panel schedules. Main circuit breaker shall be provided as indicated. The panelboard circuit breakers shall be group mounted and shall be molded case with 3- or 2-pole main breakers as required and branch circuit breakers with 10,000 AIC. Circuit breakers shall be thermal/magnetic type.

3. Surface mounted cabinets and trim in wet and damp areas shall be galvanized. Panelboards in corrosive areas shall be housed in NEMA 4X, stainless steel cabinet. Provide control enclosures under common panel trim. All panelboard doors shall be keyed alike.

C. Panelboards shall be as manufactured by Square D, Cutler-Hammer, Siemens, or equal.

2.14 PROCESS CONTROL DEVICES

A. Limit Switches:

1. Limit switches shall be of heavy-duty, precision type, and oil-tight assembly. Enclosures shall be NEMA 4X. Contact arrangement shall be single pole. Assembly shall be able to accommodate different type of head as required.

2. Limit switches shall be Square D Class 9007 Type C, or equal.

2.15 CONTROL STATIONS

A. General: Control stations shall comply with NEMA Standards ICS2-216. All control stations shall be industrial type, heavy duty, oil-tight, with legend plates.

B. Requirements: Control stations shall be as follows:

1. Pushbutton Switch: Pushbutton switches shall be momentary type with round or square button plate. All emergency-stop pushbuttons shall have red button plates. Lock-out stop shall be momentary pushbutton with locking mechanism.

2. Selector Switches: Selector switches shall be rated 10 A at 600 V and shall be rotary type with number of position and poles as indicated.

3. Indicating Lights: Pilot lights shall be full-voltage, push to test type and with plastic color caps: red color for running, green for ready, and amber for failure status.

4. Control station enclosures shall be die cast aluminum, NEMA Type 1 in general purpose area and Type 304 stainless steel, NEMA 4X in corrosive or outdoor or wet areas.

5. Manufacturers: Manufacturers shall be Square D Class 9001, Allen-Bradley Bulletin 800, or equal.

2.16 TIME CLOCKS

A. Time clocks shall be commercial electric sealed synchronous motor type, 12 inch round dial, and shall be suitable for one minute subdivisions, a manual reset button, and a recessed black box with three pole receptacle. Time clock shall be Simplex Time Record Co. type 78-45 or Edwards Co Cat. 1882B.

2.17 TRANSFORMERS

A. General: All indoor transformers shall be dry-type, copper windings, and shall conform to or exceed the requirements of the latest applicable IEEE, NEMA and ANSI standards. Transformers rated 3 kVA and below shall be insulated with 80 degree C insulation; 5 to 30 kVA transformers shall be insulated with 115 degree C insulation.

B. Transformers Rated 15 kVA and Above: Transformers rated 15 kVA and above shall have four 2-1/2 percent taps, two above and two below 480 V. Transformers rated 15 kVA and above shall be floor or wall mounted type as required and manufactured by Westinghouse, Square D, or equal.

PART 3 – EXECUTION (not used)

*** END OF SECTION ***

SECTION 16200

ENGINE GENERATOR

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The Work of this Section includes providing one complete engine-generator unit(s) mounted on a structural steel base, an attached to a monolithic concrete foundation block by means of four or more spring vibration isolators. This unit includes, but is not limited to, a diesel engine, generator frame-mounted generator control panel, starting and control equipment, radiator, fan, exhaust system, exhaust piping, intake air cleaner and piping, oil pumps, lubricating oil, air intake system and engine jacket water heater, and all other parts, instruments, and auxiliary equipment necessary to make a complete unit. The engine-generator shall be a heavy-duty, industrial type, suitable for a standby operation in the event of a utility outage under the conditions indicated, electric motor started, with engine-mounted radiator. The generator shall be a revolving field, brushless, synchronous type. The engine shall be started and stopped in both manual and automatic modes by means of control signals from the ATS. The engine-generator, piping, and all accessories shall be coated with the manufacturer's standard finish. The engine-generator manufacturer shall provide a base-frame tank fuel storage, Diesel Fuel Storage System. The engine-generator shall be equipped with a sound attenuating enclosure which meets the requirements of local and regional noise regulations.

B. The expected minimum ambient temperature at the project site is 30 degrees F and the expected maximum ambient temperature is 100 degrees F. The altitude of the project site is 513 feet. Relative humidity is 0 to 95 percent.

C. The design and enclosure layout was based on an engine-generator manufactured by Caterpillar and therefore all pipe routing connections, trench location and positions of other engine accessories may not be identical to units from other manufacturers. If the substitution of equipment is approved by the RESIDENT ENGINEER, the CONTRACTOR shall be responsible for all modifications required to complete the installation specified herein and without additional cost to the OWNER.

D. The Work also requires that one single manufacturer be made responsible for furnishing the Work of this Section but without altering or modifying the CONTRACTOR's responsibilities under the Contract Documents. The CONTRACTOR shall furnish a written, notarized certification signed by an officer of the manufacturing corporation, stating that the unloading, installation, testing, and inspection of the materials of all major equipment components and instrumentation meet or exceed the values indicated herein and in the referenced standards.

E. All equipment shall be new equipment and of the current production of the manufacturer. All materials and parts shall be new and unused.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 05500 Miscellaneous Metals
2. Section 09800 Protective Coating
3. Section 11000 Equipment General Provisions
4. Section 16050 Basic Electrical Materials and Methods
5. Section 16400 Low Voltage Electrical Service and Distribution
6. Section 16485 Local Control Panels
7. Section 16926 Automatic Transfer Switches

1.3 REFERENCE SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the Work of this Section:

1.	NEMA MG-1	National Electrical Manufacturers Associations Standards Publication No. MG-1, Motors and Generators
2.	API Standard 670	Vibration, Axial-Position and Bearing-Temperature Monitoring Systems
3.	ASME 606	Speed Governing of Internal Combustion Engine-Generator Units
4.	ASME PTC 17	American Society of Mechanical Engineers, Reciprocating Internal Combustion Engines Performance Test Codes
5.	NEC	National Electrical Code
6.	NFPA 37	National Fire Protection Association Standard 37, Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines
7.	NFPA 110	Emergency and Standby Power Systems
8.	NFPA 211	Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances
9.	SAE J431	Society of Automotive Engineers; Automotive Gray Iron Casting
10.	SAE J435C	Society of Automotive Engineers; Automotive Steel Castings

11.	SAE J438B	Society of Automotive Engineers; Tool and Die Steels
12.	UL 103	Underwriters Laboratory: Factory-Built Chimneys for Residential Type and Building Heating Appliances

1.4 CONTRACTOR SUBMITTALS

A. All of the material required for submittal under this Section shall be furnished in one complete package. The package shall be submitted in accordance with Section 01300 - Contractor Submittals. The CONTRACTOR shall submit the proposed factory testing program to the RESIDENT ENGINEER for review and comment at least 60 days before testing is scheduled to begin. The CONTRACTOR shall submit shop drawings, earthquake design data, test reports, manufacturers' certified reports, technical data, and tool and accessories to the extent required in this Section. In addition to the items required in Section 11000 - Equipment General Provisions, submittal data shall be required as follows:

1. General:

a. An affidavit attesting to the identity of the supplier having unit responsibility, as indicated above.

b. Outline installation drawings (plans and sections) for complete engine-generator set showing the location, size and other pertinent details of each piping, electrical and monitoring connection.

c. Detailed factory brochures of the complete emergency generator set including factory published specification sheets and catalog cut sheets.

d. Details of plans for shipment of the equipment to the project site.

e. Weight of complete unit.

f. Weight of heaviest part.

g. Foundation plan with anchor bolt details and dimensions.

h. Spring-type engine-generator unit vibration isolators with seismic restraints.

i. Torsional analysis

j. Exhaust emission analysis for the engine-generator set to satisfy air pollution control requirements.

k. Vibration isolators for accessories.

l. All flexible connectors.

m. Piping, cooling air and exhaust connections.

n. Exhaust silencer.

o. Electrical starting system, including batteries and battery rack.

p. Fuel gas system, including controls and automatic switch-over.

q. Legends for all devices on all diagrams.

r. Nameplate data including the nameplate material, heights of letters, inscriptions and method of mounting.

s. A certified performance rating from the engine-generator manufacturer with the engine-generator set equipped with all auxiliary equipment as specified and needed and operating on the specified diesel fuel. The certified performance rating shall be at 80° F ambient air temperature, .08 power factor, project site evaluation and other conditions, and shall include certified maximum noise level readings under full rated load at points three (3) feet and fifty (50) feet from the unit.

t. Information on at least one successfully performing engine-generator unit of comparable size and complexity constructed in the recent past with names, telephone numbers, and addresses of owners.

u. Jacket water heater connection diagram.

2. Engine:

a. Torque, brake horsepower and fuel consumption curves for the indicated conditions and various loads.

b. Engine weight.

c. Complete fuel piping schematics showing the relative position of all valving and appurtenances.

d. Details of governing system.

e. Catalog data.

f. Ventilation and combustion air CFM requirements.

3. Generator:

a. Weight.

b. Stator and field ratings including temperature rise at full and overload conditions.

c. Complete description of insulation system.

d. Complete wiring diagrams for the generator, engine control system, voltage regulation and excitation systems, showing wiring and terminal identification systems.

e. Generator impedances: Xd, Xq, Xd', Xd", X2, Xo, Xp, ra, r1, r2

f. Generator current decrement curve.

g. Generator motor starting capability.

h. Generator thermal damage curve.

i. Catalog data.

4. Control Panel and Automatic Controls:

a. Panel enclosure layout drawings.

b. Complete step-by-step functional description of the operation of each control circuit.

c. Complete elementary, connection and circuit diagrams, including interconnection wiring diagrams for all equipment, and automatic system logic diagram.

d. Conduit stubout locations.

e. Complete catalog information of all parts and components of electrical equipment.

B. Earthquake Design Data. Submit with the shop drawings complete seismic calculations, details of construction, and method of attachment for generator set mounting to base and for anchor bolts for anchoring base to concrete slab showing compliance with paragraph 2.12 herein. The calculations and details shall be signed by a Professional Engineer who has demonstrated proficiency in Structural Engineering or Civil Engineering and is registered in the State of California.

1.5 OPERATIONS AND MAINTENANCE INFORMATION

A. The following shall be submitted in compliance with Section 01730 - Operations and Maintenance Information:

1. Operation and maintenance information as indicated for each separate subassembly and separately furnished item of equipment provided under this Section. Information on the following items shall be specific to the entire engine generator furnished under this Section: startup, operating, shut down, short and long-term inactivation, and preventive maintenance procedures; lubricant list with recommended lubrication intervals; spare parts list; tool list; and overhaul instructions.

2. Copies of all factory engine tests, in quintuplicate, certified by an officer of the manufacturing corporation.

3. Copies of all generator test documentation, in quintuplicate, certified as above.

4. Point-to-point wiring diagrams for all controls.

5. Details of the engine starting system, including electrical schematics.

1.6 TOOLS AND ACCESSORIES

A. The CONTRACTOR shall furnish and deliver all special tools, instruments, accessories, and special lifting and handling devices shown in the approved instruction manuals. Unless otherwise specified or directed by the OWNER, the items shall be delivered to the OWNER, with written transmittal accompanying each shipment, in the manufacturers' original container labeled to describe the contents and the equipment for which it is furnished. The CONTRACTOR shall deliver a copy of each transmittal to the OWNER for record purposes.

1.7 REGULATORY REQUIREMENTS

A. The engine shall be specifically designed to minimize the discharge of gaseous pollutants to the atmosphere and meet all of the County of San Diego Air Pollution Control District (APCD) standards.

B. Permitting: The CONTRACTOR shall be responsible for obtaining all permits to operate the diesel generator including the APCD. The CONTRACTOR shall obtain the latest requirements and supply equipment that will meet these requirements. The CONTRACTOR shall ensure that any and all required testing is done that is necessary to acquire the permits. The OWNER will pay for all permit fees. The manufacturer shall furnish a certificate attesting to the fact that the unit furnished will be in compliance with requirements of the APCD. Fuel control system shall be specifically designed to operate on diesel gas.

C. Noise Control:

1. Engine-generator shall comply with CAL-OSHA and US-OSHA regulations in effect at the time of the award of this contract for a two (2) hour continuous exposure when using ear protection.

2. The CONTRACTOR shall provide suitable silencers, acoustical treatment of the equipment, acoustical louvers, weather proof acoustical enclosures, and other equipment and/or materials to not exceed the specified sound pressure level of 55dBA when measured at a distnace of 30 feet from the enclosure at no additional cost to the City.

1.8 SERVICES OF MANUFACTURER

A. Inspection, Startup, and Field Adjustments: An authorized service representative of the manufacturer shall visit the site for not less than 4 days provided in three site visits and shall witness the following:

1. Unloading and placement.
2. Installation.
3. Inspection, checking and adjusting.
4. Startup and field testing for proper operation.

B. Instruction of OWNER's Personnel: At no additional cost to the OWNER, the manufacturer's authorized representative shall instruct the OWNER's personnel in the operation and maintenance of the system including step-by-step troubleshooting procedures with necessary test equipment for not less than 4 days. In addition, the OWNER's personnel will be present during field testing and shall receive instruction on the startup and testing procedure. The CONTRACTOR shall give the OWNER written notice of the proposed field testing period at least two weeks prior to the commencement of field testing.

C. The manufacturer shall submit a written training program to the RESIDENT ENGINEER for approval. Training shall include 8 hours of classroom time instruction and 4 hours of equipment-demonstration time. Training shall not start until 30 days after written approval by the RESIDENT ENGINEER. A minimum of 5 trainees of each respective trade shall receive a training manual specific to their trade, as follows:

1. Mechanics
2. Electricians
3. Instrument Machinery
4. Operators

D. The training manuals will be retained by the trainees and will not be returned to the manufacturer.

E. Manufacturer's Certified Reports: The manufacturer or its authorized representative shall submit a notarized written report certifying that: (1) the equipment was properly installed, wired and connected, (2) the equipment is in accurate alignment, (3) the manufacturer or its authorized representative was present when the equipment was placed in operation, (4) the manufacturer or its authorized representative checked, inspected and adjusted the equipment as necessary, (5) the equipment was operated under full load conditions and operated satisfactorily, (6) the exhaust emission and noise level is in compliance with applicable regulations, and (7) the equipment is fully covered under the terms of the warranty.

F. Service: Maintain a service center capable of emergency maintenance and repair at the project site within eight hours maximum response time.

1.9 FACTORY TESTING

A. The CONTRACTOR shall be responsible for all costs associated with inspection and testing of materials, products, or equipment at the place of manufacture. This shall include costs for travel, meals, lodging, and car rental for one OWNER-designated inspectors for 1 day required to complete such inspections or observations exclusive of travel days, if the place of manufacture, fabrication and factory testing is more than 50 miles outside the geographical limit of the City. The CONTRACTOR shall not be responsible for salary or salary-related costs of the inspectors. The CONTRACTOR shall comply with the requirements of Section 01400 - Quality Control. The CONTRACTOR shall notify the OWNER two weeks in advance of the factory testing.

B. Before delivery to the job site, the products shall be tested at the factory and witnessed by the owner's representative. The test shall verify that products are free of any defects, and verify guaranteed performance. The CONTRACTOR shall not ship equipment before approval of the OWNER.

C. The engine-generator set shall be subject to both static and operating tests as described below:

1. Static Testing. The entire unit, including control panels and accessories, shall be set up and tested, using static methods to ensure that all safety devices and control circuits are properly installed, aligned, and connected. All trim piping shall be pressure tested, and all regulators and solenoid valves shall be tested for proper function.

2. Operating Tests. The complete unit shall be set up in a test cell and operated to determine its characteristics under various loads. The engine tests shall be conducted in accordance with applicable portions in ASME PTC 17. The generator tests shall be conducted in accordance with applicable portions of the test procedure in NEMA MG-1, through the use of dry type load banks. The test shall include full load operating test of at least 8 hours. Records, in addition to the information required by ASME PTC 17 and NEMA MG-1, shall include the average starting time for not less than 19 cold starts, test cell temperatures, the and number of cranking cycles before successful start. The CONTRACTOR shall submit four copies of the certified test reports in typed form to the OWNER.

D. Factory Prototype Testing: The system manufacturer must certify that engine, generator, controls, and switchgear have been tested as complete system of representative engineering models (not on equipment sold). Submit a certified prototype test report. Prototype testing shall include:

1. Fuel consumption at 1/2, 3/4, and full load.

2. Exhaust emissions.

3. Mechanical and exhaust noise.

4. Governor speed regulation at 1/2,3/4, and full load; and during transients.

5. Motor starting kVA

6. Generator temperature rise in accordance with NEMA MG1-22.40.

7. Harmonic analysis, voltage waveform deviation and telephone influence factor.

8. Generator short circuit capability.

9. Cooling system performance.

10. Generator revolving field assembly for 2 hours at 150% overspeed and 70 degree C, and each production unit tested at 125% overspeed at room temperature.

1.10 SHIPMENT

A. The equipment to be furnished under this Section shall be shipped to the site with weathertight covers on all piping and electrical connections. All shaft housing penetrations shall be sealed in a manner which shall protect against damage from the elements and deterioration of the equipment due to moisture, corrosive gases, dirt and debris. Additionally, each individual shipment shall be packaged in a manner designed to protect the equipment against damage caused by sudden acceleration or deceleration.

1.11 QUALIFICATIONS

A. The manufacturer shall specialize in engine-generators and demonstrate a minimum of one recently constructed, successfully performing installation of comparable size and complexity.

B. The manufacturer of the engine-generator set shall be the actual manufacturer of either the generator or the prime mover.

C. The manufacturer shall own and operate a permanent test facility where the required factory tests shall be performed.

D. The engine-generator set shall be a standard product in current production of the manufacturer.

E. The engine-generator set, including all components, shall be new, fabricated, assembled complete, tested and shipped by the manufacturer.

1.12 WARRANTY

A. The manufacturer shall provide a warranty against defects in material, workmanship, and operation for 2 years from the date of final acceptance of the project. The CONTRACTOR shall furnish the original warranty. There shall be one source responsibility for warranty, parts and service through a local representative with factory- trained service personnel. The warranty shall include repair parts, labor, reasonable travel expense necessary for repairs at the job site, and expendables (lubricating oil, filters, antifreeze, and other service items made unusable by the defect) used during the course of repair. Running hours shall not be a limiting factor for the system warranty by either the manufacturer or servicing distributor.

1.13 QUALITY ASSURANCE

A. The equipment furnished shall comply with NFPA 70, NFPA 99, and NFPA requirements for Level 2 emergency power supply system.

1.14 MAINTENANCE SERVICE

A. Maintenance: At Substantial Completion, begin 12 months= full maintenance by skilled employees of the manufacturer's designated service organization. Include quarterly exercising to check for proper, starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Maintenance agreements shall include parts and supplies as used in the manufacture and installation of original equipment.

PART 2 -- PRODUCTS

2.1 ENGINE

A. General: The engine shall be compression ignition diesel type, standby duty, fueled by No. 2 diesel fuel and shall provide emergency power as indicated and specified. The engine shall have a standby power rating at 1800 rpm, at 0.8 power factor, and with all necessary equipment connected to drive the generator at a continuous load, of not less than 750 kW after deduction of radiator fan loss, and correction for altitude at the Project site. The engine shall be a reciprocating, 4-cycle lean burn model. The engine-generator set shall have the minimum rating indicated and specified and shall be designed to start automatically on normal power failure and continuously supply emergency power to all the indicated loads for the duration of the power outage.

B. Engine Base: The engine base shall be of rigid construction with heavy transverse girders formed to support the crankshaft main bearings. The engine frame shall be suitable box shape to provide longitudinal and transverse rigidity. The design shall be of a totally enclosed, dustproof, oiltight type with large oil tight doors fitted on all sides of the frame or a removable automotive type pan to provide complete access to the bearings and running gear.

C. Crankshaft: The crankshaft shall be made from a single heat treated forged steel block or of a two-piece design and shall be sized to provide a liberal margin of safety against abnormal strains. Journals shall be hardened and micropolished. The shaft shall be statically and dynamically balanced after fabrication. If of two-piece design the crankshaft shall be machined and balanced as a single unit.

D. Cylinders: Cylinders may be cast individually or in one block. If in one block, removable jacket liners shall be provided, fitted with integral water jackets with suitable connections to inlet and outlet to eliminate the presence of water in the cylinder block. All cylinder liners shall be finished to give a straight bore, shall be carefully machined and honed, and shall be chrome-plated, or equivalent, on the water side to reduce cavitation damage.

E. Pistons: Pistons shall be of the oil-cooled trunk type, made of close-grained cast iron or aluminum alloy, accurately machined to size. The piston shall be long in proportion to the diameter and shall be provided with a sufficient number of piston rings to ensure maximum compression and to minimize oil consumption.

F. Valves: Inlet and exhaust valves shall be precision machined and shall be made of top grade heat-resisting material. Valve seats shall be replaceable, made of heat-resistant high alloy steel. Valves shall be of large diameter to produce the greatest volumetric efficiency and adequate scavenging of the cylinders in order to keep valve maintenance to a minimum. All valve mechanisms shall be constructed so as to provide positive action with utmost rigidity. Renewable hardened steel inserts shall be provided for all valve stem guides. Valve seats shall be replaceable and made of a hardened steel selected specifically for high temperature service.

G. Exhaust Manifolds: Exhaust manifolds shall be fully insulated and, if in pairs, shall be joined to provide a single exhaust outlet for the engine.

H. Materials: The engine shall be constructed of the following materials:

Component	Material
Base and frame	Cast iron, SAE G3500 or G4500, welded steel, SAE 950C, 945C

Component	Material
Crankshaft	Forged steel, SAE 1046, 4140, or 4340
Connecting rods	Heat treated steel, SAE 4340 or 9840
Flywheel	Cast iron
Cylinders and cylinder heads	Cast iron, SAE G3000, G3500, or heads G4500 for cylinder heads
Pistons	Cast aluminum, SAE 34, 39, 309, 314, 321, or 328
Exhaust manifold	Cast iron, SAE G3000 to G3500 or G4500

2.2 STARTING SYSTEM

A. General: The starting system shall be of the electric, automatic starting type, complete with solenoid shift starter, batteries, battery rack, battery cover, cables, and constant voltage charger, capable of at least three 15-second starting attempts in a 30 degree F ambient temperature, without being recharged. Dry contacts shall be provided for remote indication of starting attempts. The engine-generating set shall contain a complete engine start-stop control which automatically starts the engine on closing contact and stops the engine on opening contact. Once started, the engine shall remain in operation for an adjustable period from 5 to 90 minutes if the engine control selector switch is in the test position or for an adjustable period determined by the automatic transfer switch if the engine control selector switch is in the automatic position. Cycle cranking shall be provided for three 15 second crank periods separated by 10 second rest periods. A cranking limiter shall be provided to open the starting circuit in approximately 30 to 90 seconds if the engine is not started within that time. Low oil pressure, high coolant temperature, overspeed, underspeed vibration or overcrank shall automatically shut down the engine. The engine control shall be automatically locked out upon emergency shutdown.

B. Batteries: The engine-generator set shall be provided with a heavy duty, high rate of discharge, lead acid starting battery for diesel engine starting. The battery shall have sufficient capacity for a minimum of three 15 second crank periods each separated by a 10 second rest period, without recharging. The batteries shall provide minimum of 10 cold cranking amperes. The battery voltage shall be compatible with that of the starting system. The battery rack shall be mounted on the unit and located above the floor. A fiberglass enclosure shall be provided for the battery and rack. The battery shall be guaranteed for a minimum of 5 years. The batteries shall be mounted on the engine-generator skid. Batteries shall be furnished complete with interunit connectors and battery charger.

C. Battery Rack: A two-step battery rack shall be provided by the battery manufacturer. The rack shall be constructed to suit the batteries furnished. Rack rails shall be insulated with plastic. Batteries shall be arranged so that all electrolyte levels are easily visible. It shall be treated to be resistant to deterioration by batter electrolyte. Construction shall be such that any spillage or boil over battery electrolyte shall be contained within the tray to prevent a direct path to ground.

D. Battery Charger:

1 The battery charger shall be UL listed, float type, of the SCR full wave rectification design. The charger shall be dual rate output allowing for automatic initiation of high rate charging on battery demand. An AC outage shall not be the sole criteria for initiation of high rate charging, nor shall this charging be performed for a preset period of time. High rate charging shall be proportionate to battery demand only, and shall be controlled by solid state circuits monitoring battery demand.

2 The charger shall be capable of full output from 14 to 122 degrees F at the Project site.

3 The charger input shall be single phase, 120 VAC, 60 Hz. Output current/voltage shall be sufficient to recharge the battery in order to perform a repeat of the duty cycle in 12 hours. In addition, the charger shall supply continuously all required secondary loads.

4 Output voltage regulation shall be +0.5% when connected to the battery with input variations of +10% voltage and +5% frequency from zero to full rated output.

5 The battery charger enclosure shall be NEMA rated in accordance with the area designations of Section 16050 - Basic Electrical Materials and Methods.

2.3 COOLING SYSTEM

A. General: A complete, engine-mounted radiator cooling system including radiator, motor-driven fan and circulating pump, bypass thermostats, interconnecting piping and appurtenances shall be provided for the engine. The system shall be designed to use a water and glycol solution with a freezing point below minus 15 degrees F. The radiator shall be designed for a maximum bottom tank temperature of 175 degrees F. A coolant circulating pump shall be provided with ample capacity to circulate the required flow of engine jacket water through the radiator to remove the heat rejected from the engine to the jacket water and to maintain the water temperature as recommended by the manufacturer.

B. Radiator: The radiator shall be the high capacity copper splitcore, fin and tube type, adequately sized for 110% of full load at an ambient temperature of 110 degrees F, to properly cool water from the engine jackets, and lube oil cooler under the operating conditions indicated. The radiator shall have an air discharge adapter for connection to an air duct.

C. Fans: Fans shall be of the multibladed belt-driven or direct-drive type complete with a shroud or protective guard. Fan blades shall be of adjustable pitch, airfoil design, selected for high efficiency and quiet operation. Fan tip speeds shall be held as low as practicable to reduce fan noise to a minimum.

D. Pump Belts: Water circulation pump belts, if any, shall be T wedge type with QD sheaves, rated at 150% of running horsepower.

E. Coolant Hose: Coolant hose shall be flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric. It shall be rated at 50 psig maximum working pressure with 180 degree F coolant, and noncollapsible under vacuum. End fittings shall be flanges or steel pipe nipples with clamps to suit piping and equipment connections.

2.4 EXHAUST SYSTEM

A. General: The exhaust system shall be complete and shall include flexible connectors mounted directly on the generator manifold flange, condensate trap with drain plug or cock, roof thimble, and silencer. The exhaust system shall be provided with a means to prevent rain from entering the exhaust outlet. The exhaust system shall comply with NFPA 211. The flange rating shall be same for the emergency generator and the silencer.

B. Pipe and Coupling: The engine exhaust coupling shall be stainless steel heavy duty, convoluted pressure hose-type. The flexible coupling shall have an overall length of not less than 16 inches and 150 lb ANSI steel flanges, and it shall be designed for 1250 degrees F service. All bolts, nuts, and clamps necessary for the installation of the flexible coupling and exhaust piping shall be provided. All parts of the exhaust system, except flanges, shall be of Type 316 stainless steel. Exhaust piping inside of buildings shall be Schedule 20 stainless steel, insulated with 4 inches of high temperature calcium silicate insulation in 2 layers, staggered, suitable for 1250 degrees F, applied over .25-inch corrugated metal, and finished with aluminum lagging secured by metal bands. Ends of insulation shall be neatly finished with 2-inch plate aluminum flanges. The pipe shall be supported by steel saddles welded to the pipe and extending through the insulation.

C. Silencer: The exhaust system shall be equipped with a Type 316 stainless steel hospital type flanged silencer which shall meet local and regional noise requirements, without exceeding the manufacturer's back-pressure limitations. Supports shall be provided for horizontal suspended installation that is independent from the generator set unit. The unit shall employ ported tubes in a single or multichamber, nonreactive design selected to achieve the degree of silencing indicated, with inspection ports and drain fittings in each chamber.

D. Roof Thimble: A NFPA 37 and UL-103 compliant factory built ventilated roof thimble rated for 1250 degrees F shall be provided. The roof thimble shall include vent flashing and a storm collar. The thimble shall be Selkirk Metalbestos Model P-MVT or equal.

2.5 COMBUSTION-AIR-INTAKE SYSTEM

A Air-Intake Silencer: The air-intake silencer shall be filter type that provides filtration as recommended by engine manufacturer. The sound level emanating from air intake shall meet local and regional requirements. The air-intake silencer shall be factory installed on engine generator set at a location readily accessible for service.

B Intake Duct Connection: Size and connect intake duct to engine as recommended by manufacturer. The flexible connector shall be flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1. Select metal compatible with connected duct system. Use spring hangers and supports attached to building structure as specified in Section 15020 - Pipe Supports, for air-intake piping.

2.6 ENGINE JACKET WATER HEATER

A A heater shall be installed on each engine, complete with thermostat control in the engine cooling water system to maintain a jacket water temperature of 100 degrees F at all times, while the engine is not in operation. The heater shall be an electric immersion heater with waterproof enclosure, suitable for 120V, single-phase, 60 Hz power supply. Connections of the engine jacket water heater shall have isolation valves.

2.7 LUBRICATION SYSTEM

A General: The engine shall be of the wet sump type, provided with a full pressure lubricating oil system arranged to distribute oil to all moving parts of the engine. The lubricating oil pump shall be of the positive displacement type and shall be gear-driven from the engine crankshaft or camshaft. The pump shall have ample capacity to circulate the amount of lubricating and cooling oil required by the engine at all operating speeds. The lubricating system integral with the engine shall be complete with all required pipes, valves, heaters, fittings, pump, pressure gauge, filters and other necessary components to complete the system.

B Oil Filter: A full flow filter shall be provided. A built-in pressure relief bypass complete with pressure actuated valve and capable of conveying the maximum rate of oil flow shall be provided around each oil filter. The filter shall be rated to remove 90 percent of the particles 5 micrometers and smaller while passing full flow.

C Oil Cooler: The engine shall be equipped with a lubricating oil cooler, sized to cool the oil as recommended by the manufacturer. Aftercooler water shall be circulated through the water side of the oil cooler.

D Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps or siphons or special tools or appliances.

2.8 GOVERNOR

A The engine-generator set shall be equipped with an engine speed isochronous electronic governing system to provide speed regulation within plus or minus 0.25% of rated frequency under steady state load conditions. Governing system shall conform to ASME Specification No. 606 "Speed Governing of Internal Combustion Engine-Generator Units." Provide overspeed shutdown wiring and signal light in the control panel. The governor shall be of the hydraulic type, with provision at the engine for manual adjustment of speed, speed droop and load limit.

2.9 ENGINE-MOUNTED PANEL

A General: The control panel shall be totally metal enclosed, assembled, wired, tested and shock mounted on the engine-generator set by the manufacturer. The control panel shall contain the 100% rated main circuit breaker, frequency meter, running time meter, voltage adjusting rheostat, AC voltmeter (dual range, indicating all voltages), voltmeter phase selector switch, AC ammeter (dual range, indicating current each phase), ammeter phase selector switch, battery charge rate ammeter, engine controls and instruments, pushbuttons, switches, relays, wiring, terminals, indicating lights and other required components.

B Gauges: A vibration-isolated engine panel, NEMA rated in accordance with the area designations of Section 16050 - Basic Electrical Materials and Methods, with the following gauges and meters shall be mounted on the engine, with the face of the panel being illuminated.

1 Jacket water temperature gauge
2 Oil temperature gauge
3 Lubricating oil pressure gauge
4 Intake manifold temperature gauges
5 Digital tachometer
6 Operating hour meter
7 Exhaust temperature gauge

C Local and Remote Signals: Local and remote alarm controls and engine protection with signal lights and audible alarm shall be provided for the following alarms. All specified readings shall be made available via a Modbus TCP communications via Ethernet 10BASE-T.

1 Overcrank
2 Low oil pressure
3 Overspeed
4 High water temperature
5 Low water level
6 Low oil level
7 Low fuel
8 Control switch not in remote position
9 Circuit breaker in off position
10 Emergency stop depressed
11 Approaching high coolant temperature

12 Approaching low oil pressure
13 Low voltage in battery
14 Battery charger malfunction
15 High battery voltage

D. The alarm lights shall remain on until the alarm condition is corrected and an alarm reset switch is activated. Indicating lights shall be the same voltage as the starting battery and shall be provided complete with color caps. The lamps shall be removable without entering the generating panel.

E. Switches: The engine shall be provided with the following devices, factory installed and adjusted. Each device shall be suitable for use with the engine's 24 VDC control power and shall be complete with all necessary conduit and wiring. Phase selector switches shall be panel type, heavy duty, non-illuminated equipped with a standard black knob. Leads shall be brought to a common engine-mounted control terminal panel located on the subbase. Protective devices shall include the following:

1 An overspeed switch shall be separate from the governor and shall open at 10% above synchronous speed to actuate an alarm contact.

2 A low oil pressure switch which opens when the pressure in the lube oil system is below the permissible operating pressure.

3 A temperature switch, mounted in the lubricating oil system, designed to open when the oil temperature downstream from the oil cooler reaches unacceptable levels.

4 Cooling water float switches located in the radiator. The float switches shall cause the engine-generator to shut down and alarm if the coolant level in the radiator drops below acceptable limits.

5 A switch to silence the audible alarm.

6 A lamp test switch for local and remote signals.
7 An ammeter switch with four positions (off-A-B-C). Ammeter switch shall have intermediate positions such that current transformer circuits are never open circuited.

8 A voltmeter switch with four positions (off-AB-BC-CA).

F. Design: All devices shall be specifically designed for engine service of a type suitable for reliable operation in the presence of continuous vibration. All wiring, conduit, and appurtenances shall be as indicated under Division 16. Conduits shall be routed to provide maximum access to all maintenance points, devices and appurtenances. The bottom of the control panel shall not exceed 6 feet above the equipmnet pad floor.

G. Instrument Taps: The engine shall be provided with suitable taps or connections available for the measurement of the following:

1. Lubricating oil inlet pressure
2. Engine speed

3. Jacket water inlet temperature
4. Aftercooler water inlet temperature

H. Operation: The panel shall include automatic start/stop operation. The engine control shall be automatically locked out upon safety shutdown. Manual controls shall be provided on the front of the panel to permit manual startup and shutdown of the engine. The safety shutdown of the engine shall initiate an alarm signal for remote annunciation. The following devices shall be provided on the face of the panel:

1. MANUAL-OFF-REMOTE selector switch
2. EMERGENCY STOP red pushbutton with guard
3. ALARM ACKNOWLEDGE/CANCEL pushbuttons
4. LOCKOUT RESET pushbutton

I. When the mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic-transfer switches initiate starting and stopping of the generator set. When the mode-selector switch is switched to the on position, the generator set manually starts. The off position of the same switch initiates generator-set shutdown. When the generator set is running, specified system or equipment failures or derangements automatically shut down the generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down the generator set.

J. Circuit Breaker: The main emergency power circuit breaker shall be 100% rated, enclosed, molded case, thermal-magnetic, trip-free manual, quick-make, quick-break, 1200A three poles with solid-state trip for long time, short time, and ground fault sensors.

K. Nameplates: Provide all the required nameplates. The nameplates shall have inscriptions that identify the equipment and all its positions.

1 The nameplates shall be engraved, laminated black plastic with minimum 3-inch high letters showing through from the white core, NEMA ES-1, 3-ply (Black-White-Black), 1/16-inch thick, beveled and satin finished. Nameplate inscriptions shall include the identification for the equipment and loads and shall identify the controls on control equipment.

2 Nameplates shall be attached to the object, or adjacent to the object, with self taping stainless steel screws. Adhesive materials shall not be used for attachment.

2.10 FUEL SYSTEM

A. The engine shall be provided with a fuel system integral with the engine. The fuel system on the engine shall have the required pipes, valves, fittings, filters, pump and provisions for external flexible fuel pipe connections.

B. Fuel Storage System:

1 The generator set shall be equipped with its own sub base double wall fuel storage tank with a capacity of 750 gallons. The fuel tank shall be UL listed and be constructed of aluminized steel channel and end plates 7 Ga. Tank top and bottom 7 Ga.

2 Provide necessary suction and return line connections at pipe openings provided.

3 Fuel piping between tank and engine shall be type K soft temper copper tubing with flared fittings.

4 Provide low fuel alarm and a rupture basin alarm should the primary fuel containment tank rupture.

5 Storage tank shall be provided with 1-1/4" NPT vent 2" NPT fill, 2" level gauge, 2" dip tubes for fuel supply and return and 2" NPT for control sensor.

6 Provide weatherproof basin and double wall cover.

2.11 FLEXIBLE METAL HOSE

A. Flexible metal hose connectors for jacket water, after cooler water, lube oil, fuel and exhaust piping shall be provided. Water, oil and fuel connectors shall be single braided, Type 316 stainless steel, 150 psig working pressure. Fuel connectors shall bear the Underwriters' Laboratories label. The exhaust connector shall be as indicated above. All connectors shall be selected for a design of not less than 10 million full displacement cycles. Flexible connectors shall be not less than 12 inches long and installed with no visible deflection.

2.12 GENERATOR SET MOUNTINGS

A. The engine-generator set shall be equipped with vibration isolators and shall be capable of withstanding earthquake forces of seismic zone 4 in accordance with the Uniform Building Code, latest edition. The generator set shall be mounted on a welded structural steel base, with cross-framing for additional stiffening. The entire welded steel base shall be installed with steel spring isolators. The steel spring isolators shall meet the following requirements:

1 The minimum steel spring static deflection shall be 0.375-inches.

2 The ratio of horizontal spring constant to vertical spring constant shall be at least 1:1.

3 The spring diameter shall be no less than 0.8 times the compressed spring height at rated load.

4 The difference between compressed spring height and solid spring height shall be at least 0.5 times the rated static deflection.

5 The spring isolator shall include an adjusting bolt for leveling and attachment to the mounting base and shall be mounted on 3-inch thick ribbed or waffle-pattern neoprene acoustical pad.

6 The spring isolator shall be contained within a rigid housing that includes vertical stabilizers and seismic restraints.

7 The spring isolators shall be selected for uniform static deflections according to the weight distribution of the electric generating plant, disturbing forces such as fan thrust during starting and seismic Zone 4 restraints.

8 Submittals shall include spring diameters, static deflections, compressed spring height, and solid spring height.

9 The CONTRACTOR shall submit certification of torsional vibration compatibility in compliance with NFPA 110.

2.13 GENERATOR

A. General: The generator shall be of the brushless, revolving field, heavy-duty industrial type, rated 750 kW continuous when burning diesel fuel, 0.8 power factor lagging, 3-phase, 4-wire, 227/480 V, 130 degrees C rise, 60-Hz, 1800 rpm, Class F insulation with field windings braced for solid grounding. Each generator shall be suitable for operation the elevation and expected maximum ambient temperature at the project site. The CONTRACTOR shall provide a larger engine-generator if required to start and run the load indicated. The generator shall accept a single block application of full rated load with voltage and frequency recovery to normal value within two seconds. The voltage dip shall not exceed 25% nor shall the speed regulation exceed 2% following block load application. In addition, when the starting load (motor) is applied, the voltage dip shall not exceed 25% at any point of the motor starting sequence. The generator excitation system shall consist of a three-phase alternating current exciter, the output of which is directly connected to the main generator field through silicon rectifiers, and shall not have commutator or brushes incorporated in the generator design. The generator shall be a single-bearing machine conforming to applicable NEMA standards and shall have a rigid drip-proof frame with covers to provide easy access to the interior. The generator shall be supplied with a solid state voltage regulator or equal mounted on the machine which will hold the voltage to the set value with not over 2% variation from no-load to full-load. The rotor shall be directly connected to the engine through a semiflexible driving flange to insure permanent alignment. The generator shall be mounted on a heavy, structural, common base with the engine, and shall be equipped with the required supports and hardware.

1 Performance. Start time shall comply with NFPA 110, Type 10, system requirements. The frequency regulation shall not exceed plus or minus 0.25% of its mean value for constant loads from no load to full load. Frequency regulation under varying loads shall be isochronous. Voltage regulation shall not exceed plus or minus 2% of its mean value for varying loads and plus or minus 1% of its mean value for constant loads from no load to full load. The transient voltage dip shall be less than 25% of rated voltage when full nameplate rated load and rated power factor is applied to the generator. Recovery to stable operation shall occur within 4 seconds. Stable or steady state operation is defined as operation with terminal voltage remaining constant within plus or minus 1% of the rated voltage. A rheostat shall provide a minimum of plus or minus 5% voltage adjustment from the rated voltage. Temperature rise shall be within the NEMA MGl-22.40 standard. The telephone influence factor, determined according to NEMA MGl, shall not exceed 50.

B. Materials:

Component	Material
Stators	
Frame	Bar and ring steel
Laminations	Electrical grade sheet steel
Windings	Copper
Rotors	
Laminations	Electrical grade sheet steel
Windings	Copper

2.14 GENERATOR AND POWER SYSTEM PANELS

A. General: The CONTRACTOR shall provide a generator control panel, with NEMA rating in accordance with the area designations of Section 16050 - Basic Electrical Materials and Methods. The panel shall be an all-steel enclosure in accordance with Section 16485 - Local Control Panels and generator mounted. The panel shall be provided with a hinged door, gasketed and equipped with a lockable handle.

B. Generator Controls: The generator controls shall be provided on the generator control panel.. The panel shall be in accordance with Section 16485 - Local Control Panels.

C. Power System Panel: A 100A, 208V/120V power system panel shall be provided. Jacket water heater, battery charger, lighting and receptacles, generator control panel, ect shall be prewired to the power system panel and tested at the factory. The panel shall be in accordance with Section 16050 – Basic Electrical Materials and Methods.

2.15 GENERATOR SET WEATHERPROOF ACOUSTICAL ENCLOSURES

A. The design of the enclosure layout shall be coordinated with the installation of the sound panel walls that will surround the generator eqiupment pad to midigate the noice level impact to the surrounding residence. Therefore, the enclosure must fit within the generator equipment dimension of 10'-0" by 28'-8" and cannot exceed the height of the 20'-0" sound panels.

B. Acoustical enclosure shall be provided by the engine-generator manufacturer. Provide enclosure that ensures required air circulation by the housed equipment.

C. Provide a weatherproof sound alternating enclosure to reduce the sound level emitted by the engine and generator equipment to 55 dba at 30 feet. Acoustical packing shall be mineral wool or other approved material.

D. Enclosure shall be equipped with removable side panels or swing doors allowing access to engine and control panels. The panels/doors shall have provisions for padlocking and shall be sealed with neoprene gaskets. A minimum of four panels or doors shall be provided. Hinges shall be stainless steel heavy duty. All hardware shall be stainless steel. Provide rain lips over all panels or doors.

E. Provide an exhaust opening, rain shield and battery rack inside the enclosure. Provide minimum of 4 lifting eyes for the enclosure.

F. Provide louvers on either end of the enclosure for proper ventilation of generator set. Louvers must be sized properly, so there is no need to remove side panels for cooling. All louvers shall be covered with SS bird screening.

G. Enclosure shall be constructed of minimum 12 gauge steel panels, painted inside and out with rust inhibiting primer. Exterior shall be coated per Section 09800. Exterior finish color shall be determined by the OWNER. One gallon of exterior paint shall be included for field touch-up.

2.16 MISCELLANEOUS COMPONENTS

A. Components that are required to satisfactorily complete the generating system shall be provided by the CONTRACTOR even if not described in this Section.

2.17 NAMEPLATES, TOOLS AND SPARE PARTS

A. Spare Parts:

1. The Work includes the following spare parts for each engine-generator unit:

Quantity	Description
1	Lube Oil Filter Element Double Length
1	Lube Oil Filter Cover O-Ring
1	Water Pump Belt Set
1	Aux. Water Pump Belt Set
2	Air Cleaner Element
16	Spark Plug
1	Each size and type of relay
Quantity	Description
1	Each size and type of lamp in the control panels
2	Complete replacements, engine oil filters
2	Complete replacements, air inlet filters
1	Complete set special maintenance tools

2. Spare parts shall be crated, packaged, and stored in metal tool boxes, and identified with the equipment number by means of stainless steel or solid plastic name tags attached to the boxes.

2.18 ACCESSORIES

A. Accessories: All accessories including hardware needed for the complete installation and proper operation of the electric generating plant shall be provided. A standalone automatic transfer switch shall be provided per Section 16926 – Automatic Transfer Switches.

2.19 MANUFACTURERS

A. The equipment shall be manufactured by one of the following, or equal:

1 Engine generator

a. Caterpillar
b. Kohler

PART 3 -- EXECUTION

3.1 INSTALLATION

A. The engine-generator set shall be shipped, unloaded, installed and aligned in accordance with the procedure submitted with the shop drawings and per manufacturer's written recommendation and with NFPA 110. All fuel, coolant, exhaust piping and electrical conduit shall have flexible connectors so that vibration is not transmitted along these lines.

3.2 FIELD TESTING

A. General: Coordinate all startup and testing activities with the RESIDENT ENGINEER and OWNER. The equipment shall be subject to the following tests, including a final acceptance test to assure compliance with all operation requirements indicated. Verify all equipment and auxiliary devices are installed properly and are operating properly. Check all fluid levels and check for leaks or vibration. The field test shall include all tests performed in the factory prototype test plus an operational test that simulates a normal power failure and demonstrates that the emergency generator set can start and run all emergency loads. In addition, perform all tests required by NFPA 110. Test results shall show the maximum voltage dip that occurs during the emergency starting sequence. The field test shall be conducted by the CONTRACTOR in the presence of the RESIDENT ENGINEER. All costs of testing, including fuel, shall be borne by the CONTRACTOR. Upon completion of the tests, the CONTRACTOR shall refill the fuel tank. The test procedure shall be developed by the CONTRACTOR and shall, as a minimum, include the following features:

1. Static tests of all control and protective circuits.

2. Not less than five cold starts.

3. Not less than 4 hours of transient response tests using loads applied by portable load bank.

4. Not less than 8 hours of continuous operation at full load.

5. The CONTRACTOR shall submit four copies of the certified field test reports in typed form to the OWNER.

B. A complete system reactive load bank test is required after all equipment is installed.

C. Portable Load Bank: The CONTRACTOR shall furnish a portable load bank to provide sufficient load to complete the required testing.

D. Coordinate tests with tests for transfer switches and run them concurrently.

E. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

3.3 CLEANING

A. On completion of installation, inspect system components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish. Clean components internally using methods and materials recommended by manufacturer.

*** END OF SECTION ***

SECTION 16290

POWER MONITORS

PART 1 - GENERAL

1.1 THE REQUIREMENT

A. The MCC manufacturer shall install power monitors, current transformers, and potential transformers, all in accordance with the intent and requirements of the Contract Documents.

B. Nameplates shall be furnished as specified in Section 16050.

1.2 REFERENCE CODES AND STANDARDS

A. All work specified herein shall conform to or exceed the applicable requirements of the referenced portions of the following publications to the extent that the provisions thereof are not in conflict with other provisions of these specifications.

1. Codes and Standards:

NEC	National Electrical Code
NESC	National Electrical Safety Code (ANSI C2)
UL	Underwriters Laboratories
CBEMA	Computer Business Equipment Manufacturers Association

2. Industry Standards

ANSI C12.20	Electricity Meters 0.2 and 0.5 Accuracy Classes
ANSI C2	National Electrical Safety Code
ANSI C.62.41	IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits
FCC Part 15	
Subpart B, Class A	Electromagnetic Emission Standards
IEC60687 0.2S	Standards for Metering Accuracy
IEC1000	Electromagnetic Compatibility Limitations on Voltage Fluctuations
ENV51040	IEC Standard for Radiated EM Field Immunity
ENV51041	IEC Standard for Conducted EM Field Immunity
EN50081-2	IEC Standard for Electromagnetic Compatibility, Emissions
EN50082-2	IEC Standard for Electromagnetic Compatibility, Immunity
EN55011 (CISPR 11)	IEC Standard for Radiated/Conducted Emissions
EN55022 (CISPR 22)	IEC Standard for Radiated/Conducted Emissions

IEEE C.37.90.1	Standard for Surge Withstand Capacity for Protective Relays and Relay Systems
UL 3111-1	Electrical Measuring, Testing and Signal Generation Equipment

1.3 SYSTEM DESCRIPTION

A. The power monitors shall be mounted as indicated on the contract documents, in the control section of the appropriate starter/breaker cubicle.

B. Appropriate potential transformers and current transformers shall be furnished to provide sensing signals for the power monitors and associated load.

C. Installation of power monitors, ancillary equipment, and wiring connections to all electrical circuits, and terminal strips for external devices shall conform to all local and national electrical codes.

D. Shorting switches or test blocks shall be provided for all metering CT inputs.

1.4 SUBMITTALS

A. The power monitor supplier shall provide technical data sheets, installation manuals and/or user documentation manuals that describe the product installation and operation, physical data, electrical characteristics and connection requirements of the power monitor.

1.5 QUALITY ASSURANCE

A. The power monitor supplier's quality assurance process shall be certified by an independent certification agency to meet ISO 9001 quality assurance standards.

B. The final MCC lineup incorporating the power monitors must be UL certified and labeled by the assembler.

C. The power monitors shall be calibrated at the factory using an instrument that is certified to have been calibrated using standards whose accuracies are traceable to the National Institute of Standards and Technology (NIST).

1.6 SITE CONDITIONS

A. The power monitors shall be capable of operating under the following environmental conditions:

1. Temperature: 40°F to 122°F

2. Humidity: 5% to 95% non-condensing

1.7 WARRANTY

A. The power monitors shall be warranted by the manufacturer against manufacturing defects for a period of three (3) years including parts and labor.

B. Warranty service may be performed by the manufacturer or authorized representative.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The power monitors shall be manufactured by Cutler Hammer PXM2260, or equal, with the following options:

1. 512 megabyte (MB) memory upgrade
2. The 10Base-FL Ethernet port and TCP/IP protocol with all associated drivers and supporting hardware.
3. Analog auxiliary card which accepts (4) 0-20mA inputs and delivers (4) 0-20mA (scalable to 4 to 20mA) outputs
4. Current transformers rated 10 amperes each for all monitored phases.

2.2 POWER MONITORS

A. The power monitor shall be a multi-function 3 phase solid state unit with ability to connect to either 3 phase, 4 wire wye or 3 phase, 3 wire delta circuits.

B. Capabilities for voltage and current inputs to the meter shall conform to the following at a minimum:

1. The power monitor shall accept input of four (4) independent voltage inputs and five (3) independent current inputs of the stated capacity.
2. Voltage input shall be120 volts AC with available option for direct connection to voltage circuits of up to 600 VAC without the use of potential transformers.
3. Voltage input shall have an overload capacity of 1500VAC RMS continuous and a dielectric withstand capability of 2500 volts AC, 60Hz for one minute.
4. Current input shall be rated for 5 amps with a continuous input capability of 20 amps.
5. Current inputs shall be Class 10, rated for a 1-second over-current rating of 500 amps, non-recurring, and 20 amps continuous.

C. The power monitor shall measure and report the following quantities at a minimum:

1. Voltage, intervals must be available simultaneously both phase to neutral and phase to phase, for all three phases; Auxiliary voltage; Phase angles for each voltage relative to each other.
2. Current, phase A, B, C, N-measured, and N-calculated; Phase angles for each current relative to voltages.
3. Watts (total and per phase), VARs (total and per phase), VA (total and per phase), Power Factor (total and per phase) and Frequency.
4. Accumulated Watt-hr, VA-hr, and VAR-hr; Watt-hr received; Watt-hr delivered.
5. Updates of all voltage and current readings at intervals of 1/2 cycle and 1 second. Readings shall be available for both metering and control. All specified readings shall be made available via the Modbus and Ethernet port.
6. Time-stamped maximum and minimum readings for every measured parameter
7. Coincident VAR readings for all maximum Watt readings

D. Power monitor shall provide the following accuracies:

1. Voltage accuracy shall be within less than 0.1% for the 1 second readings.
2. Current accuracy shall be within less than 0.1% for the 1 second readings.
3. Power and energy accuracy shall be class 0.2.
4. Frequency accuracy shall be within +/- 0.03 Hz or better.

E. Power demand shall be able to be calculated using either of two (2) methods: Thermal Demand or Sliding Window Demand (Rolling Block).

F. Power monitor shall be provided with a gateway card to support Modbus and Ethernet protocols.

1. Each port shall be user configurable with regard to speed, protocol, address, and other communications parameters. Ports shall support a maximum communication speed of 57.6k baud simultaneously.
2. All instantaneous data, logged data, event data, power quality analysis and waveform information shall be available using these open protocols.

G. Power monitor shall provide sequence of events capture and recording.

H. Power monitor shall provide an external display to accommodate access to readings locally and/or remotely.

I. Power monitor shall be equipped with a minimum of 512 MB of non-volatile RAM.

1. Meter shall store historical trending data, power quality data, and waveform recordings in memory.
2. In the event of loss of control power, data stored in memory shall be retained
3. Memory shall be allocated to the various logging functions required. All logging features required shall be simultaneously available at the specified levels. Exercising any one feature at the specified level shall not limit exercising of any or all other features to their full, specified level.
4. Meter shall store all programming and set-up parameters in non-volatile memory. In the event of loss of control power, meter programming data stored in memory shall be retained.

J. Power monitor shall provide historical data logging for trending of measured values.

1. The historical log shall be user configurable. User may select measured quantities and reading intervals for each log.
2. The historical log shall record data where 10 readings are being stored every 15 minutes.

K. Power monitor shall provide extensive power quality monitoring capability.

1. Power monitor shall measure and record the magnitude and phase angle harmonics for all voltages and currents. Meter shall provide %THD for all channels.
2. All harmonic values shall be available through the digital communications ports.
3. Power monitor shall capture and record all CBEMA quality events.

4. Entries to the Limits log shall be time stamped to the millisecond and include the measured quantity value and label.

L. Power monitor shall provide waveform recording to capture and record transients and quality problems on current and voltage waveforms.

1. Meter shall hold over 60 records of waveform recording in non-volatile memory. Each record shall be a minimum of 8 cycles duration at the highest sample rate or 64 cycles duration at the lowest sample rate.

M. The power monitor shall provide the following functionality:

1. Arithmetic (+, -, X, /)

2. Trigonometric functions: COS, SIN, TAN, ARCCOS, ARCSIN, ARCTAN, LN, LOG10

3. Comparison and Logic functions: =, =>, <=, <>, <, >, AND, OR, NOT, IF

N. The power monitor shall support direct display of all parameters on the front panel in user programmable groups, using plain language labels. Simultaneous access to all parameters shall be available through any communication port.

O. The power monitor shall be field programmable as follows:

1. Basic parameters: Voltage input scale, voltage mode (wye, delta, single phase), current input scale, auxiliary input and output scales, and communications setup parameters are programmable. All basic parameters plus additional setpoint/relay and data log setup parameters shall be programmed via the communications port using a portable or remotely located computer terminal.

2. The power monitor shall support customized configurations of all operating parameters.

3. Provisions shall be made to ensure that programming through a computer can be secured by user ID and password.

4. Provisions shall be made to ensure that programming through the front panel is secured by password.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All power supply and communications wiring connections shall be performed in accordance with the guidelines set out in the product documentation.

B. All current and voltage sensing connections to the power monitor shall be made using appropriately rated CT shorting blocks and PTs.

3.2 FIELD QUALITY CONTROL

A. The power monitor supplier shall offer field services to provide quality control with on-site personnel for installation, training, and start-up, as included in the project bid.

3.3 ADJUSTING

A. The power monitor supplier shall offer field services to assist on-site personnel with re-configuration of the factory default for site-specific requirements.

3.4 DEMONSTRATION AND TRAINING

A. The power monitor supplier shall offer field demonstration services to on-site personnel which include the following:

1. A review of the power monitor operation and maintenance manual shall be provided by a qualified manufacturer's representative.

2. A hands-on demonstration of the as-installed power monitor shall be performed.

** END OF SECTION **

SECTION 16400

LOW VOLTAGE ELECTRICAL SERVICE AND DISTRIBUTION

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide all electrical service sections, distribution switchboards, special control panels, control and terminal cabinets, control devices, circuit breakers, and all appurtenant work, complete and operable, in accordance with the Contract Documents.

B. The equipment shall meet the seismic requirements in 11000 - Equipment General Provisions.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of other requirements of these Specifications, all work specified herein shall conform to or exceed the applicable requirements of the National Electrical Code (NEC); provided, that where a local code or ordinance is in conflict with the NEC, the provisions of said local code or ordinance shall take precedence.

B. Codes:

1.	NEC	National Electrical Code

C. Commercial Standards:

1.	ANSI/IEEE C37.20	Switchgear Assemblies, including Metal-Enclosed Bus
2.	ANSI/NEMA ICS-2	Devices, Controllers, and Assemblies for Industrial Control
3.	ANSI/UL 1008	Automatic Transfer Switches, Safety Standard for
4.	IEEE	Institute of Electrical and Electronic Engineers
5.	NFPA	National Fire Protection Association
6.	UL	Underwriters' Laboratories, Inc.
7.	UL	National Electrical Manufacturer's Association

1.3 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 16050 Basic Electrical Materials and Methods

2. Section 16421 Surge Arrestors
3. Section 16480 Motor Control Center
4. Section 16950 Electrical Tests
5. Section 16926 Automatic Transfer Switches

1.4 OPERATION AND MAINTENANCE

A. The CONTRACTOR shall submit operation and maintenance information in accordance with Section 01730 - Operation and Maintenance Information. The submittal shall be supplemented by written text and shall include the following:

1. Operating procedures.
2. Maintenance procedures.
3. Manufacturers parts list, illustrations, assemblies, and diagrams.

1.5 CONTRACT SUBMITTALS

A. The CONTRACTOR shall submit shop drawings of the service section and switchboards in accordance with Section 01300 – Contractor Submittals.

B. After review by the RESIDENT ENGINEER, the shop drawings of the service section shall be submitted to the utility company for approval before fabrication.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Materials: All materials and equipment furnished under this Section shall be new; they shall be in accordance with the requirements of the Institute of Electrical and Electronic Engineers, the National Electrical Manufacturer's Association, the National Fire Protection Association, and the National Electrical Code. Where available, all materials and equipment shall bear the Underwriters' Laboratories label.

B. Equipment: All equipment for the same purpose shall be of the same make.

C. Standard Products: Materials and equipment submitted for approval shall be the cataloged products of companies regularly engaged in the manufacture of such items, of the latest standard design that conforms to the specification requirements, and shall essentially duplicate material and equipment that has been in satisfactory use for several years.

2.2 SWITCHBOARD

A. Indoor Construction: Indoor construction shall be of the universal frame type using die-formed welded and bolted members. Enclosing panels shall be 14-gage steel, bolted in place. In addition, indoor construction shall conform to the following:

1. Switchboard shall be totally enclosed, NEMA 1, gasketed.

2. Bus bar shall be copper fully insulated. Copper shall be silver plated at joints. Bus bars shall be braced for short circuits of 65,000 A minimum, or more if so indicated. A full length copper ground bus bar shall be provided at the bottom of the switchboard enclosure.

B. Floor-Standing Switchboards: Floor-standing distribution switchboards, and main service switchboard, shall be cataloged products of the main circuit breaker manufacturer. Switchboard shall be shipped fully assembled and tested.

2.3 MAIN SERVICE SWITCHBOARD

A. General: The main service switchboard shall consist of a free-standing assembly which complies with the Contract Documents, with particular reference to the provisions of the above paragraph entitled, "Switchboard." The main switchboard shall be UL listed as suitable for utility type service entrance complying with the requirements of the San Diego Gas and Electric (SDG&E) utility, 480/277 V 3-phase, 4 wire.

B. Switchboard: Switchboard shall be front accessible. Switchboard shall be constructed to accommodate additional distribution sections. The switchboards shall consist of the sections described in the following paragraphs.

C. Service Section: The service section shall consist of an underground pull compartment and a revenue metering compartment all to SDG&E utility requirements. Components such as meter bases, busses, lugs, auxiliaries, shall be provided.

D. Main Circuit Breaker Compartment:

1. The main circuit breaker compartment's circuit breaker unit shall have the ratings indicated. Service neutral shall be brought to a terminal in the main circuit breaker compartment. A disconnecting link shall be provided in a bus bar connection between the neutral terminal and the switchboard ground bus.

2. The circuit breaker shall have protective features with capability of selective tripping which can be used to provide overcurrent protection from overloads, short circuits, and ground faults. In addition, the Main Circuit Breaker shall be equipped with a shunt trip. A Ground Fault Relay shall be provided as indicated.

E. The circuit breaker shall be individually mounted stationary of the size and type indicated.

F. Manufacturer: The main switchboard shall be manufactured by Cutler-Hammer Pow-R-Line C, General Electric AV-Line or equal by Square D, Siemens or equal.

2.4 SWITCHBOARD INSTRUMENTS

A. Indicating Meter: Indicating meter shall be per SDG&E utility requirements.

B. Requirements: The instrument transformer shall comply with ANSI/IEEE C37.20-Switchgear Assemblies Including Metal-Enclosed Bus and shall have standard accuracy for relaying with the burdens imposed. Mechanical and thermal ratings of current transformers shall be coordinated with short circuit ratings of related circuit breakers. Potential

transformers shall be mounted on a disconnecting rack and shall have primary fuse protection.

C. Relays: The protective relays shall be mounted within draw-out cases; current measuring circuits shall be fitted with jacks to short circuit current transformers when relays are withdrawn. The relays shall have means for testing measuring circuitry with the relay in place. The relays shall be solid state type and the product of the switchboard manufacturer.

2.5 OVERCURRENT PROTECTIVE DEVICES

A. Circuit Breakers with a Frame Size of 1200 A and larger: Circuit breakers with a frame size of 1200A and larger shall be insulated case power type with solid state interchangeable over-current trip unit and line current sensors. Trip units shall have adjustable long time tripping in the range of 60 to 100 percent of continuous rating, instantaneous tripping adjustable in the range of 300 to 1000 percent of continuous rating, and ground fault tripping adjustable in the range of 20 to 60 percent of continuous rating, with adjustable delay of approximately 5 to 40 cycles. Circuit Breakers with a frame size of 225 A and higher shall be 100% rated.

B. Provide circuit breakers equipped with shunt trip where indicated.

C. Provide electrically-operated circuit breakers where indicated.

C. The interrupting capacity of all circuit breakers shall be a minimum of 65,000 RMS symmetrical amperes.

PART 3 -- EXECUTION

3.1 INSTALLATION - GENERAL

A. General: All electrical equipment shall be installed securely in place. Equipment shall be mounted parallel and perpendicular to the walls, floors, and ceilings.

B. Anchors: All anchors and fasteners shall be types designed for the intended purpose and shall be capable of adequately, safely, and permanently securing the material in place. Generally, screws shall be used on wood surfaces, masonry anchors in concrete or brick, toggle bolts on hollow walls, machine screws, bolts, or welded studs on steel. Nails shall be used only for temporary attachment or support.

C. Omissions or Conflicts: Omissions or conflicts on the Drawings or between Drawings and Specifications shall be brought to the attention of the RESIDENT ENGINEER for clarification before proceeding with the work.

D. Preparation: The CONTRACTOR shall make all necessary provisions throughout the site to receive all equipment as construction progresses and shall furnish and install adequate backing, supports, inserts, and anchor bolts for the hanging and support of all electrical cabinets, enclosures, conduits, panelboards, and switches, and shall furnish and install sleeves through walls, floors, or foundations where electrical lines are required to penetrate.

E. Leveling: Floor-standing equipment shall be leveled with shims as required to maintain horizontal surfaces within 1/32 inch per horizontal foot; after leveling, equipment shall be anchored, then grouted so that no space exists between concrete and equipment support beams.

3.2 PREPARATION AND FINISH SYSTEMS

A. Equipment cabinets and enclosures furnished under this Section shall have a finish that conforms to Section 16480 - Motor Control Center.

** END OF SECTION ***

SECTION 16421

SURGE ARRESTORS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide surge arrestors for the protection of electrical power equipment against surges caused by lightning or switching, complete and operable, in accordance with the Contract Documents.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 16050 Basic Electrical Materials and Methods
2. Section 16400 Low Voltage Electrical Service and Distribution

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the Work of this Section:

1.	ANSI C 62.1	Surge Arrestors for AC Power Circuits
2.	NEMA LA 1	Surge Arrestors
3.	UL 1449	Clamp Voltage Documentation
4.	NFPA 70	National Electrical Code

1.4 CONTRACTOR SUBMITTALS

A. Shop Drawings: The CONTRACTOR shall submit shop drawings and catalog data in accordance with Section 01300 – Contractor Submittals.

1. Catalog literature for arrestors proposed for installation; submittal shall identify materials, ratings, loss, dimensions.

2. Shop drawings showing arrestor mounting.

3. Certified test data and individual test data for arrestors.

4. Operation and maintenance data.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Secondary Service Suppressors for Low Voltage Panels:

1. Surge protective devices shall be installed at designated panels indicated on the single line diagrams.

2. Wye systems shall have suppression elements between each phase conductor and the system neutral, between each phase conductor and the system ground and between the neutral conductor and ground.

3. Visible indication of proper suppressor connection and operation shall be provided.

4. The surge protective device shall be equipped with an audible alarm that shall actuate when any part of the surge circuitry has been damaged. A silence button shall be provided with the alarm.

5. The suppressor shall exhibit Sine Wave Tracking circuitry. The surge suppressor shall have suppression circuitry that is field replaceable without disturbing the conduit or enclosure.

6. Suppressors shall meet or exceed the following:

   a. Minimum single impulse current rating (L-N + L-G): 80,000 A per phase.

   b. UL clamping voltage shall not exceed the following:

Voltage	L-N	L-G	N-G
120/208	400V	400V	400V
277/480	800V	800V	800V

7. Suppressors shall consist of solid-state components and operate bi-directionally. The manufacturer of the surge panel shall offer either a surface or flush cover, as required by the job conditions.

8. Maximum continuous operating voltage of the suppressor shall be greater than 110% of the nominal system voltage.

9. Manufacturers, or equal

   a. EFI Electronics Corporation, Titan BP Series.
   b. Phoenix Contact, Trabtech.
   c. Current Technology, DPA Series.
   d. MCG Surge Protection

2.2 MOUNTING

A. The manufacturer shall provide all the necessary mounting hardware.

2.3 FACTORY TESTS

A. The manufacturer shall provide copies of design test data on the arrestor provided showing that the arrestors are in compliance with ANSI C62.1-Surge Arrestors for AC Power Circuits.

B. The following tests shall be made on each arrestor intended for the service entrance in conformance with ANSI 62.1:

1. Power-frequency spark-over.
2. Radio influence voltage.
3. Sealing.

C. The design test data and the individual arrestor test results shall be certified and submitted.

2.4 WARRANTY

A. The surge arrestor/suppressor manufacturer shall warrant the surge protective devices and supporting components, against defects in material and workmanship for a period of 5 years. The warranty shall include cost of component replacement, labor, travel and living expenses, all at no increased cost to the OWNER.

PART 3 -- EXECUTION

3.1 SERVICE ENTRANCE

A. The CONTRACTOR shall install one primary suppressor at each utility service entrance or as indicated on the single line diagram. Installation shall be performed in accordance with the manufacturer's installation instructions.

B. Conductors between the suppressor and point of attachment shall be at least #6 AWG stranded copper conductor or larger. The conductors shall be kept as short and straight as possible. The lead length of connecting conductors shall be within 36 inches.

C. The suppressor's ground shall be bonded to the service entrance ground.

*** END OF SECTION ***

SECTION 16431

~~SHORT CIRCUIT STUDY~~
PROTECTIVE DEVICE COORDINATION AND ARC FLASH ANALYSIS REPORT

PART 1--GENERAL

1.1 WORK OF THIS SECTION:

A. This section specifies that the Contractor subcontract an independent full member NETA Engineering and Study Firm / Testing Firm to prepare:

1. Electrical equipment short circuit study (SCS) for the new equipment being installed.

2. Protective device coordination study (PDCS) report for the new and existing equipment being installed in the Tierrasanta Pump Station

3. Arc flash analysis study report for the new and existing equipment being installed in the Tierrasanta Pump Station

B. The Testing Firm shall be responsible for the electrical testing described therein.

C. The Short Circuit and Protective Device Coordination Report shall include analysis including Utility Company equipment that affect the installed equipment's short circuit ratings, protective device ratings and protective device settings.

D. Report shall also include analysis of the equipment's short circuit ratings, protective device ratings and protective device settings affected by the installed equipment.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

1.	IEEE 141	Recommended Practice for Electric Power Distribution for Industrial Plants
2.	IEEE 242	Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
3.	NETA ATS	Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems, 1999

1.3 SCHEDULE

A. The report shall be completed, submitted to the Engineer for acceptance and reworked to include the Engineer's comments and corrections, as required. The report shall be approved by the Engineer prior to purchase and fabrication of electrical equipment including switchgear and switch boards.

1.4 CONTRACT SUBMITTALS

A. The report specified in this Section shall be provided in accordance with Section 01300 – Contractor Submittals.

PART 2--PRODUCTS

2.1 REPORT

A. The product shall be a certified report summarizing the short circuit and coordination study and conclusions or recommendations which may affect the integrity of the electric power distribution system. As a minimum, the report shall include the following:

1. The equipment manufacturer's information used to prepare the study.

2. Power Utility Company system information applicable to the project.

3. Short circuit calculations listing short circuit levels at each bus. Provide a sketch of the bus and use both the project term and the bus-code-name to identify the bus, branches, sources, loads. Base the system on the Project One-Line diagram.

4. Coordination study time-current curves including the instrument transformer ratios, model numbers of the protective relays, and the relay settings associated with each breaker.

5. Comparison of short circuit duties of each bus to the interrupting capacity of the equipment protecting that bus.

6. Data used as input to the report that includes cable impedances, source impedances, equipment ratings for the equipment being purchased for the project, etc.

7. Assumptions made during the study.

PART 3--EXECUTION

3.1 INSTALLATION - GENERAL

A. Provide a short circuit and coordination study on the electrical power distribution system as specified and as described in Section 6.1 of NETA ATS. The studies shall be performed in accordance with IEEE Standards 141 and 242 and shall utilize the ANSI method of short circuit analysis in accordance with ANSI C37.010.

B. The studies shall be performed using actual equipment data for both existing and new equipment. The coordination study shall use the data from the same manufacturer of protective relay devices as being provided by the electrical equipment manufacturer.

C. For new equipment, the Contractor shall provide copies of final reviewed equipment submittals upon request by the Study Firm.

3.2 QUALIFICATIONS

A. The short circuit and coordination report shall be performed by an independent Testing Firm. The studies shall be signed by the professional electrical engineer responsible for the studies and registered to practice engineering in the state in which the project is located.

3.3 SHORT CIRCUIT STUDY

A. The Contractor shall be responsible to obtain and verify all data needed to perform the study for both new and existing equipment. As a minimum, the short circuit study shall include the following:

B. One-Line Diagram:

1. Location and function of each protective device in the system, such as relays, direct-acting trips, fuses, etc.

2. Type designation, current rating, range or adjustment, manufacturer's style and catalog number for all protective devices.

3. Power, voltage ratings, impedance, primary and secondary connections of all transformers including the utility transformers.

4. Type, manufacturer, and ratio of all instrument transformers energizing each relay.

5. Nameplate ratings of all motors and generators with their subtransient reactances. Transient reactances of synchronous motors and generators and synchronous reactances of all generators.

6. Sources of short circuit currents such as utility ties, generators, synchronous motors, and induction motors.

7. Significant circuit elements such as transformers, cables, breakers, fuses, reactors, etc.

8. Emergency as well as normal switching conditions, as applicable.

9. The time-current setting of existing adjustable relays and direct-acting trips, as applicable.

C. Impedance Diagram:

1. Available MVA, voltage, and impedance from the power utility company.

2. Local generated capacity impedance.

3. Bus impedance.

4. Transformer and/or reactor impedances.

5. Cable impedances.

6. Equipment impedances.

7. System voltages.

8. Grounding scheme for the project: resistance grounding, solid grounding, or no grounding.

D. Calculations:

1. Determine the paths and situations where short circuit currents are the greatest.

2. Study shall address bolted faults and calculate the 3-phase and line-to-ground short circuits of each case.

3. Calculate the maximum and minimum fault currents.

3.4 PROTECTIVE DEVICE COORDINATION STUDY

A. As a minimum, the coordination study for the power distribution system shall include the following on 5-cycle, log-log graph paper:

1. Time-current for each protective relay or fuse showing graphically that the settings will provide protection and selectivity within industry standards. Each curve shall be identified, and the tap and time dial settings shall be specified.

2. Time-current curves for each device shall be positioned to provide for maximum selectivity to minimize system disturbances during fault clearing. Where selectivity cannot be achieved, the Engineer shall be notified as to the cause.

3. Time-current curves and points for cable and equipment damage.

4. Circuit interrupting device operating and interrupting times.

5. Indicate maximum fault values on the graph.

6. Sketch of bus and breaker arrangement.

3.5 ARC FLASH ANALYSIS

A. The Contractor shall be responsible to obtain and verify all data needed to perform the study. The arc flash analysis study shall include the following IEEE Standard 1584 nine step analysis process:

1. Collect system and installation data.
2. Determine modes of operation.
3. Determine bolted fault current.
4. Determine arc fault current.
5. Determine protective device characteristic and arc fault duration.
6. Document system voltages and equipment class.
7. Select working distances.
8. Calculate incident energy.
9. Calculate the arc flash protection boundary.

3.6 IMPLEMENTING PDCS SETTINGS

A. The Testing Firm shall implement the protective device coordination study settings on new and existing equipment as required, based on the Engineers accepted Protective Device Coordination Report specified herein and submit a final amended report of the Record As-Built electrical equipment protective device settings subsequent to start-up and testing.

B. The Testing Firm shall work with the Contractor and the Study Firm for implementing the Arc Flash Hazard sign installation requirements for electrical equipment as specified in NEC Article 110.16 Flash Protection and NFPA 70E.

*** END OF SECTION ***

SECTION 16480

MOTOR CONTROL CENTER

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The Contractor shall provide all motor control centers (MCCs) complete and operable, in accordance with the Contract Documents

B. If motors provided are different from those indicated, then the installation of raceway, conductors, starters, overload elements, and branch circuit protection shall be adjusted as required to control and protect the motor.

C. The MCC shall be designed, tested and assembled in accordance with the applicable standards of IEEE, NEMA and ANSI.

D. The equipment shall meet the seismic requirements in 11000 - Equipment General Provisions.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 11000 Equipment General Provisions
2. Section 11033 Variable Frequency Drives
3. Section 16050 Basic Electrical Materials and Methods
4. Section 16290 Power Monitors
5. Section 16485 Local Control Panels
6. Section 16950 Electrical Tests

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Unless otherwise specified, the current editions of the following apply to the Work of this Section:

1.	ANSI	Standard Techniques Dielectric Tests.
2.	NEMA AB-1, ICS-1, ICS-2	National Electrical Manufacturers Association.
3.	NFPA 70	National Electrical Code.
4.	UL 489	Molded Case Circuit Breakers
5.	UL 845	Motor Control Centers
6.	UL 508	Industrial Control Equipment

1.4 CONTRACTOR SUBMITTALS

A. The Contractor shall submit shop drawings of all MCCs and components in accordance with the requirements of Section 01300 – Contractor Submittals and Section 16050 - Basic Electrical Materials and Methods.

B. Complete data shall be submitted with the MCC shop drawings. Submittals with drawings not meeting this requirement will not be reviewed further and will be rejected. The shop drawings shall include the following as a minimum:

1. Enclosure NEMA rating and color.

2. Horizontal and vertical bus ampacities, voltage rating and interrupting capacity. Include materials of construction.

3. Ground bus size and material of construction.

4. Conduit entrance provisions.

5. Main incoming line entry provision (top or bottom).

6. Nameplate engraving legends.

7. All circuit breaker types, frames and settings.

8. All starter NEMA sizes, auxiliary contact provisions, coil voltage.

9. Reduced Voltage Solid-State Starter rating and technical data

10. Power Monitors technical data per specification section 16290

11. Relays, timers, pilot devices, control transformer VA and fuse sizes.

102. Elementary schematic ladder diagrams for each compartment. Custom schematics shall be furnished. MCCs shall be constructed and submitted in strict accordance with NEMA Class II S, Type B construction and diagrams shall include all remote devices.

113. Short circuit rating of the complete assembly.

124. Replacement parts lists and operation and maintenance procedures.

135. Seismic design certification of the anchoring system in accordance with 11000 - Equipment General Provisions.

146. Time-current curves for all protective devices.

1.5 QUALITY ASSURANCE

A. All materials shall be inspected in accordance with Section 16050 - Basic Electrical Materials and Methods.

B. MCCs shall be stored in a clean, dry space. Factory wrapping shall be maintained, or an additional heavy plastic cover shall be provided to protect units from dirt, water, construction debris, and traffic. Storage space shall be heated or MCC space heaters shall be energized.

C. MCCs shall be handled carefully to avoid damage to MCC components, enclosure, and finish.

1.6 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. Manufacturer shall have the ability for service maintenance to be available to the City within a two hour period under emergency situations.

1.7 WARRANTY

A. The system warranty shall be not less than one year after the date of Substantial Completion and shall include all costs for repair, parts, travel and living expenses, and labor.

PART 2 - PRODUCTS

2.1 GENERAL

A. MCCs shall conform to the standards for NEMA Class IIS, type B assemblies.

2.2 DESIGN, CONSTRUCTION, AND MATERIAL REQUIREMENTS

A. The MCC shall be 600-V class suitable for operation on a three-phase, 60-Hz system. The system operating voltage and number of wires shall be as indicated on the drawings.

B. A continuous copper ground bus shall be provided for full width of the MCC line-up.

C. Circuit breakers shall be provided with shunt trip capability where shown on the contract drawings.

C. Structural members shall be fabricated of not less than 12 gauge steel and side and top panels and doors shall be not less than 14 gauge steel.

D. The main horizontal copper bus shall be shielded front and rear with full width and height polyester barrier provided through each section and shall be supported by bus supports. Sections shall have wire gutters and split terminal blocks to permit easy withdrawal.

E. A separate vertical wireway shall be provided adjacent to each vertical unit, and shall be covered by a hinged door. Each individual unit compartment shall be provided with a

side barrier to permit pulling wire in the vertical wireway without disturbing adjacent unit components.

F. Enclosures shall be NEMA Type 1, gasketed. Compartment door shall be interlocked with compartment circuit breakers. The interlock shall be fitted with a maintenance override.

G. Motor control sections shall be nominally 90 inches high and 20 inches (minimum) deep for front-mounted units, unless otherwise indicated.

H. The main horizontal bus shall be copper with a capacity as shown on the drawings or a minimum of 2000 A, but in no case less than the main lug or main breaker frame sizes. Main bus shall be copper, tin or silver-plated, enclosed in an isolated compartment.

I. The vertical bus in each section shall consist of a single silver-plated copper conductor per phase with a current capacity of not less than 300 A. The vertical bus shall be completely isolated and insulated, and shall extend the full height of the section wherever possible.

J. All power buses shall be braced to withstand 65,000 A.

K. Feeder breakers and motor circuit protectors shall have a withstand rating of not less than 65,000 amp symmetrical interrupting capacity. Current limiters will be acceptable, only as part of a motor starter, to meet this requirement.

L. Spaces designated as "SPACE", "FUTURE" or "BLANK" shall include blank hinged doors and vertical bus bars.

M. The control center shall be of size to accommodate the equipment, but the overall length must be as shown where critical with respect to the allotted space depicted on the drawings.

N. Each control unit (including spares, spaces and blanks), light and device shall be identified by a small nameplate. Identification shall include circuit number as indicated on the Drawings.

O. Control units inside compartments shall be clearly identified with tags or stencil markings.

P. Finish for MCC shall be ANSI 61. The panels shall be given two coats of primer inside and out and two coats of enamel finish. External colors other than ANSI 61 will not be acceptable.

Q. Circuit breaker disconnect operators shall be capable of accommodating three padlocks for locking in the "open" position.

S. Motor circuit breaker or MCP shall be fitted with a "C" contact wired to terminals to be used for remote indication of device position.

T. Where "L" or "U" shaped MCC layouts are shown, corner compartments shall have similar current and short circuit ratings as functional compartments.

U. MCCs shall not be designed to exceed the space requirements indicated on the Contract Drawings, including spaces, spares and future compartments. MCCs shall be subject to rejection for exceeding the lengths indicated.

V. Equipment within the MCC may be rearranged at the discretion of the manufacturer, providing the MCC includes not less than the spares, space and future provisions indicated.

W. Manufacturers who do not meet at least the above requirements will be rejected.

2.3 MOTOR STARTERS

A. Motor starters shall be mounted in standard MCC assemblies, arranged essentially as indicated.

B. Each motor starter unit shall consist of a combination magnetic contactor and short circuit protective device, all mounted in a completely enclosed cubicle. Short circuit protective device shall be an instantaneous, magnetic only circuit breaker, Cutler-Hammer Type HMCP, or equal. All circuit breakers provided as part of a motor starter unit shall be capable of being padlocked in the open position. Reset of thermal overload elements shall be possible with unit door closed. Three phase overload trip units shall be furnished to suit the full load current of the equipment installed. Overload trip unit shall be adjusted as required for power factor correction capacitors.

C. Magnetic starters shall have auxiliary contacts as required by electrical motor control diagrams including one spare, N-O, and N-C contacts, as a minimum. The combination motor starters shall be drawout-type for size 5 and below. The fixed-type unit assembly shall be so constructed that it can be easily removed from its panel after disconnecting the wires to the terminal block and withdrawing from the primary bus. Removal of a unit assembly shall be possible without rear access and without disturbing any other unit in the MCC.

D. Each starter unit shall have its own control power transformer. It shall have a 115-V grounded secondary. One secondary fuse and two primary fuses shall be provided. Unit control power transformers shall be sized to accommodate the control devices indicated on the control schematics plus 25 percent. Local control devices shall be mounted independently of the cover door. All starters shall have a local "red" running lamp, a "green" off light to indicate the presence of control power when the motor is not running. Starters shall be provided with elapsed time meters, hand/off/auto selector switches, and other devices, as specifically indicated. All cubicle control wires shall be terminated at a disconnecting (pull-apart) terminal block at the cubicle.

E. The MCC manufacturer shall be responsible for identifying each control wire within each motor starter unit with wrap-around permanent plastic markers. Each control wire shall be identified at both ends.

F. Full voltage motor starter units shall be NEMA Size 1 or larger. The combination starters shall be rated for a minimum 65,000 RMS symmetrical amperes.

G. Motor starters shall be designed to NEMA standards. Starters designed to IEC standards or with dual IEC/NEMA ratings will not be acceptable, either as part of any MCC, as remote starters, or as part of an equipment package.

H. Two-speed starters shall be of the two-winding type.

I. Each MCC shall be fitted with the manufacturer's nameplate which shall include the NEMA Standard electric rating and other pertinent data, including sales order number, date of manufacturer, and place of manufacture.

J. Reduced voltage starters shall be of the solid state type with a full bypass starter, Cutler-Hammer S811 Series, or equal.

K. Reduced Voltage Motor Starter Type S811:

1. Controller shall be Cutler-Hammer type S811 or equal.

2. The solid-state reduced-voltage starter shall be UL and CSA listed. The solid-state reduced-voltage starter shall be an integrated unit with power SCRs, logic board, paralleling bypass contactor, and electronic overload relay enclosed in a single molded housing

3. The SCR-based power section shall consist of six (6) back-to-back SCRs and shall be rated for a minimum peak inverse voltage rating of 1500 volts PIV

4. Units using triacs or SCR/diode combinations shall not be acceptable

5. Resistor/capacitor snubber networks shall be used to prevent false firing of SCRs due to dV/dT effects

6. The logic board shall be mounted for ease of testing, service and replacement. It shall have quick disconnect plug-in connectors for current transformer inputs, line and load voltage inputs and SCR gate firing output circuits

7. The logic board shall be identical for all ampere ratings and voltage classes and shall be conformally coated to protect environmental concerns

8. The paralleling run bypass contactor shall energize when the motor reaches 90 percent of full speed and close/open under one (1) times motor current

9. The paralleling run bypass contactor shall utilize an intelligent coil controller to limit contact bounce and optimize coil voltage during varying system conditions

10. Digital interface module mounted on the face of the S811 shall be used to program the soft starter. Display shall include six line LED readout. Monitoring parameters shall include line currents, pole currents, pole voltages, number of starts, and DC control voltage. Soft starter shall display motor status and the previous 5 fault conditions

11. Starter shall be provided with electronic overload protection as standard and shall be based on inverse time-current algorithm. Overload protection shall be capable of being disabled during ramp start for long acceleration loads via digital interface module

12. Overload protection shall be adjusted via the device keypad and shall have a motor full load ampere adjustment from 30 to 100% of the maximum continuous ampere rating of the starter

13. Starter shall have selectable overload class setting of 5, 10, 20 or 30 via a DIP switch setting on the device keypad

14. Starter shall be capable of either an electronic or mechanical reset after a fault

15. Units using bimetal overload relays are not acceptable

16. Overtemperature protection (on heat sink) shall be standard

17. Starters shall provide protection against improper line-side phase rotation as standard. Starter will shut down if a line-side phase rotation other than A-B-C exists. This feature can be disabled via digital interface module

18. Starters shall provide protection against a phase loss or unbalance condition as standard. Starter will shut down if a 50% current differential between any two phases is encountered. This feature can be disabled via digital interface module

19. Start shall provide protection against a motor stall condition as standard. This feature can be disabled via digital interface module

20. Starter shall provide protection against a motor jam condition as standard. This feature can be disabled via digital interface module

21. Starter shall be provided with a Form C normally open (NO), normally closed (NC) contact that shall change state when a fault condition exists. Contacts shall be rated 60 VA (resistive load) and 20 VA (inductive load). In addition, an LED display on the device keypad shall indicate type of fault (Overtemperature, Phase Loss, Jam, Stall, Phase Reversal and Overload)

22. The following control function adjustments from digital interface module are required:

    a. Selectable Torque Ramp Start or Current Limit Start
    b. Adjustable Kick Start Time: 0–2 seconds
    c. Adjustable Kick Start Torque: 0–85%
    d. Adjustable Ramp Start Time: 0.5–180 seconds
    e. Adjustable Initial Starting Ramp Torque: 0–85%
    f. Adjustable Smooth Stop Ramp Time: 0–60 seconds.

23. Units enclosed in motor control centers shall be of the same manufacturer as that of the circuit breaker and motor control center for coordination and design issues

24. Maximum continuous operation shall be at 115% of continuous ampere rating Pump Control Option – Provide control algorithm for pump start-up and shut down sequences. Control algorithm shall reduce the potential for water hammer in a centrifugal pump system. Upon a start command, the speed of the motor is increased, under the control of the IT Soft Starter microprocessor, to achieve a gentle start. After the speed has reached its nominal value, the bypass contactors close. Upon a stop command, the bypass contactors are opened and the motor speed is decreased in a tapered manner, to gradually slow the flow until the motor is brought to a stop. The start and stop ramp times are user adjustable and are to be set for the application requirements. The pump control option shall be factory installed

L. Variable Frequency Drives:

1. Variable Frequency Drives installed within the MCC lineup shall be of the same make as MCC manufacturer.

2. Refer to Section 11033 – Variable Frequency Drives for requirements.

2.4 MAIN AND FEEDER CIRCUIT BREAKERS (480 V)

A. Circuit breakers having a frame size of 150 A or less shall be molded-case type with thermal magnetic non-interchangeable, trip-free, sealed trip units.

B. Circuit breakers with a frame size of 225 A and larger shall be molded case with RMS sensing electronic trip elements.

D. The interrupting capacity of all main, and feeder branch circuit breakers shall be a minimum of 65,000 RMS symmetrical amperes.

E. Main, and feeder branch circuit breakers with a frame size of 225 A and higher shall be 100% rated.

F. Provide circuit breakers equipped with shunt trip where indicated.

2.5 CONTROL DEVICES

A. Products of the same type shall be of the same make. This requirement applies to all control devices, and insofar as practical, to equipment manufactured on a production basis. It also applies without exception to equipment custom fabricated for this Project.

B. Pushbuttons, lights, and selector switches shall be of the same manufacturer as the MCC. Control devices shall be heavy duty, oil tight type. Contact rating shall be 10 A.

C. All control devices shall be in conformance of the requirements of Section 16485 – Local Control Panels.

D. Provide solid-state type metering where indicated. Include CTs and PTs of ratios as indicated or required. Solid state metering shall be Cutler-Hammer "PXM2260" or equal. See section 16290 – Power Monitors for additional information.

2.6 SPARE PARTS

A. The Contractor shall furnish loose one unit control transformer of each size furnished in magnetic starters installed, three bezels of each color installed for pilot indicators, one dozen panel lamps, and one dozen control fuses of each size installed.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall install the MCC in accordance with the manufacturer's published instructions. Conduit installation shall be coordinated with Manufacturer's as-built drawings so that all conduit stub-ups are within the area allotted for conduit. Conduit shall be stubbed up in the section that contains the devices to which conductors are terminated.

3.2 INSTALLATION

A. MCCs shall be installed on 4-inch concrete pads. After leveling and shimming, anchor MCC to concrete pad, and grout in place so that no space exists between the pad and support beams.

B. The Contractor shall:

1. Torque all bus bar bolts to manufacturer's recommendations; tighten all sheet metal and structure assembly bolts

2. Adjust all MCP devices to the instantaneous trip setting position recommended for the actual horsepower and full load amps of the motor. Verify that overload devices are proper for equipment installed; make necessary changes in overload devices as required for motors having power factor correcting capacitors

3. After equipment is installed, touch up scratches, and verify that nameplate, and other identification is accurate and in compliance with these requirements

4. Furnish and install high voltage switchboard matting in front of the MCC. The mat shall be 1/4" thick and 36" wide and shall be Model M36 as manufactured by W.H. Salisbury & Co., or equal

3.3 FACTORY TESTS

A. All MCCs, and their components shall be given manufacturer's standard electrical and mechanical production tests and inspections with complete test reports submitted for approval. The tests shall include, electrical continuity check, dielectric tests for each circuit, and inspection for proper functioning of all components, including controls, protective devices, metering, and alarm devices. The factory test reports shall be submitted with the production shop drawings.

3.4 FIELD TESTING

A. Field tests shall be as specified in Section 16950 – Electrical Tests.

B. Visual and mechanical inspections by the Contractor shall include the following:

1. Inspect for physical damage, proper anchorage and grounding
2. Verify overload heaters with motor full load current for proper size
3. Check tightness of bolted connections
4. Adjust solid-state starter ramp up and ramp down time settings in accordance with Mechanical equipment requirements

C. Electrical Tests

1. Insulation tests shall include the following:

   a. Measure insulation resistance of each bus section phase to phase and phase to ground for one minute. Test voltage and minimum acceptable values in accordance with manufacturer's recommendations.

   b. Measure insulation resistance of each starter section phase to phase and phase to ground with the starter contacts closed and the protective device open. Test voltage and minimum acceptable values in accordance with manufacturer's recommendations.

   c. Measure insulation resistance of each control circuit with respect to ground

2. The Contractor shall verify proper operation of control logic in all modes of control.

*** END OF SECTION ***

SECTION 16485

LOCAL CONTROL PANELS

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The Contractor shall provide local control panels (LCPs) complete and operable, in accordance with the Contract Documents.

B. The equipment shall meet the seismic requirements in 11000 - Equipment General Provisions, and 16050 – Basic Electrical Materials And Methods.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 13300 Instrumentation and Control
2. Section 13370 Control Panels
3. Section 16050 Basic Electrical Materials and Methods

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. LCPs shall comply with the requirements of NEC, NEMA, and UL.

1.4 CONTRACTOR SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01300 - Submittals and Section 16050 - Basic Electrical Materials and Methods.

B. Ladder diagrams and written descriptions explaining ladder diagrams operation and system operation shall be submitted.

C. The Contractor shall submit catalog cuts of all control equipment including enclosures, overcurrent devices, relays, pilot devices, terminations, and wire troughs.

PART 2 -- PRODUCTS

2.1 GENERAL

A. The Contractor shall provide LCPs to satisfy the functional requirements in other Sections and as indicated on the Drawings. Each LCP shall be fabricated with UL label components. Panels not specifically provided in other Sections shall be provided under this Section. LCPs shall be wired as provided in this Section.

B. The LCP controls shall be 120 V maximum. Control conductors shall be provided in accordance with Section 16050 - Basic Electrical Materials and Methods.

C. Each LCP shall be provided with identified terminal strips for the connection of all external conductors. Provide sufficient terminal blocks to connect 25% additional conductors for future use. Termination points shall be identified in accordance with accepted shop drawings. The LCPs shall be the source of power for all 120 VAC solenoid valves interconnected with the LCPs. All equipment associated with the LCPs shall be ready for service after connection of conductors to equipment, controls, and LCPs. Terminal strips for AC and DC signal wires shall be separated from each other.

D. All internal wiring shall be factory-installed and shall be contained in plastic wireways having removable covers. Wiring to door-mounted devices shall be extra flexible and be anchored to doors using wire anchors cemented in place. Exposed terminals of door-mounted devices shall be guarded to prevent accidental personnel contact with energized terminals. DC and AC control signal wires shall be installed in separate wireways.

E. Enclosures:

1. In finished rooms, enclosures shall be NEMA 12 painted steel enclosures with ANSI 61 exterior and white interior. Enclosures shall be Hoffman or equal.

2. In all other non-hazardous areas enclosures, shall be NEMA 4X Type 304 stainless steel (before modifications) with brushed finish. Where possible, penetrations shall be made in such a manner to maintain the NEMA 4X rating. If this is not possible, the penetrations shall be made in such a manner to minimize entry of foreign materials into the enclosure. Enclosures shall be Hoffman or equal.

3. Enclosures shall be wall mounted, freestanding, pedestal-mounted, or equipment skid-mounted, as indicated. Internal control components shall be mounted on a removable mounting pan. The mounting pan shall be finished white. Enclosures 3 feet wide or more shall include a fluorescent light fixture, a light switch, and duplex receptacle, all controlled by 15 A circuit breaker.

F. The main feeder disconnect shall have a door-mounted handle unless otherwise indicated.

G. Identification of panel-mounted devices, conductors, and electrical components shall meet the requirements specified in Section 16050 - Basic Electrical Materials and Methods.

H. All panel-mounted devices shall be mounted a minimum of 3 feet above finished floor elevation.

2.2 LCP COMPONENTS

A. Pushbuttons, selector switches, and pilot lights shall be of the heavy-duty, oil-tight type sized to 30 mm. Miniature style devices are not acceptable. Devices shall be as manufactured by Square-D, Allen-Bradley, or equal.

1. Lens colors shall be red for "run," "open," or "on"; green for "stopped," "closed," or "off;" amber for alarm.

2. Pilot lights shall be full voltage LED cluster style.

3. Provide hazardous location type pilot devices in classified locations.

B. Relays shall be 3 PDT with 10 A contacts, plug-in type using rectangular blades and provided with sockets for screw-type termination and hold-down clips. Relays shall be as manufactured by Square D, Potter Brumfield, or equal.

C. Elapsed time meters shall be non-resettable type, read to a maximum of 99999.9 hours and shall be as manufactured by Eagle Signal, Westinghouse, or equal.

D. Current-to-current converter/isolators shall be 4-20 mA input, 4-20 mA output for operation from 120 VAC power, and shall be by Moore, A.G.M., or equal.

E. Process alarm relays shall have a 4-20 mA input and two independent SPST contact outputs as manufactured by A.G.M., or equal. Power input shall be 120 VAC.

F. Digital indicators shall have 4-20 mA input and shall display the signal in process units. 0-100% as a displayed signal shall only be acceptable to indicate speed. Indicators shall be as manufactured by Newport, Red Lion, or equal for operation from 120 VAC. Splash-proof covers shall be provided in NEMA 4X panels, and viewing windows shall be provided in NEMA 7 panels.

G. Time delay relays shall be combination on delay and off delay (selectable) with adjustable timing ranges. Time delay relays shall be Square D JCK70. Provide socket with screw terminal connections and retaining strap. Similar shall be by ATC, or equal.

H. Alternating/Duplexing relays shall select alteration or continuous operation of either load. Relay shall be DPDT output relay rated for 7-amps inductive at 120VAC, and rotary switch for alternating or continuious mode. Manufactured by ABB-SSAC type ARP series or equal.

2.3 FACTORY TESTING

A. Each LCP shall be factory assembled, and tested for sequence of operation before delivery to the jobsite. The OWNER reserves the right to witness factory tests.

2.4 SPARE PARTS

A. The Contractor shall furnish a minimum of 10% spare lamps (minimum 2) and one spare lens for each color pilot lamp in each panel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. LCPs shall be installed in accordance with Section 16050 - Basic Electrical Materials and Methods, and in accordance with the manufacturer's recommendations.

B. LCPs shall be protected at the job site from loss, damage, and the effects of weather. LCPs shall be stored in an indoor, dry location. Heating shall be provided in areas subject to corrosion, and humidity.

C. LCP interiors and exteriors shall be cleaned, and coatings shall be touched up to match original finish upon completion of the Work.

D. Conduit, conductors, and terminations shall be installed in accordance with the Section 16050 - Basic Electrical Materials and Methods.

E. A ground lug for a size No. 2 AWG bare copper conductor shall be included to ground LCP to the plant's grounding system.

F. A copy of the final (as-built) wiring diagrams shall be placed in a metal pocket provided inside of the LCP door.

3.2 FIELD TESTING

A. Each LCP shall be tested again for functional operation in the field after the connection of external conductors, and prior to equipment startup.

*** END OF SECTION ***

SECTION 16500

LIGHTING

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide lighting fixtures, and accessories for all lighting systems, complete and operable, in accordance with the Contract Documents and Title 24.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 16050 Basic Electrical Materials and Methods

1.3 STANDARD SPECIFICATIONS

A. Except as otherwise indicated, the CONTRACTOR shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC), including the latest adopted editions of the Regional and City of San Diego Supplement Amendments.

1.4 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the Work of this Section:

1. American National Standards Institute (ANSI):

ANSI C82.1	Specifications for Fluorescent Lamp Ballasts
ANSI C84.4	Specifications for High-Intensity-Discharge Lamp Ballasts (Multiple Supply Type)

2. Other:

NEC	National Electric Code
UBC	Uniform Building Code
UL	Underwriters Laboratories
CEC	California Energy Commission

2013 Building Energy Efficiency Standards for Nonresidential Buildings, Title 24

2015 Appliance Efficiency Regulations

Standards of the Certified Ballast Manufacturer's Association

1.5 CONTRACTOR SUBMITTALS

A. Submit the following in accordance with the requirements of Section 01300 - Submittals.

1. Shop drawings and catalog data.

2. Catalog literature for each fixture. Each such submittal shall clearly describe materials, type of diffuser, hardware, gasketing, reflector and chassis, finish, and ballast.

3. Photocell data submittal shall indicate switching capacity, the means of adjusting the lighting pickup level, and enclosure.

4. Submit typical wiring diagrams for all components including, but not limited to, lighting control panels, relays, contactors, photocells, switches, occupancy sensors and daylighting controls.

5. Submit a one-line diagram of the proposed system configuration.

B. Substitutions for indicated fixtures shall be based upon quality of construction, light distribution, appearance, and maintenance.

1.6 QUALITY ASSURANCE

A. Through demonstration, verify that panel schedules properly indicate the lighting outlets connected to each circuit.

B. Lighting demonstration shall occur within 2 weeks before Project acceptance.

C. Lighting fixtures shall be stored in their original cartons from the manufacturers until the time of installation. Fixtures poles shall be stored on blocks above grade until the time of installation.

D. Indoor and outdoor lighting system shall comply with the 2013 California Building Energy Efficiency Standards for nonresidential buildings. Installation of the indoor and outdoor lighting system shall be documented via the latest certificate of installation forms and in coordination with the certificate of compliance forms shown on the electrical drawings.

E. Lighting control system including but not limited to controller, sensor, and digital light switch shall be from the same manufacturer, Watt Stopper DLM series or equal.

1.7 CLEANUP

A. Fixture lenses, diffusers, and reflectors shall be cleaned just before the system demonstrations.

B. Fixture trim, including poles and support brackets, where finish has been damaged, shall be refinished.

PART 2 - PRODUCTS

2.1 FIXTURES - GENERAL

A. All fixtures shall be prewired with leads of 18-AWG, minimum, for connection to building circuits.

2.2 EXTERIOR FIXTURES

A. Exterior fixtures in combination with their mounting and bracket shall be capable of withstanding 100-mph winds without damage. Exterior fixtures shall have corrosion-resistant hardware and hinged doors or lens retainer. Fixtures shall be furnished with a central photoelectrical control system with independent dimming operation and motion sensor.

2.3 INTERIOR FIXTURES

A. Interior lighting fixtures located in the electrical room and pump room shall be LED type light fixtures with dimming capability and high efficiency drivers >90%pf.

B. Interior lighting fixtures located in the SDGE room shall be fluorescent type lighting fixture with a high impact prismatic acrylic diffuser.

C. Incandescent light fixtures are not acceptable.

2.4 LAMPS

A. Lamps shall be GE, Phillips, Sylvania, or equal.

B. Fluorescent lamps shall be cool/white unless otherwise indicated. LED lamps shall be 4000 kelvin color and minimum lumen maintenance of 90% for 60,000 hours, unless otherwise indicated.

2.5 LIGHTING CONTROL

A. Exterior: Exterior lighting control panel and outdoor photo cell shall be provided for where indicated on the drawings shall be from the same manufacturer. The controller shall be 120VAC, 20amps within a NEMA1, hinged, lockable enclosure. The controller shall contain individually controlled switching relays with 20 Amp load contacts, connection for an exterior photocell for integrated control of exterior lighting based on light level and time schedules. An internal clock shall have a backlight display, user keypad and shall provide 8 channels of time or astronomical control. Preprogrammed lighting control scenarios shall include: scheduled on/off, manual on/scheduled off, manual on/automatic switch sweep off, astronomic or photocell on/off and astronomic or photocell control with scheduled on/off. Time clock shall provide up to 42 holidays, automatic daylight savings adjustment, astronomic coordinates by major cities, and help screens. Program memory shall be non-volatile and clock shall retain time keeping during power outages for at least 48 hours Photoelectric cells for control of outdoor lighting fixtures shall be self-contained, weatherproof type and shall be provided with time-delay features. Watt Stopper, LP8 Series or equal.

B. Pump Room: Day lighting controller and daylight sensor shall be provided where indicated on drawings. The controller shall contain three individually controlled switching relays with 20 Amp load contacts and three 0-10 VDC diming outputs to control the LED drivers. RJ45 connections for associated input devise. The daylight sensor shall be a skylight type, mounted within the skylight well. The daylight sensor shall be able to adjust the lighting levels based on natural light via a RJ45 connection to the controller. A daylight zone remote programmer shall be provided.

C. Electrical Room: Room controller shall be provided where indicated on drawings. The controller shall contain two individually controlled switching relays with 20 Amp load contacts and two 0-10 VDC diming outputs to control the LED drivers. RJ45 connections for associated input devise.

2.6 LIGHT FIXTURE CONTROL RELAYS

A. Relays for light fixtures control shall be mechanically held. Such relays shall be based-mounted, single-purpose units, i.e., no attachments to a multi-purpose solenoid operator.

B. If not indicated otherwise, coil voltage shall be 115 VAC with contacts rated at 20 A. Relays shall be ASCO Series 166, Zenith Series MSC, or equal.

2.7 BALLASTS

A. Ballasts for fluorescent fixtures in office areas shall be high efficiency solid-state type and shall have a Class "A" sound rating. Such ballasts shall be of the low loss type. All ballasts shall be high power factor, Class P. Primary ballast voltage shall be suitable for use in the branch circuits indicated in the Contract Documents.

2.8 LIGHTING POLES

A. NOT USED

2.9 EMERGENCY LIGHTING POWER SUPPLY

A. Sealed battery, inverter and automatic transfer switch shall be rated to start two LED lamps immediately and maintain a lamp output of at least 1footcandle for 90 minutes following power failure. The emergency power supply shall be installed at the factory and shall be internally mounted inside the fluorescent fixture ballast compartment. External status pilot light and manual test button shall be provided.

2.10 LIGHT SWITCHES

A. Pump room light switches shall be a 6 button pre-engraved, dimmable, low voltage switch that operate on 24VDC power supplied by the day light room controller. Each switch shall be designed to fit in a standard gang box and has two RJ45 connections ports. Modes of operation for shall be able to control 3 groups of lights (row 1, row 2, and row 3), dim up, dim down, and all off button.

B. Electrical room light switches shall be a 5 button pre-engraved, dimmable, low voltage switch that operate on 24VDC power supplied by the dimming room controller. Each switch shall be designed to fit in a standard gang box and has two RJ45 connections ports. Modes of operation for shall be able to control 2 groups of lights (row 1 and row 2), dim up, dim down, and an all off button.

C. Interconnection wiring of the electrical and pump room light switches are based around a room controller with RJ45 connection. Selection of a room controller requiring a different type of wiring connection shall replace the switches and associated hardware with ones that are compatible at not additional cost.

D. All other light switches shall be of 1 pole, 20A, 120V, toggle switch type and rated for their respective indoor/outdoor application.

PART 3 - EXECUTION

3.1 LIGHTING FIXTURES

A. Lighting fixtures shall be provided complete at each outlet in accordance with the Fixture Schedule.

B. Lighting fixtures shall be installed plumb and square with building and wall intersections. Pendant-mounted fixtures which are mounted from sloping ceilings shall be suspended by ball hangers. Fixtures installed in machinery rooms shall be located after machines have been installed. In all cases, fixture locations shall be coordinated with work of other trades to prevent obstruction of light from the fixtures. Fixtures shall be installed in accordance with the architectural reflected ceiling Drawings. Unless otherwise indicated, fixtures shall be centered on ceiling tiles. Fixtures weighing more than 25 pounds shall be supported independently of the fixture outlet box.

C. Recessed fixtures shall be installed light-tight to the ceiling and shall be provided with auxiliary safety supports attached directly to the building structure. Said safety supports shall consist of #12 AWG soft drawn galvanized wire or #10 Aluminum wire. Fixture support shall be braced for seismic loads in accordance with UBC for Seismic Zone 4.

3.2 TITLE 24 INDOOR LIGHTING COMPLIANCE DOCUMENTS AND TESTING

A. The Contractor shall fill out and submit all Certificates of Installation forms relating to the project for permitting. If any portion the forms get rejected, the contractor shall fix all the problems and resubmit forms until they are approved at no additional cost to the City.

B. The Contractor shall hire a Certified Acceptance Field Technician in accordance with the 2013 Building Energy Efficiency Standards for Nonresidential Buildings to perform the field testing/verification work required to complete the Certificates of Acceptance forms relating the project. The Contractor shall fill out any remaining portion of the Acceptance forms and submit them for permitting. If any portion of the forms get rejected, the contractor shall fix all the problems and resubmit forms until they are approved at no additional cost to the City.

C. Indoor lighting, daylighting, and dimming operation shall be tested for acceptance by a certified Acceptance Test Technician and documented via the latest certificate of acceptance forms.

D. Outdoor lighting, photocell, motion, and dimming operation shall be tested during the hours of darkness for acceptance by a certified Acceptance Test Technician and documented via the latest certificate of acceptance forms.

E. The latest version of Certificate of installation and Acceptance forms shall be obtained at www.energy.ca.gov/title24 website at time of documentation. As a minimum, the forms shall be but not limit to the following:

1.	NRCI-ELC-01-E	Electrical Power Distribution
2.	NRCI-LTI-01-E	Indoor Lighting
3.	NRCI-LTO-01-E	Outdoor Lighting
4.	NRCA-LTI-02-A	Lighting Control Acceptance Document
5.	NRCA-LTI-03-A	Automatic Daylighting Control Acceptance Document
6.	NRCA-LTO-02-A	Outdoor Lighting Acceptance Tests

*** END OF SECTION ** *

SECTION 16926

AUTOMATIC TRANSFER SWITCHES

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The Contractor shall provide an Automatic Transfer Switch (ATS) complete and operable, in accordance with the Contract Documents

B. The ATS shall be designed, tested and assembled in accordance with the applicable standards of IEEE, NEMA and ANSI.

C. The equipment shall meet the seismic requirements in 11000 - Equipment General Provisions, and 16050 – Basic Electrical Materials And Methods.

1.2 RELATED SECTIONS

A. Section 11000 – Equipment General Provisions
B. Section 16050 – Basic Electrical Materials and Methods
C. Section 16400 – Low Voltage Electrical Service and Distribution
D. Section 16480 – Motor Control Center
E. Section 16950 – Electrical Tests

1.3 REFERENCES

A. UL Standard #1008, Automatic Transfer Switches.
B. NEMA 1CS2-447, AC Automatic Transfer Switches.
C. NEMA 1CS1-109, Tests and Procedures.
D. IEEE Standard 472-1974, Guide for Surge Withstand Capability Tests.
E. National Electrical Code.

1.4 SUBMITTALS

A. Shop Drawings: Submit for approval the following:

1. Manufacturer's technical information for automatic transfer switches proposed for use.

2. Listing of the transfer switches to be furnished with their ratings and locations identified.

1.5 QUALIFICATIONS

A. The manufacturer of the automatic transfer switch shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9000, 9001 or 9002 certified.

1.6 REGULATORY REQUIREMENTS

A. All transfer switches shall bear the UL label.

B. A certificate of compliance with UL 1008 must be submitted for the transfer switches to be supplied. The certificate is not required if the manufacturer's published data submitted and approved reflect a UL 1008 listing. Proof of UL 1008 listing does not, however, relieve the Contractor of compliance with other provisions of this specification.

1.7 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.8 OPERATION AND MAINTENANCE INFORMATION

A. Operation and maintenance information shall include the following information:

1. Instruction books and/or leaflets.
2. Recommended renewal parts list.
3. Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Kohler
B. Approved equal.

2.2 MATERIALS

A. Rating:

1. Switches shall be capable of switching all classes of loads and shall be 100% equipment rated, rated for continuous duty when installed in a non-ventilated enclosure.

2. Ampere rating and number of poles shall be as indicated on the Drawings.

3. The transfer switches shall have withstand, closing and interrupting ratings sufficient for the voltage and the available short circuit current at the point of application as shown on the Drawings. The transfer switches shall be rated for application downstream of protective devices having short time delay settings of up to 30 cycles.

B. Operation:

1. The transfer switches shall consist of completely enclosed contact assemblies and a separate control logic panel. The contact assemblies shall be operated by a reliable electrical mechanism, and be energized only momentarily during transfer providing inherently double throw switching action. Control power for all transfer operations shall be derived from the line side of the source to which the load is being transferred.

2. A manual operating handle shall be provided for maintenance purposes.

3. Each transfer switch shall be positively interlocked both mechanically and electrically to prevent simultaneous closing of both sources under either automatic or manual operation. A transfer switch position indicator shall be visible from the front of the switch to show to which source the transfer switch is connected.

4. Inspection and replacement of all separate arcing contact (moving and stationary) shall be possible from the front of the transfer switch.

C. Electrical and Mechanical Performance: Comply with UL Standard 1008 and NEMA Standard ICS2-447. In addition, performance must meet or exceed the following requirements and, if so requested, be verified by certified laboratory test data:

1. Temperature Rise: Measurements shall be made after the overload and endurance tests.

2. Withstand: UL listed to withstand the magnitude of fault current available at the switch terminals when coordinated with respective protective devices as shown on the Drawings at an X/R ratio of 6.6 or less. The main contacts shall not trip open or weld when subjected to fault currents.

3. Dielectric: Measurement shall be made at 1960 VAC rms minimum following the withstand current rating test.

4. Transient Withstand: Control panel shall pass the voltage surge withstand test per IEEE Standard 472-1974 and the voltage impulse withstand test per NEMA ICS-1-109.

D. Enclosure: The enclosure shall be NEMA Type 1, gasketed with a finish that conforms to Section 16480 - Motor Control Center. Compartment door shall be interlocked and fitted with a maintenance override.

2.3 AUTOMATIC TRANSFER SWITCH

A. Furnish and install equipment herein to form a complete system for automatic engine start and transfer of load between power sources, including status indication, and alarm.

B. Accessories: Provide a control panel with adjustable programmable microprocessor sensing and timing functions shall provide the following operational characteristics:

1. Time delay on momentary dips in normal source (0.0-6.0 seconds), factory set at 1 second.

2. Time delay on transfer to emergency for controlled loading of generator (0-5 minute), factory set at 0 minutes.

3. Time delay on retransfer to normal (0-30 minutes), factory set at 30 minutes.

4. Time delay on engine shutdown after retransfer to normal (0-60 minutes), factory set at 5 minutes.

5. Close differential voltage sensing of all normal source phases (pickup adjustable from 85-100 percent of nominal and dropout adjustable from 75-98 percent of pickup), factory set to pickup at 90 percent and dropout at 85 percent of nominal.

6. Independent voltage (85-100 percent pickup) and frequency (90-100 percent pickup), sensing of the emergency source to prevent premature transfer, factory set to pickup at 90 percent of nominal voltage and 95 percent of nominal frequency.

7. Test switch (momentary type) to simulate failure of normal source.

8. One set of single pole, double throw contact, which operates when the normal source fails.

9. Pilot lights to indicate switch position.

10. Auxiliary contacts (one closed on "Normal" and one closed on "Emergency") rated 10 amps, 480 VAC.

11. Provide an adjustable, delayed transition neutral position feature to allow for motor voltage decay and drop out of control logic relays or in phase monitor.

12. All time delay and sending functions shall be field adjustable over the ranges indicated and shall operate with minimum drift (not to exceed "1 percent of set frequency, "2 percent of set voltage, and "10 percent of set time delay) over the temperature range of -20 C to +70 C. The control panel shall be provided with a protective cover and an isolation plug in the wiring harness to disconnect all the control wires between the control panel and the main transfer panel.

13. The transfer switch shall have provisions for initiating a transfer to the generator based on a remote dry contact.

14. Provide programmable engine exercise feature.

15. Engine start and run contact closure; contact closure shall be adjustable from zero to 120 seconds after failure of the normal source is detected. The "engine run" contact shall remain closed for an adjustable period of zero to 5 minutes (cool down period) after the load has been transferred back to the normal source. The "engine run" contact shall have provisions to interlock with a remote field contact that will prevent the engine from starting and the ATS from switching over to emergency source in the event of a "pump room flood".

PART 3 - EXECUTION

3.1 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of UL and NEMA standards.

1. Insulation check to ensure the integrity of insulation and continuity of the entire system.

2. Visual inspection to ensure that the switch matches the specification requirements and to verify that the fit and finish meet quality standards.

3. Mechanical tests to verify that the switch's power sections are free of mechanical hindrances.

4. Electrical tests to verify the complete electrical operation of the switch and to set up time delays and voltage sensing settings of the logic.

B. The manufacturer shall provide three (3) certified copies of factory test reports.

3.2 INSTALLATION

A. ATS shall be installed on 4-inch concrete pads. After leveling and shimming, anchor ATS to concrete pad, and grout in place so that no space exists between the pad and support beams.

3.3 FIELD ADJUSTMENTS

A. The Contractor shall field adjust all timing and voltage settings of the transfer switch as necessary for proper operation of the unit.

3.4 FIELD TESTING

A. The Contractor shall provide field testing with the generator supplier to test the complete standby system in the presence of the Owners representatives. The transfer switch factory representative shall be available during startup and training.

B. Refer to 01660 - Facility Start-Up and Operator Training, and 16950 – Electrical Tests.

3.5 TRAINING

A. The Contractor shall provide field training to plant personnel on transfer switch operation and maintenance. This training may be concurrent with field-testing.

*** END OF SECTION ***

SECTION 16950

ELECTRICAL TESTS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The Contractor shall test, commission and demonstrate that the electrical work satisfies the criteria of the CONSTRUCTION DOCUMENTS and functions as required by the CONTRACT DOCUMENTS.

1.2 GENERAL

A. The Work of this Section includes furnishing the labor, equipment and power required to support the testing in other Divisions of these Specifications. Electrical testing herein, and functional testing of all power and controls not tested under Section 13300 - Instrumentation and Control shall be completed before commencement of the 14-day test required in Section 01660. This scope may require the Contractor to activate circuits, shutdown circuits, run equipment, make electrical measurements, replace blown fuses, and install temporary jumpers.

1.3 CODES

A. The Work of this Section shall comply with the current editions of the National Electrical Code as adopted by the City of San Diego.

1.4 STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the Work of this Section:

1.	NETA	National Electrical Testing Association
2.	ICEA	Insulated Cable Engineers Association

1.5 TESTING

A. The following test requirements are intended to supplement test and acceptance criteria that may be stated elsewhere.

1. Lighting: Switching, including remote and automatic control, as indicated. Circuitry is in accordance with panel schedules. Lighting fixtures located to minimize obstruction of illumination by mechanical equipment or building structural elements.

2. Power Instrumentation: Demonstrate that voltmeter and ammeter switches are functional. Demonstrate that meters are within catalog accuracy as installed with specific reference to kilowatt meters.

3. Demonstrate mechanical and/or electrical interlocking by attempting to subvert the intended sequence.

4. Activate ground fault tripping by operating test features provided with ground current protective systems and by injecting a known, and reasonable, current in the ground current sensor circuit. In general, ground fault tripping should occur at a ground current equivalent to 20% of phase current. Current injection is not required of circuit 400A or less.

5. Cable Testing: 480-V circuits shall be tested for insulation resistance with a 1000-V megohm meter. Testing shall be done after the 480-V equipment is terminated. Phase-to-phase A-B, B-C, A-C, and phase-to-ground insulation resistance tests shall be performed on each cable prior cable termination at equipment. Test results shall be submitted for review 30 days prior to plant operation and any system testing. Equipment which may be damaged during this test shall be disconnected. Perform tests with all other equipment connected to the circuit. In order to be acceptable, the cable must withstand the test high voltage without breakdown, have steady or decreasing leakage current during the high potential test, and have satisfactory comparable megger readings in each megger test. Test results shall be submitted and shall state equipment used and time of test. Cable operating at more than 2000 V shall be tested in accordance with ICEA publications S-68-61, S-61-402, S-19-81, and S-68-516. Cable testing and report submittal shall be performed by an organization sanctioned by the Manufacturer of the cable to be tested. Testing shall verify the quality of cable terminations. Test results for medium and high voltage cable shall be submitted 30 days prior to the time schedule for equipment energization.

6. Test ground interrupter (GFI) receptacles and circuit breakers for proper operation by methods sanctioned by the receptacle manufacturer.

7. A functional test and check of all electrical components is required prior to performing subsystem testing and commissioning. Compartments and equipment shall be cleaned as required by other provisions of these Specifications before commencement of functional testing. Functional testing shall comprise:

   a. Visual and physical check of cables, busswork, circuit breakers, transformers, and connections associated with all new and modified equipment.

   b. Setting of protective relays in conformance with results of the Short Circuit Study and testing of relays to assure that relays will trip at the current value and time required by the Study.

   c. Circuit breakers with adjustable time or pick-up settings for ground current, instantaneous overcurrent, short-time overcurrent, or long-time overcurrent, shall be field adjusted by a representative of the circuit breaker Manufacturer. Time and pickup setting shall correspond to the recommendations of the Short Circuit Study. Setting shall be tabulated and proven for each circuit breaker in its installed position; test results shall be certified by the tester and transmitted to the RESIDENT ENGINEER.

8. Complete ground testing of all grounding electrodes prior to operating the equipment.

B. Subsystem testing shall occur after the proper operation of alarm and status contacts has been demonstrated or otherwise accepted by the RESIDENT ENGINEER and after process control devices have been adjusted as accurately as possible. It is intended that the Contractor will adjust limit switches and level switches to their operating points prior to testing and will set pressure switches, flow switches, and timing relays as dictated by operating results.

C. After initial settings have been completed, each subsystem shall be operated in the manual mode and it shall be demonstrated that operation is in compliance with the Contract Documents. Once the manual mode of operation has been proven, automatic operation shall be demonstrated to verify such items as proper start and stop sequence of pumps, proper operation of valves, and proper speed control.

D. Motor operated valves shall be tested after having been phased and tested for correct motor rotation and after travel and torque limit switches have been adjusted by a representative of the valve Manufacturer. Tests shall verify status indication, proper valve travel, and correct command control from local and remote devices.

E. Provide ground resistance tests in the presence of the RESIDENT ENGINEER and submit results. Use a ground resistance meggar "Earth" tester with a maximum of 0-50 scale. Use the full of potential method or the three terminal methods as described by Biddle or Neta.

F. Subsystems, in the context discussed here, shall mean individual and groups of pumps, conveyor systems, chemical feeders, air conditioning units, ventilation fans, and air compressors.

G. General: Carry out tests for individual items of materials and equipment indicated in other Sections.

1.3 COMMISSIONING

A. Commissioning during the 14-day test as specified in Section 01660, shall not be attempted until all subsystems have been found to operate satisfactorily; commissioning shall only be attempted as a function of normal plant operation in which plant process flows and levels are routine and equipment operates automatically in response to flow and level parameters or computer command, as applicable. Simulation of process parameters will be considered only upon receipt of a written request.

B. The indications of all switchboard ammeters and kilowatt meters shall be recorded every half-hour during commissioning.

PART 2 -- PRODUCTS (Not Used)

PART 3 -- EXECUTION (Not Used)

*** END OF SECTION ***

SUPPLEMENTARY SPECIAL PROVISIONS

APPENDICES

APPENDIX A

FINAL MITIGATED NEGATIVE DECLARATION

City of San Diego
Development Services

Advance Planning & Engineering Division
(619) 446-5460

FINAL

MITIGATED NEGATIVE DECLARATION

Project No. 317092
SCH No. N/A

SUBJECT: Tierrasanta (Via Dominique) Pump Station: The Tierrasanta (Via Dominque) Pump Station project proposes to construct a new 14 Million Gallons per Day (MGD) pump station at the location of the existing Via Dominique Pump Station located at 4701 Seda Drive in the Tierrasanta Community. The existing Via Dominique pump station has been in service since 1979 and is reaching the end of its useful life. The new Tierrasanta Pump Station will provide for the water supply demands projected to Year 2030, of both the existing Via Dominique Pump Station and the Tierrasanta Temporary Pump Station. The project includes demolition of the existing Tierrasanta Temporary Pump Station located at 11100 Clairemont Mesa Boulevard, and installation of approximately 3,000 feet of new 20-inch PVC water main along Clairemont Mesa Boulevard. The existing Via Dominique Pump Station will remain in place as a back-up pump station. The project will also include street paving, water service connections and new pedestrian ramps along the pipeline alignment.

The project site is located at 4701 Seda Drive on the northeast corner at Clairemont Mesa Boulevard. The project site is located within the RS-1-14 zone (Residential) as are all surrounding properties to the north, west, east and south. The site is within the Tierrasanta Community Planning Area, (Council District 7). Legal Description: All that portion of Lot 144 of Villa Dominique Unit No. 3, in the City of San Diego, County of San Diego, State of California, according to the Map thereof No. 9235, filed in the Office of the County Recorder of said San Diego County on May 30, 1979. Assessor's Parcel Number: 373-342-0200. The Tierrasanta Temporary Pump Station is located within A City of San Diego owned Parcel. Assessor's Parcel Number: 3730800900.

I. PROJECT DESCRIPTION: See attached Initial Study.

II. ENVIRONMENTAL SETTING: See attached Initial Study.

III. DETERMINATION:

The City of San Diego conducted an Initial Study, which determined that the proposed project could have a significant environmental effect in the following areas(s): Paleontological Resources. The project as presented now avoids or mitigates the potentially significant environmental effects identified and the preparation of an Environmental Impact Report (EIR) would not be required.

IV. DOCUMENTATION:

The attached Initial Study documents the reasons to support the above Determination.

V. MITIGATION, MONITORING AND REPORTING PROGRAM (MMRP):

A. GENERAL REQUIREMENTS – PART I
Plan Check Phase (prior to permit issuance)

1. Prior to Bid Opening/Bid Award or beginning any construction related activity on-site, the Development Services Department (DSD) Director's Environmental Designee (ED) shall review and approve all Construction Documents (CD) (plans, specification, details, etc.) to ensure the MMRP requirements have been incorporated.

2. In addition, the ED shall verify that the MMRP Conditions/Notes that apply ONLY to the construction phases of this project are included VERBATIM, under the heading, "**ENVIRONMENTAL/MITIGATION REQUIREMENTS.**"

3. These notes must be shown within the first three (3) sheets of the construction documents in the format specified for engineering construction document templates as shown on the City website:

   http://www.sandiego.gov/development-services/industry/standtemp.shtml

4. The **TITLE INDEX SHEET** must also show on which pages the "Environmental/Mitigation Requirements" notes are provided.

B. GENERAL REQUIREMENTS – PART II
Post Plan Check (After permit issuance/Prior to start of construction)

1. **PRE CONSTRUCTION MEETING IS REQUIRED TEN (10) WORKING DAYS PRIOR TO BEGINNING ANY WORK ON THIS PROJECT.** The PERMIT HOLDER/OWNER is responsible to arrange and perform this meeting by contacting the CITY RESIDENT ENGINEER (RE) of the Field Engineering Division and City staff from MITIGATION MONITORING COORDINATION (MMC). Attendees must also include the Permit holder's Representative(s), Job Site Superintendent and the following consultants:

Paleontologist

Note: Failure of all responsible Permit Holder's representatives and consultants to attend shall require an additional meeting with all parties present.

CONTACT INFORMATION:

a) The PRIMARY POINT OF CONTACT is the **RE** at the **Field Engineering Division 858-627-3200**

b) For Clarification of ENVIRONMENTAL REQUIREMENTS, it is also required to call **RE and MMC at 858-627-3360**

2. **MMRP COMPLIANCE:** This Project, Project Tracking System (PTS) No. 317092, shall conform to the mitigation requirements contained in the associated Environmental Document and implemented to the satisfaction of the DSD's ED, MMC and the City Engineer (RE). The requirements may not be reduced or changed but may be annotated (i.e., to explain when and how compliance is being met and location of verifying proof, etc.). Additional clarifying information may also be added to other relevant plan sheets and/or specifications as appropriate (i.e., specific locations, times of monitoring, methodology, etc).

   Note:
   Permit Holder's Representatives must alert RE and MMC if there are any discrepancies in the plans or notes, or any changes due to field conditions. All conflicts must be approved by RE and MMC BEFORE the work is performed.

3. **OTHER AGENCY REQUIREMENTS:** Evidence that any other agency requirements or permits have been obtained or are in process shall be submitted to the RE and MMC for review and acceptance prior to the beginning of work or within one week of the Permit Holder obtaining documentation of those permits or requirements. Evidence shall include copies of permits, letters of resolution or other documentation issued by the responsible agency.

   None required.

4. **MONITORING EXHIBITS:** All consultants are required to submit, to RE and MMC, a monitoring exhibit on an 11x17 reduction of the appropriate construction plan, such as site plan, grading, landscape, etc., marked to clearly show the specific areas including the **LIMIT OF WORK**, scope of that discipline's work, and notes indicating when in the construction schedule that work will be performed. When necessary for clarification, a detailed methodology of how the work will be performed shall be included.

5. **OTHER SUBMITTALS AND INSPECTIONS:** The Permit Holder/Owner's representative shall submit all required documentation, verification letters, and

requests for all associated inspections to the RE and MMC for approval per the following schedule:

Document Submittal/Inspection Checklist

Issue Area	*Document submittal*	*Associated Inspection/Approvals/Note*
General	Consultant Qualification Letters	Prior to Precon Meeting
General	Consultant Const. Monitoring	Prior to or at the Precon Meeting
Paleontology	Monitoring Report	Prior to Construction

SPECIFIC MMRP ISSUE AREA CONDITIONS/REQUIREMENTS:

A. PALEONTOLOGICAL RESOURCES

Paleontological Mitigation is required during Grading/Excavation/Trenching for the new pump station only. Pipeline trenching will not require paleontological monitoring.

I. Prior to Permit Issuance or Bid Opening/Bid Award

A. Entitlements Plan Check
   1. Prior to permit issuance or Bid Opening/Bid Award, whichever is applicable, the Assistant Deputy Director (ADD) Environmental designee shall verify that the requirements for Paleontological Monitoring have been noted on the appropriate construction documents.

B. Letters of Qualification have been submitted to ADD
   1. Prior to Bid Award, the applicant shall submit a letter of verification to Mitigation Monitoring Coordination (MMC) identifying the Principal Investigator (PI) for the project and the names of all persons involved in the paleontological monitoring program, as defined in the City of San Diego Paleontology Guidelines.
   2. MMC will provide a letter to the applicant confirming the qualifications of the PI and all persons involved in the paleontological monitoring of the project.
   3. Prior to the start of work, the applicant shall obtain approval from MMC for any personnel changes associated with the monitoring program.

II. Prior to Start of Construction

A. Verification of Records Search
   1. The PI shall provide verification to MMC that a site specific records search has been completed. Verification includes, but is not limited to a copy of a confirmation letter from San Diego Natural History Museum, other institution or, if the search was in-house, a letter of verification from the PI stating that the search was completed.
   2. The letter shall introduce any pertinent information concerning expectations and probabilities of discovery during trenching and/or grading activities.

B. PI Shall Attend Precon Meetings
   1. Prior to beginning any work that requires monitoring, the Applicant shall arrange

a Precon Meeting that shall include the PI, Construction Manager (CM) and/or Grading Contractor, Resident Engineer (RE), Building Inspector (BI), if appropriate, and MMC. The qualified paleontologist shall attend any grading/excavation related Precon Meetings to make comments and/or suggestions concerning the Paleontological Monitoring program with the Construction Manager and/or Grading Contractor.

a. If the PI is unable to attend the Precon Meeting, the Applicant shall schedule a focused Precon Meeting with MMC, the PI, RE, CM or BI, if appropriate, prior to the start of any work that requires monitoring.

2. Acknowledgement of Responsibility for Curation (CIP or Other Public Projects)
The applicant shall submit a letter to MMC acknowledging their responsibility for the cost of curation associated with all phases of the paleontological monitoring program.

3. Identify Areas to be Monitored
   a. Prior to the start of any work that requires monitoring, the PI shall submit a Paleontological Monitoring Exhibit (PME) based on the appropriate construction documents (reduced to 11x17) to MMC for approval identifying the areas to be monitored including the delineation of grading/excavation limits. Monitoring shall begin at depths below 10 feet from existing grade or as determined by the PI in consultation with MMC. The determination shall be based on site specific records search data which supports monitoring at depths less than ten feet.
   b. The PME shall be based on the results of a site specific records search as well as information regarding existing known soil conditions (native or formation).
   c. MMC shall notify the PI that the PME has been approved.

4. When Monitoring Will Occur
   a. Prior to the start of any work, the PI shall also submit a construction schedule to MMC through the RE indicating when and where monitoring will occur.
   b. The PI may submit a detailed letter to MMC prior to the start of work or during construction requesting a modification to the monitoring program. This request shall be based on relevant information such as review of final construction documents which indicate conditions such as depth of excavation and/or site graded to bedrock, presence or absence of fossil resources, etc., which may reduce or increase the potential for resources to be present.

5. Approval of PME and Construction Schedule
After approval of the PME by MMC, the PI shall submit to MMC written authorization of the PME and Construction Schedule from the CM.

III. During Construction

A. Monitor Shall be Present During Grading/Excavation/Trenching

1. The monitor shall be present full-time during grading/excavation/trenching activities including, but not limited to mainline, laterals, jacking and receiving pits, services and all other appurtenances associated with underground utilities as identified on the PME that could result in impacts to formations with high and/or moderate resource sensitivity. **The Construction Manager is responsible for notifying the RE, PI, and MMC of changes to any construction activities such as in the case of a potential safety concern within the area being monitored.**

In certain circumstances OSHA safety requirements may necessitate modification of the PME.

2. The PI may submit a detailed letter to MMC during construction requesting a modification to the monitoring program when a field condition such as trenching activities that do not encounter formational soils as previously assumed, and/or when unique/unusual fossils are encountered, which may reduce or increase the potential for resources to be present.
3. The monitor shall document field activity via the Consultant Site Visit Record (CSVR). The CSVR's shall be faxed by the CM to the RE the first day of monitoring, the last day of monitoring, monthly (**Notification of Monitoring Completion**), and in the case of ANY discoveries. The RE shall forward copies to MMC.

B. Discovery Notification Process
1. In the event of a discovery, the Paleontological Monitor shall direct the contractor to temporarily divert trenching activities in the area of discovery and immediately notify the RE or BI, as appropriate.
2. The Monitor shall immediately notify the PI (unless Monitor is the PI) of the discovery.
3. The PI shall immediately notify MMC by phone of the discovery, and shall also submit written documentation to MMC within 24 hours by fax or email with photos of the resource in context, if possible.

C. Determination of Significance
1. The PI shall evaluate the significance of the resource.
   a. The PI shall immediately notify MMC by phone to discuss significance determination and shall also submit a letter to MMC indicating whether additional mitigation is required. The determination of significance for fossil discoveries shall be at the discretion of the PI.
   b. If the resource is significant, the PI shall submit a Paleontological Recovery Program (PRP) and obtain written approval of the program from MMC, MC and/or RE. PRP and any mitigation must be approved by MMC, RE and/or CM before ground disturbing activities in the area of discovery will be allowed to resume.
      (1). Note: For pipeline trenching projects only, the PI shall implement the Discovery Process for Pipeline Trenching projects identified below under "D."
   c. If resource is not significant (e.g., small pieces of broken common shell fragments or other scattered common fossils) the PI shall notify the RE, or BI as appropriate, that a non-significant discovery has been made. The Paleontologist shall continue to monitor the area without notification to MMC unless a significant resource is encountered.
   d. The PI shall submit a letter to MMC indicating that fossil resources will be collected, curated, and documented in the Final Monitoring Report. The letter shall also indicate that no further work is required.
      (1). Note, For Pipeline Trenching Projects Only: If the fossil discovery is limited in size, both in length and depth; the information value is limited and there are no unique fossil features associated with the discovery area, then the discovery should be considered not significant.

(2). Note, for Pipeline Trenching Projects Only: If significance can not be determined, the Final Monitoring Report and Site Record shall identify the discovery as Potentially Significant.

D. Discovery Process for Significant Resources - Pipeline Trenching Projects
The following procedure constitutes adequate mitigation of a significant discovery encountered during pipeline trenching activities including but not limited to excavation for jacking pits, receiving pits, laterals, and manholes to reduce impacts to below a level of significance.

1. Procedures for documentation, curation and reporting
   a. One hundred percent of the fossil resources within the trench alignment and width shall be documented in-situ photographically, drawn in plan view (trench and profiles of side walls), recovered from the trench and photographed after cleaning, then analyzed and curated consistent with Society of Invertebrate Paleontology Standards. The remainder of the deposit within the limits of excavation (trench walls) shall be left intact and so documented.
   b. The PI shall prepare a Draft Monitoring Report and submit to MMC via the RE as indicated in Section VI-A.
   c. The PI shall be responsible for recording (on the appropriate forms for the San Diego Natural History Museum) the resource(s) encountered during the Paleontological Monitoring Program in accordance with the City's Paleontological Guidelines. The forms shall be submitted to the San Diego Natural History Museum and included in the Final Monitoring Report.
   d. The Final Monitoring Report shall include a recommendation for monitoring of any future work in the vicinity of the resource.

IV. Night and/or Weeekend Work

A. If night and/or weekend work is included in the contract
   1. When night and/or weekend work is included in the contract package, the extent and timing shall be presented and discussed at the precon meeting.
   2. The following procedures shall be followed.
      a. No Discoveries
      In the event that no discoveries were encountered during night and/or weekend work, The PI shall record the information on the CSVR and submit to MMC via the RE via fax by 8AM on the next business day.
      b. Discoveries
      All discoveries shall be processed and documented using the existing procedures detailed in Sections III - During Construction.
      c. Potentially Significant Discoveries
      If the PI determines that a potentially significant discovery has been made, the procedures detailed under Section III - During Construction shall be followed.
      d. The PI shall immediately contact the RE and MMC, or by 8AM on the next business day to report and discuss the findings as indicated in Section III-B, unless other specific arrangements have been made.

B. If night and/or weekend work becomes necessary during the course of construction
   1. The Construction Manager shall notify the RE, or BI, as appropriate, a minimum of 24 hours before the work is to begin.

2. The RE, or BI, as appropriate, shall notify MMC immediately.

C. All other procedures described above shall apply, as appropriate.

V. Post Construction

A. Preparation and Submittal of Draft Monitoring Report

1. The PI shall submit two copies of the Draft Monitoring Report (even if negative), prepared in accordance with the Paleontological Guidelines which describes the results, analysis, and conclusions of all phases of the Paleontological Monitoring Program (with appropriate graphics) to MMC via the RE for review and approval within 90 days following the completion of monitoring,
   a. For significant paleontological resources encountered during monitoring, the Paleontological Recovery Program or Pipeline Trenching Discovery Process shall be included in the Draft Monitoring Report.
   b. Recording Sites with the San Diego Natural History Museum
      The PI shall be responsible for recording (on the appropriate forms) any significant or potentially significant fossil resources encountered during the Paleontological Monitoring Program in accordance with the City's Paleontological Guidelines, and submittal of such forms to the San Diego Natural History Museum with the Final Monitoring Report.
2. MMC shall return the Draft Monitoring Report to the PI via the RE for revision or, for preparation of the Final Report.
3. The PI shall submit revised Draft Monitoring Report to MMC via the RE for approval.
4. MMC shall provide written verification to the PI of the approved report.
5. MMC shall notify the RE or BI, as appropriate, of receipt of all Draft Monitoring Report submittals and approvals.

B. Handling of Fossil Remains

1. The PI shall be responsible for ensuring that all fossil remains collected are cleaned and catalogued.

C. Curation of artifacts: Deed of Gift and Acceptance Verification

1. The PI shall be responsible for ensuring that all fossil remains associated with the monitoring for this project are permanently curated with an appropriate institution.
2. The PI shall submit the Deed of Gift and catalogue record(s) to the RE or BI, as appropriate for donor signature with a copy submitted to MMC.
3. The RE or BI, as appropriate shall obtain signature on the Deed of Gift and shall return to PI with copy submitted to MMC.
4. The PI shall include the Acceptance Verification from the curation institution in the Final Monitoring Report submitted to the RE or BI and MMC.

D. Final Monitoring Report(s)

1. The PI shall submit two copies of the Final Monitoring Report to MMC (even if negative), within 90 days after notification from MMC of the approved report.
2. The RE shall, in no case, issue the Notice of Completion until receiving a copy of the approved Final Monitoring Report from MMC which includes the Acceptance Verification from the curation institution.

VI. PUBLIC REVIEW DISTRIBUTION:

Draft copies or notice of this Mitigated Negative Declaration were distributed to:

State of California
Regional Water Quality Control Board, Region 9 (44)

City of San Diego:
Councilmember Scott Sherman, District 7
City Attorney
Shannon Thomas (MS 59)
Public Works Department - Engineering and Capital Projects
Dwayne Abbey
Darren Genova

Development Services Department
Helene Deisher
Myra Herrmann
Sam Johnson - MMC
Mehdi Rastakhiz
Leonard Wilson
Library Dept.-Gov. Documents MS 17 (81)
Tierrasanta Branch Library (81II)
Public Utilities Department
Keli Balo
Dirk Smith

Other groups and Individuals:
Tierrasanta Community Council (462 & 464)
Murphy Canyon Community Council (463)
San Diego Unified School District (125)
Metropolitan Transit System (112)
San Diego Gas & Electric (114)
San Diego Natural History Museum (166)

VII. RESULTS OF PUBLIC REVIEW:

(X) No comments were received during the public input period.

( ) Comments were received but did not address the draft Mitigated Negative Declaration finding or the accuracy/completeness of the Initial Study. No response is necessary. The letters are attached.

( ) Comments addressing the findings of the draft Mitigated Negative Declaration and/or accuracy or completeness of the Initial Study were received during the public input period. The letters and responses follow.

Copies of the ~~draft~~ Mitigated Negative Declaration, the Mitigation, Monitoring and Reporting Program and any Initial Study material are available in the office of the Entitlements Division for review, or for purchase at the cost of reproduction.

Myra Herrmann, Senior Planner
Development Services Department

February 26, 2014
Date of Draft Report

April 2, 2014
Date of Final Report

Attachments:

Figure 1 – Location Map
Initial Study Checklist

TIERRASANTA (VIA DOMINIQUE) PUMP STATION

SENIOR ENGINEER
Hossein Azar
619-533-4102

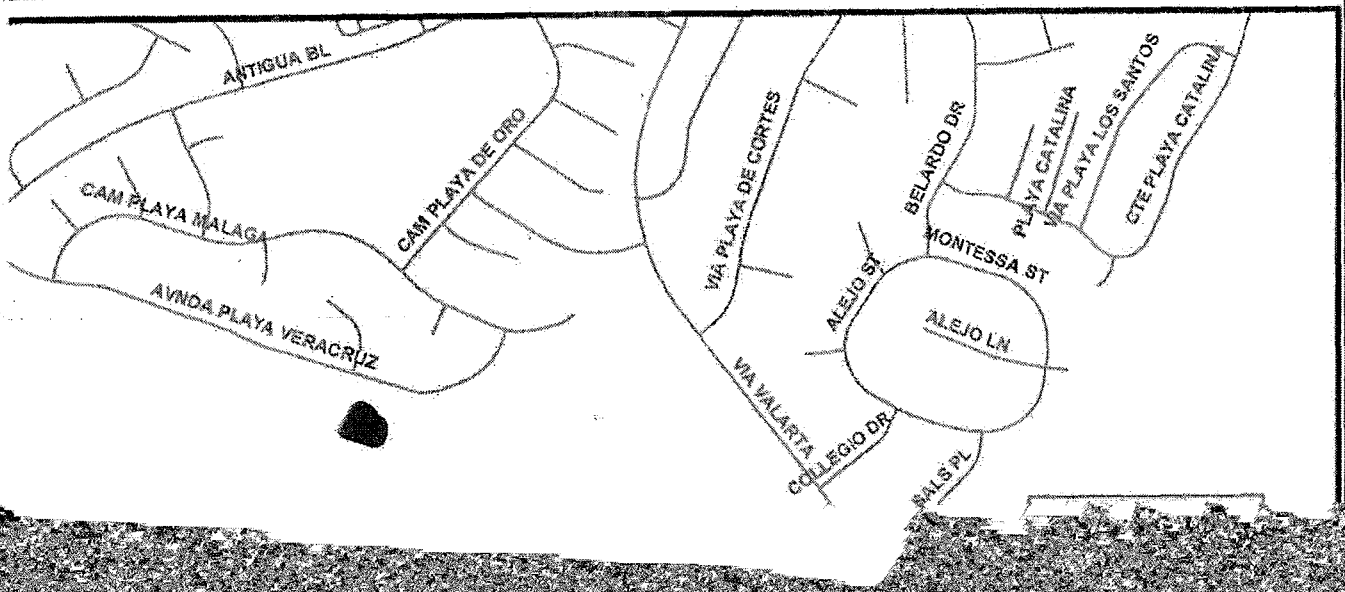
PROJECT ENGINEER
Robert Belciano
619-533-4630

PROJECT MANAGER
Dwayne Abbey
619-533-5154

PUBLIC INFORMATION OFFICER
Hotline
619-533-4207

City of San Diego
Engineering & Capital Projects Department

Architectural Engineering & Parks



Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact

paleontological monitoring given the depth and type of excavation employed which may be by mass excavation or mass drilling. If drilled, the holes would be several feet in diameter which may be large enough to allow discoveries of intact fossils and prevent an entire fossil from being destroyed by the extraction method. In addition, an 8-10 foot trench will be excavated along the center of the station to recess the discharge piping. Implementation of paleontological monitoring would reduce any potential impacts to below a level of significance.

d) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☐	☐	☒

No buried human remains are known to exist within the project site. However, in the event that remains are encountered during construction, all work is required to stop, and a coroner called to assess any such findings in accordance with the City Greenbook standards. Therefore the project would not significantly impact any human remains.

VI. GEOLOGY AND SOILS – Would the project:

a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☐	☒

A Report of Geotechnical Investigation was prepared by Allied Geotechnical Engineers, Inc., dated August 9, 2013, which included geotechnical field exploration and laboratory testing. The field exploration included the advancement of two (2) air-rotary borings to depths of 21.5 feet and 41.5 feet below ground surface. No soil borings were taken along the proposed water pipeline alignment along Clairemont Mesa Boulevard. Based on the results of the investigation, the new pump station building, meter vault and retaining walls as proposed are feasible provided the geotechnical recommendations are followed. Therefore, the proposed project would not expose people or structures to adverse geotechnical effects.

ii) Strong seismic ground	☐	☐	☒	☐

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact

shaking?

A Report of Geotechnical Investigation (Report) prepared by Allied Geotechnical Engineers, Inc., dated August 9, 2013, evaluated the project for strong seismic ground shaking. The project site is subject to moderate to severe ground shaking in response to a major earthquake occurring on the Rose Canyon Fault Zone or on one of the major regional active faults. The computer program EQFAULT (Blake, 2010) was used to approximate the distance of known faults to the site. Seven known active faults are identified within a search radius of 50 miles from the site. The project site is not located astride or near any known (mapped) active or potentially active faults (Kennedy and Peterson, 1975; City of San Diego, 1995). Therefore the potential for fault ground rupture at the site is considered insignificant. Based on the Report, design and construction of the new pump station, meter vault and retaining walls are feasible, provided the recommendations presented in the report are followed.

iii) Seismic-related ground failure, including liquefaction?	☐	☐	☐	☒

A Report of Geotechnical Investigation prepared by Allied Geotechnical Engineers, Inc., dated August 9, 2013, evaluated the project for geologic issues including soil liquefaction. The analysis concluded that the project site is underlain by very dense to hard Friars Formation and Stadium Conglomerate which are not considered susceptible to seismic-induced soil liquefaction or ground settlement. Furthermore, a review of the State of California Seismic Hazard Zones (2009) indicates that the site is not located within an area that is considered susceptible to soil liquefaction during a seismic event.

iv) Landslides?	☐	☐	☐	☒

A review of the pertinent geologic map indicates that the project site is not located on or below any known (mapped) ancient landslides (Kennedy and Peterson, 1975 and City of San Diego, 1995). Furthermore, a review of the State of California Seismic Hazard Zones (2009) indicates that the site is not located in an area that is susceptible to landslide hazards.

b) Result in substantial soil erosion or the loss of topsoil?	☐	☐	☐	☒

See VI (iii). In addition, the analysis concludes that the majority of soil materials encountered in the borings are considered suitable for use as compacted fill materials. The project proposes approximately 3,000 linear feet of new 20-inch PVC water main and a new pump station directly adjacent to the existing pump station. Also included will be street paving, water services and pedestrian ramps along the pipeline alignment. The area around the pump station and new water main will be paved or revegetated after construction. Therefore, the project would not result in substantial soil erosion or the loss of topsoil.

c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and	☐	☐	☐	☒

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?				

Project implementation would not result in such an impact. See VI (iii).

d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	☐	☐	☐	☒

Project implementation would not result in such an impact. See VI (iii).

e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	☐	☐	☐	☒

The project does not propose any septic tanks or alternative waste disposal methods.

VII. GREENHOUSE GAS EMISSIONS - Would the project:

a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☐	☐	☒	☐

The City of San Diego is utilizing the California Air Pollution Control Officers Association (CAPCOA) report "CEQA and Climate Change" (CAPCOA 2009) to determine whether a GHG analysis would be required for submitted projects. The CAPCOA report references a 900 metric ton guideline as a conservative threshold for requiring further analysis and possible mitigation. This emission level is based on the amount of vehicle trips, the typical energy and water use associated with projects, and other factors.

CAPCOA identifies project types that are estimated to emit approximately 900 metric tons of GHG's annually. This 900 metric ton threshold is roughly equivalent to 35,000 square feet of office space, 11,000 square feet of retail, 50 single-family residential units, 70 multi-family residential units and 6,300 square feet of supermarkets.

The Urbemis Model (2007 9.2.4) was utilized to generate GHGs emissions estimates for the project. The model utilizes project information (e.g. total construction months, project type, construction equipment, grading quantities and the total disturbance area, etc.) to quantify GHG emissions from

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact

heavy-duty construction equipment, haul trucks, and worker commute trips associated with construction projects.

The result of the model indicates that this project would result in less than 900 annual metric tons of emissions. Therefore, based upon the analysis showed above the project would result in a less than significant CEQA Greenhouse gas impact and mitigation would not be required.

b) Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☒	☐

Please see VII.a. The project would not conflict with any applicable plans, policies, or regulations related to greenhouse gases.

VIII. HAZARDS AND HAZARDOUS MATERIALS – Would the project:

a) Create a significant hazard to the public or the environment through routine transport, use, or disposal of hazardous materials?	☐	☐	☐	☒

The project proposes approximately 3,000 linear feet of new 20-inch PVC water main and a new pump station directly adjacent to the existing pump station. Also included will be street paving, water services and pedestrian ramps along the pipeline alignment. It is not anticipated that any hazardous materials will be discovered during project implementation and therefore, no significant hazards would be created. No mitigation is required.

b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☐	☒

See VIII a)

c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☐	☒

The project is not within one-quarter mile of an existing school. It is not anticipated that any hazardous materials will be discovered during project implementation and therefore, no significant hazards would be created to the public as indicated.

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	☒

The project site is not included on a list of hazardous materials sites and therefore implementation of the project would not create a significant hazard to the public or environment.

e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒

The proposed project is located within the Airport Influence Area (AIA) of the MCAS Miramar and Montgomery Field Airport's Airport Land Use Compatibility Plan (ALUCP). It is also within the FAA Part 77 Noticing Area. The pump house will be 24 feet above finish grade at the highest point. The site is located at the base of a slope approximately 50 feet in height that is below a residential subdivision and the project would not result in a safety hazard for people residing or working in the project areas.

f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒

The project is not located within the vicinity of a private airstrip. As such, the project would not result in a safety hazard for people residing or working in the project area.

g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☒

It is not anticipated that the project would interfere with an adopted emergency response or evacuation plan.

h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to	☐	☐	☐	☒

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
urbanized areas or where residences are intermixed with wildlands?				

The majority of the project site is located on the northeast corner of Clairemont Mesa Boulevard and Seda Drive within an open area adjacent to a gentle slope, surrounded by residential development. The project proposes to revegetate the disturbed areas once work on the approximately 3,000 linear feet of new 20-inch PVC water main and a new pump station is complete. The re-vegetation plan would blend with the existing slope vegetation and adhere to all City of San Diego brush management requirements. As such, project implementation would not expose people or structures to a significant risk of loss, injury or death involving wildland fires.

IX. HYDROLOGY AND WATER QUALITY - Would the project:

a) Violate any water quality standards or waste discharge requirements?	☐	☐	☐	☒

Based on the City of San Diego Storm Water Standards section 2, the project does not meet any of the criteria for Priority Development Projects and is subject to only the Standard Development Project requirements for Permanent Best Management Practices. The project will include source control measures and implementation of Low Impact Development design practices such as preservation of existing landscaping, use of low water use landscaping and directing runoff from buildings and parking areas into planting areas.

b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☐	☒

The project does not propose the use of groundwater nor would it impact groundwater during grading activities. Furthermore, the project would not introduce a substantially large amount of new impervious surfaces over ground that could interfere with groundwater recharge. Therefore, the project would not substantially deplete groundwater supplies or interfere substantially with groundwater recharge.

c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner, which would result in substantial erosion or siltation on- or	☐	☐	☐	☒

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
off-site?				

The proposed project to install approximately 3,000 linear feet of new 20-inch PVC water main and a new pump station directly adjacent to the existing pump station. Also included will be street paving, water services and pedestrian ramps along the pipeline alignment. The site will be revegetated once work has been completed. The existing drainage pattern will not be substantially altered and will not result in erosion or siltation on or off-site.

d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner, which would result in flooding on- or off-site?	☐	☐	☐	☒

Please see IX.c.

e) Create or contribute runoff water, which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☐	☒

The project would not result in an increase in storm water volume, frequency or velocity nor will it significantly reduce existing infiltration rates.

f) Otherwise substantially degrade water quality?	☐	☐	☐	☒

See IX-a.

g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☐	☐	☐	☒

The project is not located within the 100-year flood plain or other flood hazard area.

h) Place within a 100-year flood hazard area, structures that would impede or redirect flood flows?	☐	☐	☐	☒

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact

The project site is located in Zone X as identified on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) number 06073C1629G. Zone X refers to areas outside of the O.2% annual chance floodplain and describes areas with a minimal risk of flood.

i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	☐	☒

No impact. Please see IX.h.

j) Inundation by seiche, tsunami, or mudflow?	☐	☐	☐	☒

The project would not include any new features that would increase the risk associated with seiche, tsunami, or mudflow beyond those of the existing conditions.

X. LAND USE AND PLANNING – Would the project:

a) Physically divide an established community?	☐	☐	☐	☒

The project would result in approximately 3,000 linear feet of new 20-inch PVC water main and a new pump station directly adjacent to the existing pump station. Also included will be street paving, water services and pedestrian ramps along the pipeline alignment. Therefore, project implementation would not result in the division of an established community.

b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	☒

The project includes the upgrades to existing public infrastructure and is consistent with the policies, goals and recommendations of the General Plan and the Tierrasanta Community Plan. Therefore, it would not conflict with any land use planning document for the community.

c) Conflict with any applicable habitat conservation plan or natural	☐	☐	☐	☒

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact

community conservation plan?

The project site is located outside of the Multi-Habitat Planning Area (MHPA) and would not conflict with the City's Biological Guidelines or the Multiple Species Conservation Plan (MSCP) Subarea Plan.

XI. MINERAL RESOURCES – Would the project?

a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☒

The areas surrounding the project are not being used for the recovery of mineral resources. Similarly, these areas surrounding the project site are not designated for the recovery of mineral resources on the City of San Diego General Plan Land Use Map. Therefore, the project would not result in the loss of availability of a known mineral resource.

b) Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	☒

The project would not result in the loss of the availability of a locally important mineral resource. There are no existing quarries within close proximity to the site. As such, project implementation would not impact the operations of any existing quarries.

XII. NOISE – Would the project result in:

a) Exposure of persons to, or generation of, noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☐	☐	☒

The project would not result in a permanent substantial increase in the existing noise environment. Noise dampening panels will be mounted on the inside face of the building walls and roof structure. The pump station will be designed to meet the current City Ordinance limit of 40 dBA at the facility property line (including during emergency generator operation). Noise-proof enclosures will be installed around the heating/ventilation/air conditioning (HVAC) equipment to dampen noise and maintain the 40 dBA requirement at the property line.

b) Exposure of persons to, or generation of, excessive ground borne vibration or ground borne noise levels?	☐	☐	☐	☒

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact

The project would not result in people being exposed to excessive ground borne noise levels.

c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	☒

See XII.a . Noise dampening measures will be installed to meet local standards, therefore the project would not result in ambient noise levels above the 40 dBA requirement at the property line.

d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above existing without the project?	☐	☐	☐	☒

The project site is subject to noise typical of an urban neighborhood, such as residential traffic on local streets. The planned new pump station would have a variety of noise sources. These noise sources vary from the pump equipment noise emanations through the building structure to the new generator. The project will be designed to meet the current City Ordinance limit of 40 dBA at the facility property line.

e) For a project located within an airport land use plan, or, where such a plan has not been adopted, within two miles of a public airport or public use airport would the project expose people residing or working in the area to excessive noise levels?	☐	☐	☐	☒

No Impact. Please see XII.a.

f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒

The project is not located within the vicinity of a private airport.

XIII. POPULATION AND HOUSING – Would the project:

a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for	☐	☐	☐	☒

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
example, through extension of roads or other infrastructure)?				

The project would provide a more efficient means to supply water to existing population levels. The proposed improvements are not associated with growing demand.

b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒

Project implementation would not displace any housing. Therefore, the construction of housing elsewhere would not be necessitated.

c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒

See XIII.b.

XIV. PUBLIC SERVICES

a) Would the project result in substantial adverse physical impacts associated with the provisions of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service rations, response times or other performance objectives for any of the public services:				
i) Fire Protection	☐	☐	☐	☒

The project would not alter any fire protection response times, facilities or impact the operation of fire personnel.

ii) Police Protection	☐	☐	☐	☒

The project would not alter any police protection response times, facilities or impact the operation of police personnel.

iii) Schools	☐	☐	☐	☒

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
The project would not physically alter any schools.				
v) Parks	☐	☐	☐	☒
The project would not physically alter any parks.				
vi) Other public facilities	☐	☐	☐	☒
The project would not result in the increased demand for electricity, gas, or other public facilities. The project would improve existing infrastructure and would not impact any other public facilities.				
XV. RECREATION –				
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	☒
The project would not result in the building of residential units and would therefore not result in an increase in demand for recreational facilities.				
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities, which might have an adverse physical effect on the environment?	☐	☐	☐	☒
See XV.a.				
XVI. TRANSPORTATION/TRAFFIC – Would the project?				
a) Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?	☐	☐	☐	☒

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact

The project does include work within the public right-of-way and therefore traffic control plans will be implemented in accordance with contract specifications. These measures will ensure that no conflicts would occur with the effectiveness of the circulation system.

b) Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?	☐	☐	☐	☒

See XVI.a.

c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	☐	☐	☐	☒

The project would not result in a change in air traffic patterns.

d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☐	☒

The project does include work within the public right-of-way and therefore traffic control plans will be implemented in accordance with contract specifications. No such hazards resulting from a design feature would occur.

e) Result in inadequate emergency access?	☐	☐	☐	☒

The project does include work within the public right-of-way and therefore traffic control plans will be implemented in accordance with contract specifications. Adequate emergency access would be maintained throughout construction.

f) Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance	☐	☐	☐	☒

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact

or safety of such facilities?

As noted above under XVI.e, a traffic control plan would be required and implemented by the contractor.

XVII. UTILITIES AND SERVICE SYSTEMS – Would the project:

a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☐	☒

The project would not result in an increase in the intensity of the use and would not exceed wastewater treatment requirements.

b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒

The project would result in approximately 3,000 linear feet of new 20-inch PVC water main and a new pump station directly adjacent to the existing pump station. Also included will be street paving, water services and pedestrian ramps along the pipeline alignment. The project was initiated to improve inefficiencies with the Tierrasanta Temporary and Via Dominique pumps, causing high maintenance and operating costs. A new single facility would combine the pumping requirements of both the Tierrasanta and the Via Dominique stations at one location resulting in a more efficient system. Construction of the pump station and water main would not cause significant environmental effects.

c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒

The project would not require or result in the construction of new storm water drainage facilities or expansion of existing facilities and therefore, would not cause significant environmental effects.

d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☐	☒

The project would not increase the intensity of use of the site and would therefore be served by the

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
existing water supplies available to the site.				
e) Result in a determination by the wastewater treatment provided which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☐	☒

The proposed project will result in approximately 3,000 linear feet of new 20-inch PVC water main and a new pump station directly adjacent to the existing pump station. Also included will be street paving, water services and pedestrian ramps along the pipeline alignment. The project would have no impact on the current demand on existing wastewater commitments.

f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☐	☐	☐	☒

Construction of the project would likely generate minimal waste. This waste would be disposed of in conformance with all applicable local and state regulations pertaining to solid waste including permitting capacity of the landfill serving the project area. Operation of the project would not generate waste and, therefore, would not affect the permitted capacity of the landfill serving the project area.

g) Comply with federal, state, and local statutes and regulation related to solid waste?	☐	☐	☐	☒

See XVII f). Any solid waste generated during construction related activities would be recycled or disposed of in accordance with all applicable local, state and federal regulations.

XVIII. MANDATORY FINDINGS OF SIGNIFICANCE –

a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or	☐	☒	☐	☐

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact

prehistory?

The project is located in a developed urbanized neighborhood and would not degrade the quality of the surrounding environment. The project has the potential to result in impacts to paleontological resources requiring mitigation. Implementation of the Mitigation Monitoring & Reporting Program (MMRP) would reduce potential impacts to paleontological resources to below a level of significance. The project is not located within or adjacent to the City's MHPA.

b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable futures projects)?	☐	☐	☒	☐

The project may result in minimal dust and GHGs during the construction process. However, these emissions would be relatively minor and temporary in nature and would not be considerable. When viewed in connection with the effects of other projects in the area, construction activities do not have the potential to be cumulatively considerable.

c) Does the project have environmental effects, which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☒	☐	☐

As stated previously, potentially significant impacts have been identified for paleontological resources. The proposed project is located on a previously graded site within a developed residential area of San Diego. The project is consistent with the planning objectives of the communities in which it is located. Mitigation has been included in Section V of this MND to reduce impacts to paleontological resources to below a level of significance. As such, project implementation would not result in substantial adverse impacts to human beings.

INITIAL STUDY CHECKLIST

REFERENCES

I. AESTHETICS / NEIGHBORHOOD CHARACTER

X City of San Diego General Plan.

X Community Plan.

___ Local Coastal Plan.

II. AGRICULTURAL RESOURCES & FOREST RESOURCES

X City of San Diego General Plan.

___ U.S. Department of Agriculture, Soil Survey - San Diego Area, California, Part I and II, 1973.

___ California Agricultural Land Evaluation and Site Assessment Model (1997)

___ Site Specific Report:

III. AIR QUALITY

___ California Clean Air Act Guidelines (Indirect Source Control Programs) 1990.

___ Regional Air Quality Strategies (RAQS) - APCD.

___ Site Specific Report:

IV. BIOLOGY

X City of San Diego, Multiple Species Conservation Program (MSCP), Subarea Plan, 1997

X City of San Diego, MSCP, "Vegetation Communities with Sensitive Species and Vernal Pools" Maps, 1996.

X City of San Diego, MSCP, "Multiple Habitat Planning Area" maps, 1997.

X Community Plan - Resource Element.

___ California Department of Fish and Game, California Natural Diversity Database, "State and Federally-listed Endangered, Threatened, and Rare Plants of California," January 2001.

___ California Department of Fish & Game, California Natural Diversity Database, "State and Federally-listed Endangered and Threatened Animals of California," January 2001.

___ City of San Diego Land Development Code Biology Guidelines.

___ Site Specific Report:

V. **CULTURAL RESOURCES (INCLUDES HISTORICAL RESOURCES)**

_X_ City of San Diego Historical Resources Guidelines.

___ City of San Diego Archaeology Library.

___ Historical Resources Board List.

___ Community Historical Survey:

___ Site Specific Report:

VI. **GEOLOGY/SOILS**

___ City of San Diego Seismic Safety Study.

___ U.S. Department of Agriculture Soil Survey - San Diego Area, California, Part I and II, December 1973 and Part III, 1975.

_X_ Site Specific Report: A Geotechnical Evaluation, prepared by Allied Geotechnical Engineers, Inc., dated August 9, 2013

VII. **GREENHOUSE GAS EMISSIONS**

_X_ California Emissions Estimator Model (CalEEmod) TM. Version 2011.1.1

VIII. **HAZARDS AND HAZARDOUS MATERIALS**

_X_ San Diego County Hazardous Materials Environmental Assessment Listing

___ San Diego County Hazardous Materials Management Division

___ FAA Determination

___ State Assessment and Mitigation, Unauthorized Release Listing, Public Use Authorized.

___ Airport Land Use Compatibility Plan.

___ Site Specific Report:

IX. **HYDROLOGY/WATER QUALITY**

_X_ Flood Insurance Rate Map (FIRM).

___ Federal Emergency Management Agency (FEMA), National Flood Insurance Program - Flood Boundary and Floodway Map.

___ Clean Water Act Section 303(b) list, http://www.swrcb.ca.gov/tmdl/303d_lists.html).

___ Site Specific Report:

X. **LAND USE AND PLANNING**

_X_ City of San Diego General Plan.

_X_ Community Plan: Tierrasanta Community Plan

_X_ Airport Land Use Compatibility Plan

_X_ City of San Diego Zoning Maps

___ FAA Determination

XI. MINERAL RESOURCES

_X_ California Department of Conservation - Division of Mines and Geology, Mineral Land Classification.

___ Division of Mines and Geology, Special Report 153 - Significant Resources Maps.

___ California Geological Survey - SMARA Mineral Land Classification Maps.

XII. NOISE

_X_ Community Plan

___ San Diego International Airport Master Plan CNEL Maps.

___ MCAS Miramar ACLUP

___ Brown Field Airport Master Plan CNEL Maps.

___ Montgomery Field CNEL Maps.

___ San Diego Association of Governments - San Diego Regional Average Weekday Traffic Volumes.

___ San Diego Metropolitan Area Average Weekday Traffic Volume Maps, SANDAG.

_X_ City of San Diego General Plan.

XIII. PALEONTOLOGICAL RESOURCES

_X_ City of San Diego Paleontological Guidelines.

_X_ Deméré, Thomas A., and Stephen L. Walsh, "Paleontological Resources City of San Diego," Department of Paleontology San Diego Natural History Museum, 1996.

_X_ Kennedy, Michael P., and Gary L. Peterson, "Geology of the San Diego Metropolitan Area, California. Del Mar, La Jolla, Point Loma, La Mesa, Poway, and SW 1/4 Escondido 7 1/2 Minute Quadrangles," California Division of Mines and Geology Bulletin 200, Sacramento, 1975.

___ Kennedy, Michael P., and Siang S. Tan, "Geology of National City, Imperial Beach and Otay Mesa Quadrangles, Southern San Diego Metropolitan Area, California," Map Sheet 29, 1977.

XIV. POPULATION / HOUSING

_X_ City of San Diego General Plan.

_X_ Community Plan.

___ Series 11 Population Forecasts, SANDAG.

___ Other:

XV. PUBLIC SERVICES

_X_ City of San Diego General Plan.

_X_ Community Plan.

XVI. RECREATIONAL RESOURCES

_X_ City of San Diego General Plan.

_X_ Community Plan.

___ Department of Park and Recreation

___ City of San Diego - San Diego Regional Bicycling Map

___ Additional Resources:

XVII. TRANSPORTATION / CIRCULATION

_X_ City of San Diego General Plan.

_X_ Community Plan.

___ San Diego Metropolitan Area Average Weekday Traffic Volume Maps, SANDAG.

___ San Diego Region Weekday Traffic Volumes, SANDAG.

___ Site Specific Report:

XVIII. UTILITIES

_X_ City of San Diego General Plan.

_X_ Community Plan.

___ Site Specific Report:

XIX. WATER CONSERVATION

_X_ City of San Diego General Plan.

_X_ Community Plan.

___ Sunset Magazine, New Western Garden Book. Rev. ed. Menlo Park, CA: Sunset Magazine.

APPENDIX B

FIRE HYDRANT METER PROGRAM

CITY OF SAN DIEGO CALIFORNIA DEPARTMENT INSTRUCTIONS	NUMBER DI 55.27	DEPARTMENT Water Department
SUBJECT FIRE HYDRANT METER PROGRAM (FORMERLY: CONSTRUCTION METER PROGRAM)	PAGE 1OF 10	EFFECTIVE DATE October 15, 2002
	SUPERSEDES DI 55.27	DATED April 21, 2000

1. **PURPOSE**

1.1 To establish a Departmental policy and procedure for issuance, proper usage and charges for fire hydrant meters.

2. **AUTHORITY**

2.1 All authorities and references shall be current versions and revisions.

2.2 San Diego Municipal Code (NC) Chapter VI, Article 7, Sections 67.14 and 67.15

2.3 Code of Federal Regulations, Safe Drinking Water Act of 1986

2.4 California Code of Regulations, Titles 17 and 22

2.5 California State Penal Code, Section 498B.0

2.6 State of California Water Code, Section 110, 500-6, and 520-23

2.7 Water Department Director

Reference

2.8 State of California Guidance Manual for Cross Connection Programs

2.9 American Water Works Association Manual M-14, Recommended Practice for Backflow Prevention

2.10 American Water Works Association Standards for Water Meters

2.11 U.S.C. Foundation for Cross Connection Control and Hydraulic Research Manual

3. **DEFINITIONS**

3.1 **Fire Hydrant Meter:** A portable water meter which is connected to a fire hydrant for the purpose of temporary use. (These meters are sometimes referred to as Construction Meters.)

3.2 **Temporary Water Use:** Water provided to the customer for no longer than twelve (12) months.

3.3 **Backflow Preventor:** A Reduced Pressure Principal Assembly connected to the outlet side of a Fire Hydrant Meter.

4. **POLICY**

4.1 The Water Department shall collect a deposit from every customer requiring a fire hydrant meter and appurtenances prior to providing the meter and appurtenances (see Section 7.1 regarding the Fees and Deposit Schedule). The deposit is refundable upon the termination of use and return of equipment and appurtenances in good working condition.

4.2 Fire hydrant meters will have a 2 ½" swivel connection between the meter and fire hydrant. The meter shall not be connected to the 4" port on the hydrant. All Fire Hydrant Meters issued shall have a Reduced Pressure Principle Assembly (RP) as part of the installation. Spanner wrenches are the only tool allowed to turn on water at the fire hydrant.

4.3 The use of private hydrant meters on City hydrants is prohibited, with exceptions as noted below. All private fire hydrant meters are to be phased out of the City of San Diego. All customers who wish to continue to use their own fire hydrant meters must adhere to the following conditions:

a. Meters shall meet all City specifications and American Water Works Association (AWWA) standards.

b. Customers currently using private fire hydrant meters in the City of San Diego water system will be allowed to continue using the meter under the following conditions:

1. The customer must submit a current certificate of accuracy and calibration results for private meters and private backflows annually to the City of San Diego, Water Department, Meter Shop.

2. The meter must be properly identifiable with a clearly labeled serial number on the body of the fire hydrant meter. The serial number shall be plainly stamped on the register lid and the main casing. Serial numbers shall be visible from the top of the meter casing and the numbers shall be stamped on the top of the inlet casing flange.

3. All meters shall be locked to the fire hydrant by the Water Department, Meter Section (see Section 4.7).

4. All meters shall be read by the Water Department, Meter Section (see Section 4.7).

5. All meters shall be relocated by the Water Department, Meter Section (see Section 4.7).

6. These meters shall be tested on the anniversary of the original test date and proof of testing will be submitted to the Water Department, Meter Shop, on a yearly basis. If not tested, the meter will not be allowed for use in the City of San Diego.

7. All private fire hydrant meters shall have backflow devices attached when installed.

8. The customer must maintain and repair their own private meters and private backflows.

9. The customer must provide current test and calibration results to the Water Department, Meter Shop after any repairs.

10. When private meters are damaged beyond repair, these private meters will be replaced by City owned fire hydrant meters.

11. When a private meter malfunctions, the customer will be notified and the meter will be removed by the City and returned to the customer for repairs. Testing and calibration results shall be given to the City prior to any re-installation.

12. The register shall be hermetically sealed straight reading and shall be readable from the inlet side. Registration shall be in hundred cubic feet.

13. The outlet shall have a 2 ½ "National Standards Tested (NST) fire hydrant male coupling.

14. Private fire hydrant meters shall not be transferable from one contracting company to another (i.e. if a company goes out of business or is bought out by another company).

4.4 All fire hydrant meters and appurtenances shall be installed, relocated and removed by the City of San Diego, Water Department. All City owned fire hydrant meters and appurtenances shall be maintained by the City of San Diego, Water Department, Meter Services.

4.5 If any fire hydrant meter is used in violation of this Department Instruction, the violation will be reported to the Code Compliance Section for investigation and appropriate action. Any customer using a fire hydrant meter in violation of the requirements set forth above is subject to fines or penalties pursuant to the Municipal Code, Section 67.15 and Section 67.37.

4.6 **Conditions and Processes for Issuance of a Fire Hydrant Meter**

Process for Issuance

a. Fire hydrant meters shall only be used for the following purposes:

1. Temporary irrigation purposes not to exceed one year.

2. Construction and maintenance related activities (see Tab 2).

b. No customer inside or outside the boundaries of the City of San Diego Water Department shall resell any portion of the water delivered through a fire hydrant by the City of San Diego Water Department.

c. The City of San Diego allows for the issuance of a temporary fire hydrant meter for a period not to exceed 12 months (365 days). An extension can only be granted in writing from the Water Department Director for up to 90 additional days. A written request for an extension by the consumer must be submitted at least 30 days prior to the 12 month period ending. No extension shall be granted to any customer with a delinquent account with the Water Department. No further extensions shall be granted.

d. Any customer requesting the issuance of a fire hydrant meter shall file an application with the Meter Section. The customer must complete a "Fire Hydrant Meter Application" (Tab 1) which includes the name of the company, the party responsible for payment, Social Security number and/or California ID, requested location of the meter (a detailed map signifying an exact location), local contact person, local phone number, a contractor's license (or a business license), description of specific water use, duration of use at the site and full name and address of the person responsible for payment.

e. At the time of the application the customer will pay their fees according to the schedule set forth in the Rate Book of Fees and Charges, located in the City Clerk's Office. All fees must be paid by check, money order or cashiers check, made payable to the City Treasurer. Cash will not be accepted.

f. No fire hydrant meters shall be furnished or relocated for any customer with a delinquent account with the Water Department.

g. After the fees have been paid and an account has been created, the

meter shall be installed within 48 hours (by the second business day). For an additional fee, at overtime rates, meters can be installed within 24 hours (within one business day).

4.7 **Relocation of Existing Fire Hydrant Meters**

a. The customer shall call the Fire Hydrant Meter Hotline (herein referred to as "Hotline"), a minimum of 24 hours in advance, to request the relocation of a meter. A fee will be charged to the existing account, which must be current before a work order is generated for the meter's relocation.

b. The customer will supply in writing the address where the meter is to be relocated (map page, cross street, etc). The customer must update the original Fire Hydrant Meter Application with any changes as it applies to the new location.

c. Fire hydrant meters shall be read on a monthly basis. While fire hydrant meters and backflow devices are in service, commodity, base fee and damage charges, if applicable, will be billed to the customer on a monthly basis. If the account becomes delinquent, the meter will be removed.

4.8 **Disconnection of Fire Hydrant Meter**

a. After ten (10) months a "Notice of Discontinuation of Service" (Tab 3) will be issued to the site and the address of record to notify the customer of the date of discontinuance of service. An extension can only be granted in writing from the Water Department Director for up to 90 additional days (as stated in Section 4.6C) and a copy of the extension shall be forwarded to the Meter Shop Supervisor. If an extension has not been approved, the meter will be removed after twelve (12) months of use.

b. Upon completion of the project the customer will notify the Meter Services office via the Hotline to request the removal of the fire hydrant meter and appurtenances. A work order will be generated

for removal of the meter.

c. Meter Section staff will remove the meter and backflow prevention assembly and return it to the Meter Shop. Once returned to the Meter Shop the meter and backflow will be tested for accuracy and functionality.

d. Meter Section Staff will contact and notify Customer Services of the final read and any charges resulting from damages to the meter and backflow or its appurtenance. These charges will be added on the customer's final bill and will be sent to the address of record. Any customer who has an outstanding balance will not receive additional meters.

e. Outstanding balances due may be deducted from deposits and any balances refunded to the customer. Any outstanding balances will be turned over to the City Treasurer for collection. Outstanding balances may also be transferred to any other existing accounts.

5. EXCEPTIONS

5.1 Any request for exceptions to this policy shall be presented, in writing, to the Customer Support Deputy Director, or his/her designee for consideration.

6. MOBILE METER

6.1 Mobile meters will be allowed on a case by case basis. All mobile meters will be protected by an approved backflow assembly and the minimum requirement will be a Reduced Pressure Principal Assembly. The two types of Mobile Meters are vehicle mounted and floating meters. Each style of meters has separate guidelines that shall be followed for the customer to retain service and are described below:

a) **Vehicle Mounted Meters**: Customer applies for and receives a City owned Fire Hydrant Meter from the Meter Shop. The customer mounts the meter on the vehicle and brings it to the Meter Shop for

inspection. After installation is approved by the Meter Shop the vehicle and meter shall be brought to the Meter Shop on a monthly basis for meter reading and on a quarterly basis for testing of the backflow assembly. Meters mounted at the owner's expense shall have the one year contract expiration waived and shall have meter or backflow changed if either fails.

b) **Floating Meters:** Floating Meters are meters that are not mounted to a vehicle. **(Note: All floating meters shall have an approved backflow assembly attached.)** The customer shall submit an application and a letter explaining the need for a floating meter to the Meter Shop. The Fire Hydrant Meter Administrator, after a thorough review of the needs of the customer, (i.e. number of jobsites per day, City contract work, lack of mounting area on work vehicle, etc.), may issue a floating meter. At the time of issue, it will be necessary for the customer to complete and sign the "Floating Fire Hydrant Meter Agreement" which states the following:

1) The meter will be brought to the Meter Shop at 2797 Caminito Chollas, San Diego on the third week of each month for the monthly read by Meter Shop personnel.

2) Every other month the meter will be read and the backflow will be tested. This date will be determined by the start date of the agreement.

If any of the conditions stated above are not met the Meter Shop has the right to cancel the contract for floating meter use and close the account associated with the meter. The Meter Shop will also exercise the right to refuse the issuance of another floating meter to the company in question.

Any Fire Hydrant Meter using reclaimed water shall not be allowed use again with any potable water supply. The customer shall incur the cost of replacing the meter and backflow device in this instance.

7. **FEE AND DEPOSIT SCHEDULES**

7.1 **Fees and Deposit Schedules:** The fees and deposits, as listed in the Rate Book of Fees and Charges, on file with the Office of the City Clerk, are based on actual reimbursement of costs of services performed, equipment and materials. Theses deposits and fees will be amended, as needed, based on actual costs. Deposits, will be refunded at the end of the use of the fire hydrant meter, upon return of equipment in good working condition and all outstanding balances on account are paid. Deposits can also be used to cover outstanding balances.

All fees for equipment, installation, testing, relocation and other costs related to this program are subject to change without prior notification. The Mayor and Council will be notified of any future changes.

8. **UNAUTHORIZED USE OF WATER FROM A HYDRANT**

8.1 Use of water from any fire hydrant without a properly issued and installed fire hydrant meter is theft of City property. Customers who use water for unauthorized purposes or without a City of San Diego issued meter will be prosecuted.

8.2 If any unauthorized connection, disconnection or relocation of a fire hydrant meter, or other connection device is made by anyone other than authorized Water Department personnel, the person making the connection will be prosecuted for a violation of San Diego Municipal Code, Section 67.15. In the case of a second offense, the customer's fire hydrant meter shall be confiscated and/or the deposit will be forfeited.

8.3 Unauthorized water use shall be billed to the responsible party. Water use charges shall be based on meter readings, or estimates when meter readings are not available.

8.4 In case of unauthorized water use, the customer shall be billed for all applicable charges as if proper authorization for the water use had been obtained, including but not limited to bi-monthly service charges, installation charges and removal charges.

8.5 If damage occurs to Water Department property (i.e. fire hydrant meter, backflow, various appurtenances), the cost of repairs or replacements will be charged to the customer of record (applicant).

Larry Gardner
Water Department Director

Tabs:
1. Fire Hydrant Meter Application
2. Construction & Maintenance Related Activities With No Return To Sewer
3. Notice of Discontinuation of Service

APPENDIX

Administering Division: Customer Support Division

Subject Index:
Construction Meters
Fire Hydrant
Fire Hydrant Meter Program
Meters, Floating or Vehicle Mounted
Mobile Meter
Program, Fire Hydrant Meter

Distribution: DI Manual Holders

Application for Fire Hydrant Meter (EXHIBIT A)

City of San Diego PUBLIC UTILITIES Water & Wastewater

(For Office Use Only)

NS REQ	FAC#
DATE	BY

METER SHOP (619) 527-7449

Application Date	Requested Install Date:

Meter Information

Fire Hydrant Location: (Attach Detailed Map//Thomas Bros. Map Location or Construction drawing.) Zip:	T.B.	G.B. (CITY USE)
Specific Use of Water:		
Any Return to Sewer or Storm Drain, If so, explain:		
Estimated Duration of Meter Use:		Check Box If Reclaimed Water

Company Information

Company Name:			
Mailing Address:			
City:	State:	Zip:	Phone: ( )
*Business license#	*Contractor license#		
A Copy of the Contractor's license OR Business License is required at the time of meter issuance.			
Name and Title of Billing Agent: (PERSON IN ACCOUNTS PAYABLE)			Phone: ( )
Site Contact Name and Title:			Phone: ( )
Responsible Party Name:			Title:
Cal ID#			Phone: ( )
Signature:		Date:	

Guarantees Payment of all Charges Resulting from the use of this Meter. Insures that employees of this Organization understand the proper use of Fire Hydrant Meter

Fire Hydrant Meter Removal Request		Requested Removal Date:
Provide Current Meter Location If Different from Above:		
Signature:	Title:	Date:
Phone: ( )	Pager: ( )	

City Meter	Private Meter	
Contract Acct #:	Deposit Amount: $ 936.00	Fees Amount: $ 62.00
Meter Serial #	Meter Size: 05	Meter Make and Style: 6-7
Backflow #	Backflow Size:	Backflow Make and Style:
Name:	Signature:	Date:

WATER USES WITHOUT ANTICIPATED CHARGES FOR RETURN TO SEWER

Auto Detailing
Backfilling
Combination Cleaners (Vactors)
Compaction
Concrete Cutters
Construction Trailers
Cross Connection Testing
Dust Control
Flushing Water Mains
Hydro Blasting
Hydro Seeing
Irrigation (for establishing irrigation only; not continuing irrigation)
Mixing Concrete
Mobile Car Washing
Special Events
Street Sweeping
Water Tanks
Water Trucks
Window Washing

Note:

1. If there is any return to sewer or storm drain, then sewer and/or storm drain fees will be charges.

Date

Name of Responsible Party
Company Name and Address
Account Number:_____

Subject: Discontinuation of Fire Hydrant Meter Service

Dear Water Department Customer:

The authorization for use of Fire Hydrant Meter #_____, located at *(Meter Location Address)* ends in 60 days and will be removed on or after *(Date Authorization Expires)*. Extension requests for an additional 90 days must be submitted in writing for consideration 30 days prior to the discontinuation date. If you require an extension, please contact the Water Department, or mail your request for an extension to:

City of San Diego
Water Department
Attention: Meter Services
2797 Caminito Chollas
San Diego, CA 92105-5097

Should you have any questions regarding this matter, please call the Fire Hydrant Hotline at (619)_____-_____.

Sincerely,

Water Department

APPENDIX C

MATERIALS TYPICALLY ACCEPTED BY CERTIFICATE OF COMPLIANCE

Materials Typically Accepted by Certificate of Compliance

1. Soil amendment
2. Fiber mulch
3. PVC or PE pipe up to 16 inch diameter
4. Stabilizing emulsion
5. Lime
6. Preformed elastomeric joint seal
7. Plain and fabric reinforced elastomeric bearing pads
8. Steel reinforced elastomeric bearing pads
9. Waterstops (Special Condition)
10. Epoxy coated bar reinforcement
11. Plain and reinforcing steel
12. Structural steel
13. Structural timber and lumber
14. Treated timber and lumber
15. Lumber and timber
16. Aluminum pipe and aluminum pipe arch
17. Corrugated steel pipe and corrugated steel pipe arch
18. Structural metal plate pipe arches and pipe arches
19. Perforated steel pipe
20. Aluminum underdrain pipe
21. Aluminum or steel entrance tapers, pipe downdrains, reducers, coupling bands and slip joints
22. Metal target plates
23. Paint (traffic striping)
24. Conductors
25. Painting of electrical equipment
26. Electrical components
27. Engineering fabric
28. Portland Cement
29. PCC admixtures
30. Minor concrete, asphalt
31. Asphalt (oil)
32. Liquid asphalt emulsion
33. Epoxy

APPENDIX D

SAMPLE CITY INVOICE

City of San Diego, Field Engineering Div., 9485 Aero Drive, SD CA 92123		**Contractor's Name:**	
Project Name:		Contractor's Address:	
Work Order No or Job Order No.			
City Purchase Order No.		Contractor's Phone #:	**Invoice No.**
Resident Engineer (RE):		Contractor's fax #:	**Invoice Date:**
RE Phone#:	Fax#:	Contact Name:	Billing Period: (to

Item #	Item Description	Contract Authorization				Previous Totals To Date		This Estimate		Totals to Date	
		Unit	Price	Qty	Extension	%/QTY	Amount	% / QTY	Amount	% / QTY	Amount
1					$ -		$ -		$ -	0.00%	$ -
2					$ -		$ -		$ -	0.00%	$ -
3					$ -		$ -		$ -	0.00%	$ -
4					$ -		$ -		$ -	0.00%	$ -
5					$ -		$ -		$ -	0.00%	$ -
6					$ -		$ -		$ -	0.00%	$ -
7					$ -		$ -		$ -	0.00%	$ -
8					$ -		$ -		$ -	0.00%	$ -
9					$ -		$ -		$ -	0.00%	$ -
10					$ -		$ -		$ -	0.00%	$ -
11					$ -		$ -		$ -	0.00%	$ -
12					$ -		$ -		$ -	0.00%	$ -
13					$ -		$ -		$ -	0.00%	$ -
14					$ -		$ -		$ -	0.00%	$ -
15					$ -		$ -		$ -	0.00%	$ -
16					$ -		$ -		$ -	0.00%	$ -
17	**Field Orders**				$ -		$ -		$ -	0.00%	$ -
18					$ -		$ -		$ -	0.00%	$ -
	CHANGE ORDER No.				$ -		$ -		$ -	0.00%	$ -
					$ -		$ -		$ -	0.00%	$ -
	Total Authorized Amount (including approved Change Order)				**$ -**		$ -		$ -	**Total Billed**	$ -

SUMMARY

A. Original Contract Amount	$ -
B. Approved Change Order #00 Thru #00	$ -
C. Total Authorized Amount (A+B)	$ -
D. Total Billed to Date	$ -
E. Less Total Retention (5% of D)	$ -
F. Less Total Previous Payments	$ -
G. Payment Due Less Retention	**$0.00**
H. Remaining Authorized Amount	$0.00

I certify that the materials have been received by me in the quality and quantity specified

Resident Engineer

Construction Engineer

Retention and/or Escrow Payment Schedule

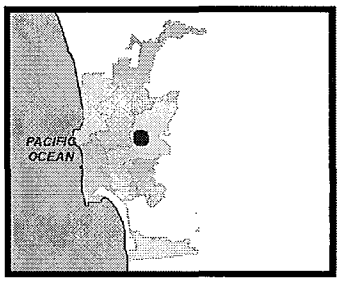
Total Retention Required as of this billing (Item E)	$0.00
Previous Retention Withheld in PO or in Escrow	$0.00
Add'l Amt to Withhold in PO/Transfer in Escrow:	***$0.00***
Amt to Release to Contractor from PO/Escrow:	

Contractor Signature and Date: _____

APPENDIX E

LOCATION MAP

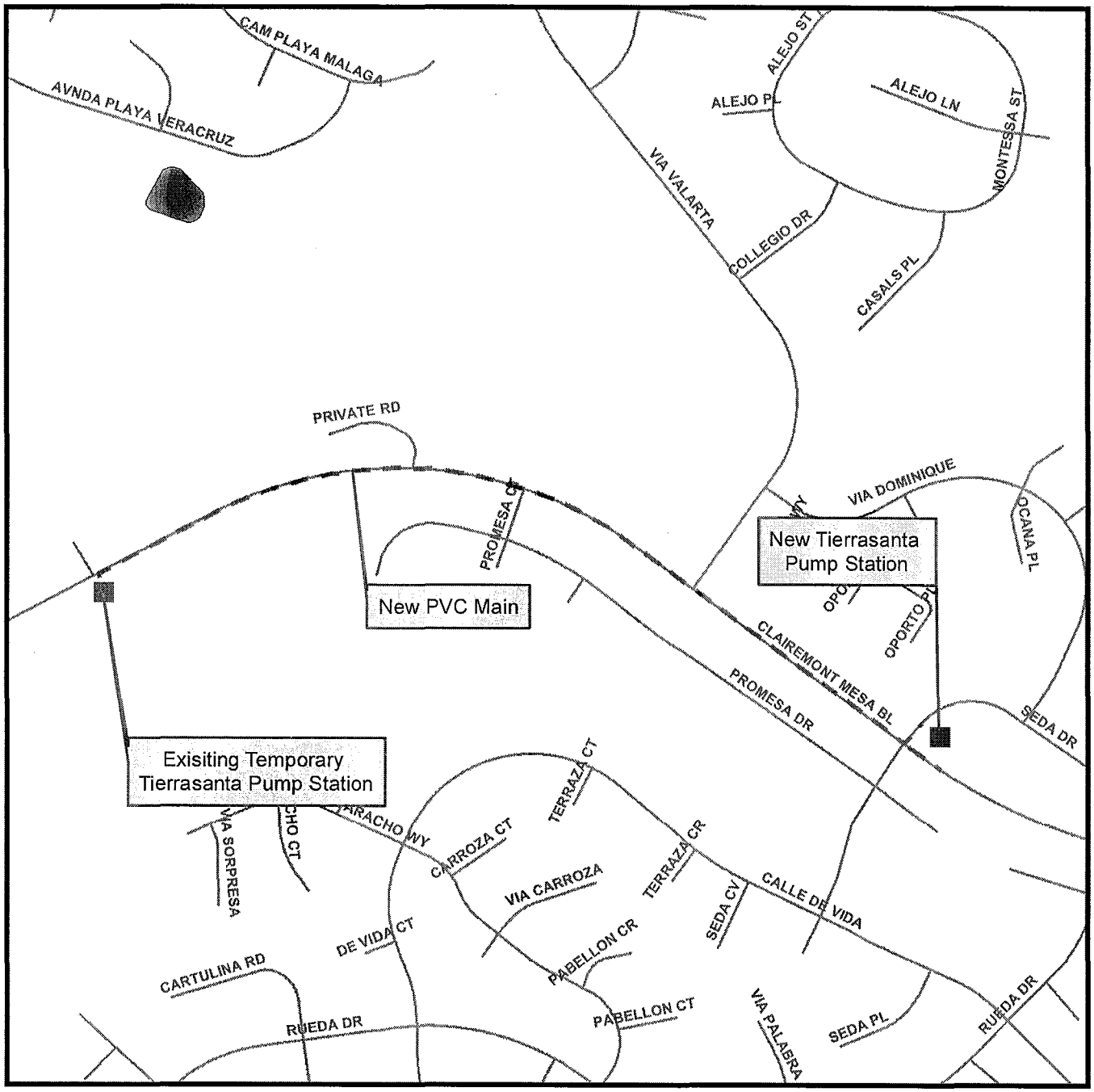
THIS MAP/DATA IS PROVIDED WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OR MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Note: This product may contain information from the SANDAG Regional Information System which cannot be reproduced without the written permission of SANDAG. This product may contain information reproduce with permission granted by RAND MCNALLY & COMPANY© to SanGIS. This map is copyrighted by RAND MCNALLY & COMPANY©. It is unlawful to copy or reproduce all or any part thereof, whether for personal use or resale, without the prior, written permission of RAND MCNALLY & COMPANY



The City of SAN DIEGO Public Works

Tierrasanta Pump Station

SENIOR ENGINEER	PROJECT MANAGER	PROJECT ENGINEER	FOR QUESTIONS ABOUT THIS PROJECT
Alex Garcia	Dwayne Abbey	Maryam Kargar	Call: (619) 533-4207
619-533-3634	619-533-5154	619-533-6673	Email: *engineering@sandiego.gov*



Legend

- Pump Station
- New PVC Water Line

N W E S

COMMUNITY NAME: TIERRASANTA

COUNCIL DISTRICT: 7

SAP ID: S-12040 (W)

Date: June 6, 2016

SanGIS

APPENDIX F

HYDROSTATIC DISCHARGE FORM

Hydrostatic Discharge Requirements Certification (Discharge Events ≥ 325,850 gpd)

All discharge activities related to this project comply with the Regional Water Quality Control Board (RWQCB) Order No. R9-2010-0003, General Permit for Discharges of Hydrostatic Test Water and Potable Water to Surface Water and Storm Drains as referenced by (http://www.waterboards.ca.gov/sandiego/board_decisions/adopted_orders/2010/R9-2010-0003.pdf), and as follows:

Discharged water has been dechlorinated to below **0.1** *(mg/l)* level; and effluent has been maintained between **6 and 9** *(pH)* based on:

Event #	Discharge Date	Item Tested	Duration	Amount (gpd)	Description of the Proposed Discharge	Method and Test Result	*Is Discharge Within Limits?*		Comment/Action Taken
							YES	*NO*	
		Chlorine							
		pH							
		Chlorine							
		pH							
		Chlorine							
		pH							
		Chlorine							
		pH							

Qualified Personnel Conducting Tests (Print Name):	***SAP No.(s):***
***Signed:**	**Project Name:**

* By signing, I hereby certify and affirm under penalty of perjury that all of the statements and conditions for hydrostatic discharge events are correct.

Have any thresholds been exceeded? Per Order No. R9-2010-0003, would this be a reportable discharge and must be reported **within 24 hours** of the event? [Reportable discharge would include violation of maximum gallons per day, any upset which exceeds any effluent limit]

APPENDIX G

HAZARDOUS LABEL/FORMS

HAZARDOUS WASTE

STATE AND FEDERAL LAW PROHIBITS IMPROPER DISPOSAL
IF FOUND, CONTACT THE NEAREST POLICE, OR PUBLIC SAFETY AUTHORITY, OR THE U.S. ENVIRONMENTAL PROTECTION AGENCY OR THE CALIFORNIA DEPARTMENT OF HEALTH SERVICES

GENERATOR NAME _____

ADDRESS _____ 24 HR. PHONE ( )

CITY _____ STATE _____ ZIP _____

EPA ID NO. _____ MANIFEST DOCUMENT NO. _____

EPA WASTE NO. _____ CA WASTE NO. _____ ACCUMULATION START DATE / /

CONTENTS, COMPOSITION _____

PROPER DOT SHIPPING NAME _____

TECHNICAL NAME (S) _____

UN/NA NO. WITH PREFIX _____

PHYSICAL STATE ☐ SOLID ☐ LIQUID | HAZARDOUS PROPERTIES ☐ CORROSIVE ☐ REACTIVE ☐ FLAMMABLE ☐ TOXIC ☐ OTHER _____

HANDLE WITH CARE!

CONTAINS HAZARDOUS OR TOXIC WASTES

INCIDENT/RELEASE ASSESSMENT FORM [1]

If you have an emergency, Call 911

Handlers of hazardous materials are required to report releases. The following is a tool to be used for assessing if a release is reportable. Additionally, a non-reportable release incident form is provided to document why a release is not reported (see back).

Questions for Incident Assessment:	YES	NO
1. Was anyone killed or injured, or did they require medical care or admitted to a hospital for observation?	☐	☐
2. Did anyone, other than employees in the immediate area of the release, evacuate?	☐	☐
3. Did the release cause off-site damage to public or private property?	☐	☐
4. Is the release greater than or equal to a reportable quantity (RQ)?	☐	☐
5. Was there an uncontrolled or unpermitted release to the air?	☐	☐
6. Did an uncontrolled or unpermitted release escape secondary containment, or extend into any sewers, storm water conveyance systems, utility vaults and conduits, wetlands, waterways, public roads, or off site?	☐	☐
7. Will control, containment, decontamination, and/or clean up require the assistance of federal, state, county, or municipal response elements?	☐	☐
8. Was the release or threatened release involving an unknown material or contains an unknown hazardous constituent?	☐	☐
9. Is the incident a threatened release (a condition creating a substantial probability of harm that requires immediate action to prevent, reduce, or mitigate damages to persons, property, or the environment)?	☐	☐
10. Is there an increased potential for secondary effects including fire, explosion, line rupture, equipment failure, or other outcomes that may endanger or cause exposure to employees, the general public, or the environment?	☐	☐

If the answer is YES to any of the above questions – report the release to the California Office of Emergency Services at 800-852-7550 and the local CUPA daytime: (619) 338-2284, after hours: (858) 565-5255. Note: other state and federal agencies may require notification depending on the circumstances.

Call 911 in an emergency

If all answers are NO, complete a Non Reportable Release Incident Form (page 2 of 2) and keep readily available. Documenting why a "no" response was made to each question will serve useful in the event questions are asked in the future, and to justify not reporting to an outside regulatory agency.

If in doubt, report the release.

[1] This document is a guide for accessing when hazardous materials release reporting is required by Chapter 6.95 of the California Health and Safety Code. It does not replace good judgment, Chapter 6.95, or other state or federal release reporting requirements.

NON REPORTABLE RELEASE INCIDENT FORM

1. RELEASE AND RESPONSE DESCRIPTION

Incident #

Date/Time Discovered	Date/Time Discharge	Discharge Stopped ☐ Yes ☐ No
Incident Date / Time:		
Incident Business / Site Name:		
Incident Address:		
Other Locators (Bldg, Room, Oil Field, Lease, Well #, GIS)		
Please describe the incident and indicate specific causes and area affected. Photos Attached?: ☐Yes ☐No		
Indicate actions to be taken to prevent similar releases from occurring in the future.		

2. ADMINISTRATIVE INFORMATION

Supervisor in charge at time of incident:	Phone:
Contact Person:	Phone:

3. CHEMICAL INFORMATION

Chemical	Quantity ☐ GAL ☐ LBS ☐ FT^3
Chemical	Quantity ☐ GAL ☐ LBS ☐ FT^3
Chemical	Quantity ☐ GAL ☐ LBS ☐ FT^3
Clean-Up Procedures & Timeline:	
Completed By:	Phone:
Print Name:	Title:

EMERGENCY RELEASE FOLLOW-UP NOTICE REPORTING FORM

A

BUSINESS NAME	FACILITY EMERGENCY CONTACT & PHONE NUMBER ( ) -

B

INCIDENT DATE MO DAY YR	TIME OES NOTIFIED (use 24 hr time)	OES CONTROL NO.

C

INCIDENT ADDRESS LOCATION	CITY / COMMUNITY	COUNTY ZIP

D

CHEMICAL OR TRADE NAME (print or type)	CAS Number
CHECK IF CHEMICAL IS LISTED IN 40 CFR 355, APPENDIX A ☐	CHECK IF RELEASE REQUIRES NOTIFICATION UNDER 42 U.S.C. Section 9603 (a) ☐

PHYSICAL STATE CONTAINED ☐ SOLID ☐ LIQUID ☐ GAS	PHYSICAL STATE RELEASED ☐ SOLID ☐ LIQUID ☐ GAS	QUANTITY RELEASED

ENVIRONMENTAL CONTAMINATION ☐ AIR ☐ WATER ☐ GROUND ☐ OTHER	TIME OF RELEASE	DURATION OF RELEASE ___DAYS ___HOURS ___MINUTES

E

ACTIONS TAKEN

F

KNOWN OR ANTICIPATED HEALTH EFFECTS (Use the comments section for addition information)

☐ ACUTE OR IMMEDIATE (explain) _____

☐ CHRONIC OR DELAYED (explain) _____

☐ NOT KNOWN (explain)

G

ADVICE REGARDING MEDICAL ATTENTION NECESSARY FOR EXPOSED INDIVIDUALS

H

COMMENTS (INDICATE SECTION (A - G) AND ITEM WITH COMMENTS OR ADDITIONAL INFORMATION)

I

CERTIFICATION: I certify under penalty of law that I have personally examined and I am familiar with the information submitted and believe the submitted information is true, accurate, and complete.

REPORTING FACILITY REPRESENTATIVE (print or type) _____

SIGNATURE OF REPORTING FACILITY REPRESENTATIVE _____ DATE: _____

EMERGENCY RELEASE FOLLOW-UP NOTICE
REPORTING FORM INSTRUCTIONS

GENERAL INFORMATION:

Chapter 6.95 of Division 20 of the California Health and Safety Code requires that written emergency release follow-up notices prepared pursuant to 42 U.S.C. § 11004, be submitted using this reporting form. Non-permitted releases of reportable quantities of Extremely Hazardous Substances (listed in 40 CFR 355, appendix A) or of chemicals that require release reporting under section 103(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 [42 U.S.C. § 9603(a)] must be reported on the form, as soon as practicable, but no later than 30 days, following a release. The written follow-up report is required in addition to the verbal notification.

BASIC INSTRUCTIONS:

- The form, when filled out, reports follow-up information required by 42 U.S.C § 11004. Ensure that all information requested by the form is provided as completely as possible.
- If the incident involves reportable releases of more than one chemical, prepare one report form for each chemical released.
- If the incident involves a series of separate releases of chemical(s) at different times, the releases should be reported on separate reporting forms.

SPECIFIC INSTRUCTIONS:

Block A: Enter the name of the business and the name and phone number of a contact person who can provide detailed facility information concerning the release.

Block B: Enter the date of the incident and the time that verbal notification was made to OES. The OES control number is provided to the caller by OES at the time verbal notification is made. Enter this control number in the space provided.

Block C: Provide information pertaining to the location where the release occurred. Include the street address, the city or community, the county and the zip code.

Block D: Provide information concerning the specific chemical that was released. Include the chemical or trade name and the Chemical Abstract Service (CAS) number. Check all categories that apply. Provide best available information on quantity, time and duration of the release.

Block E: Indicate all actions taken to respond to and contain the release as specified in 42 U.S.C. § 11004(c).

Block F: Check the categories that apply to the health effects that occurred or could result from the release. Provide an explanation or description of the effects in the space provided. Use Block H for additional comments/information if necessary to meet requirements specified in 42 U.S.C. § 11004(c).

Block G: Include information on the type of medical attention required for exposure to the chemical released. Indicate when and how this information was made available to individuals exposed and to medical personnel, if appropriate for the incident, as specified in 42 U.S.C. § 11004(c).

Block H: List any additional pertinent information.

Block I: Print or type the name of the facility representative submitting the report. Include the official signature and the date that the form was prepared.

MAIL THE COMPLETED REPORT TO:

State Emergency Response Commission (SERC)
Attn: Section 304 Reports
Hazardous Materials Unit
3650 Schriever Avenue
Mather, CA 95655

NOTE: Authority cited: Sections 25503, 25503.1 and 25507.1, Health and Safety Code. Reference: Sections 25503(b)(4), 25503.1, 25507.1, 25518 and 25520, Health and Safety Code.

APPENDIX H

SAMPLE ARCHAEOLOGY INVOICE

(FOR ARCHAEOLOGY ONLY)
Company Name

Address, telephone, fax

Date: Insert Date

To: Name of Resident Engineer
City of San Diego
Field Engineering Division
9485 Aero Drive
San Diego, CA 92123-1801

Project Name: Insert Project Name

SAP Number (WBS/IO/CC): Insert SAP Number

Drawing Number: Insert Drawing Number

Invoice period: Insert Date to Insert Date

Work Completed: Bid item Number – Description of Bid Item – Quantity – Unit Price– Amount

Detailed summary of work completed under this bid item: Insert detailed description of Work related to Archaeology Monitoring Bid item. See Note 1 below.

Summary of charges:

Description of Services	Name	Start Date	End Date	Total Hours	Hourly Rate	Amount
Field Archaeologist	Joe Smith	8/29/2011	9/2/2011	40	$84	$3,360
Laboratory Assistant	Jane Doe	8/29/2011	9/2/2011	2	$30	$60
Subtotal						$3,420

Work Completed: Bid item Number – Description of Bid Item – Quantity – Unit Price– Amount

Detailed summary of work completed under this bid item: Insert detailed description of Work related to Archaeology Curation/Discovery Bid item. See Note 2 below.

Summary of charges:

Description of Services	Where work occurred (onsite vs offsite/lab)	Name	Start Date	End Date	Total Hours	Hourly Rate	Amount
Field Archaeologist		Joe Smith	8/29/2011	9/2/2011	40	$84	$3,360
Laboratory Assistant		Jane Doe	8/29/2011	9/2/2011	2	$30	$60
Subtotal							$3,420

Total this invoice: $_____

Total invoiced to date: $_____

SAMPLE

Note 1:

For monitoring related bid items or work please include summary of construction work that was monitored from Station to Station, Native American monitors present, MMC coordination, status and nature of monitoring and if any discoveries were made.

Note 2:

For curation/discovery related bid items or work completed as part of a discovery and curation process, the PI must provide a response to the following questions along with the invoice:

1. Preliminary results of testing including tentative recommendations regarding eligibility for listing in the California Register of Historical Resources (California Register).

    a. Please briefly describe your application (consideration) of all four California Register criteria.

    b. If the resource is eligible under Criterion D, please define the important information that may be present.

    c. Were specialized studies performed? How many personnel were required? How many Native American monitors were present?

    d. What is the age of the resource?

    e. Please define types of artifacts to be collected and curated, including quantity of boxes to be submitted to the San Diego Archaeological Center (SDAC). How many personnel were required? How many Native American monitors were present?

2. Preliminary results of data recovery and a definition of the size of the representative sample.

    a. Were specialized studies performed? Please define types of artifacts to be collected and curated, including quantity of boxes to be submitted to the SDAC. How many personnel were required? How many Native American monitors were present?

3. What resources were discovered during monitoring?

4. What is the landform context and what is the integrity of the resources?

5. What additional studies are necessary?

6. Based on application of the California Register criteria, what is the significance of the resources?

    a. If the resource is eligible for the California Register, can the resource be avoided by construction?

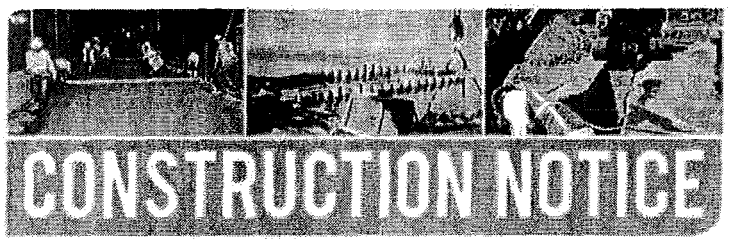
    b. If not, what treatment (mitigation) measures are proposed? Please define data to be recovered (if necessary) and what material will be submitted to the SDAC for curation. Are any specialized studies proposed?

(After the first invoice, not all the above information needs to be re-stated, just revise as applicable).

SAMPLE

APPENDIX I

SAMPLE OF PUBLIC NOTICES



PROJECT NAME

The work will consist of:

- *Edit this information:* The construction work will include pot holing in the northbound curb lane of Torrey Pines Road between Coast Walk and Princess Street.

How your neighborhood may be impacted:

- *Edit this information:* Traffic delays due to lane closure.
- Two-way traffic will be maintained at all times.

Anticipated Construction Schedule

- *Edit this information:* The project upgrades for the entire neighborhood have been ongoing and now are scheduled to start on your street.
- The entire neighborhood project started in ____ and is anticipated to be complete in ____.

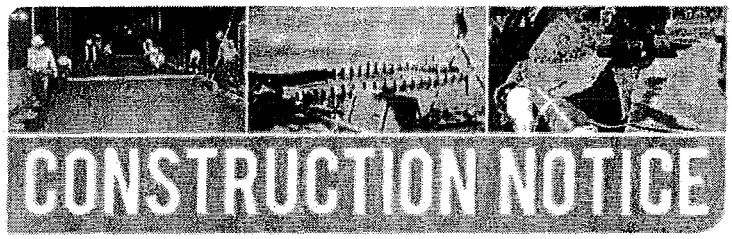
Hours and Days of Operation

- *Edit this information*: Monday to Friday (7:30 a.m. to 4 p.m.)

For questions related to this work
Call: (619) 533-4207
Email: engineering@sandiego.gov
Visit: sandiego.gov/CIP

CITY OF SAN DIEGO
PUBLIC WORKS
DEPARTMENT

This information is available in alternative formats upon request.



PROJECT NAME

The work will consist of:

- *Edit this information:* The construction work will include pot holing in the northbound curb lane of Torrey Pines Road between Coast Walk and Princess Street.

How your neighborhood may be impacted:

- *Edit this information:* Traffic delays due to lane closure.
- Two-way traffic will be maintained at all times.

Anticipated Construction Schedule

- *Edit this information:* The project upgrades for the entire neighborhood have been ongoing and now are scheduled to start on your street.
- The entire neighborhood project started in ____ and is anticipated to be complete in ____.

Hours and Days of Operation

- *Edit this information*: Monday to Friday (7:30 a.m. to 4 p.m.)

For questions related to this work
Call: (619) 533-4207
Email: engineering@sandiego.gov
Visit: sandiego.gov/CIP

CITY OF SAN DIEGO
PUBLIC WORKS
DEPARTMENT

This information is available in alternative formats upon request.

ATTACHMENT F

INTENTIONALLY LEFT BLANK

ATTACHMENT G

CONTRACT AGREEMENT

CONTRACT AGREEMENT

CONSTRUCTION CONTRACT

This contract is made and entered into between THE CITY OF SAN DIEGO, a municipal corporation, herein called "City", and L.H. Woods and Sons, Inc., herein called "Contractor" for construction of **Tierrasanta Pump Station;** Bid No. **K-16-1431-DBB-3;** in the amount of Ten Million Nine Hundred Ninety Five Thousand Dollars and Zero Cents ($10,995,000.00), which is comprised of the Base Bid.

IN CONSIDERATION of the payments to be made hereunder and the mutual undertakings of the parties hereto, City and Contractor agree as follows:

1. The following are incorporated into this contract as though fully set forth herein:

   (a) The attached Faithful Performance and Payment Bonds.

   (b) The attached Proposal included in the Bid documents by the Contractor.

   (c) Reference Standards listed in the Instruction to Bidders and the Supplementary Special Provisions (SSP).

   (d) Phased Funding Schedule Agreement

   (e) That certain documents entitled **Tierrasanta Pump Station**, on file in the office of the City Clerk as Document No. **S-12040**, as well as all matters referenced therein.

2. The Contractor shall perform and be bound by all the terms and conditions of this contract and in strict conformity therewith shall perform and complete in a good and workmanlike manner **Tierrasanta Pump Station**, Bid Number **K-16-1431-DBB-3,** San Diego, California.

3. For such performances, the City shall pay to Contractor the amounts set forth at the times and in the manner and with such additions or deductions as are provided for in this contract, and the Contractor shall accept such payment in full satisfaction of all claims incident to such performances.

4. No claim or suit whatsoever shall be made or brought by Contractor against any officer, agent, or employee of the City for or on account of anything done or omitted to be done in connection with this contract, nor shall any such officer, agent, or employee be liable hereunder.

5. This contract is effective as of the date that the Mayor or designee signs the agreement.

CONTRACT AGREEMENT (continued)

IN WITNESS WHEREOF, this Agreement is signed by the City of San Diego, acting by and through its Mayor or designee, pursuant to Municipal Code §22.3102 authorizing such execution.

THE CITY OF SAN DIEGO

By_____

Print Name: James Nagelvoort
Director
Department of Public Works

Date: 12/5/16

APPROVED AS TO FORM

Jan I. Goldsmith, City Attorney

By_____

Print Name: Mark M. Mera
Deputy City Attorney

Date: 12/5/16

CONTRACTOR

See attached California
All-Purpose Acknowledgment

By_____

Print Name: JAMES D. WOODS, JR.

Title: PRESIDENT

Date: 9-28-16

City of San Diego License No.: B2000009642

State Contractor's License No.: 213353

DEPARTMENT OF INDUSTRIAL RELATIONS (DIR) REGISTRATION NUMBER: 1000013566

CALIFORNIA ALL-PURPOSE ACKNOWLEDGMENT **CIVIL CODE § 1189**

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of California)
County of San Diego)
On 28 Sept 2016 before me, Amanda Lutz, notary public,
Date *Here Insert Name and Title of the Officer*
personally appeared James D Woods Jr
Name(s) of Signer(s)

who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature
Signature of Notary Public

AMANDA LUTZ
COMM. #2138854
NOTARY PUBLIC-CALIFORNIA
SAN DIEGO COUNTY
My Comm. Expires Jan. 1 2020

Place Notary Seal Above

OPTIONAL

Though this section is optional, completing this information can deter alteration of the document or fraudulent reattachment of this form to an unintended document.

Description of Attached Document
Title or Type of Document: Contract Agreement
Document Date: _____ Number of Pages: 1
Signer(s) Other Than Named Above: _____

Capacity(ies) Claimed by Signer(s)

Signer's Name: _____
☐ Corporate Officer — Title(s): _____
☐ Partner — ☐ Limited ☐ General
☐ Individual ☐ Attorney in Fact
☐ Trustee ☐ Guardian or Conservator
☐ Other: _____
Signer Is Representing: _____

Signer's Name: _____
☐ Corporate Officer — Title(s): _____
☐ Partner — ☐ Limited ☐ General
☐ Individual ☐ Attorney in Fact
☐ Trustee ☐ Guardian or Conservator
☐ Other: _____
Signer Is Representing: _____

©2015 National Notary Association • www.NationalNotary.org • 1-800-US NOTARY (1-800-876-6827) Item #5907

CERTIFICATIONS AND FORMS

The Bidder, by submitting its electronic bid, agrees to and certifies under penalty of perjury under the laws of the State of California, that the certifications, forms and affidavits submitted as part of this bid are true and correct.

Bidder's General Information

To the City of San Diego:

Pursuant to "Notice Inviting Bids", specifications, and requirements on file with the City Clerk, and subject to all provisions of the Charter and Ordinances of the City of San Diego and applicable laws and regulations of the United States and the State of California, the undersigned hereby proposes to furnish to the City of San Diego, complete at the prices stated herein, the items or services hereinafter mentioned. The undersigned further warrants that this bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the bid is genuine and not collusive or sham; that the bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding; that 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, or to secure any advantage against the public body awarding the contract of anyone interested in the proposed contract; that all statements contained in the bid are true; and, further, that 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, or paid, and will not pay, any fee to any corporation, partnership, company, association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

The undersigned bidder(s) further warrants that bidder(s) has thoroughly examined and understands the entire Contract Documents (plans and specifications) and the Bidding Documents therefore, and that by submitting said Bidding Documents as its bid proposal, bidder(s) acknowledges and is bound by the entire Contract Documents, including any addenda issued thereto, as such Contract Documents incorporated by reference in the Bidding Documents.

NON-COLLUSION AFFIDAVIT TO BE EXECUTED BY BIDDER AND SUBMITTED WITH BID UNDER 23 UNITED STATES CODE 112 AND PUBLIC CONTRACT CODE 7106

State of California

County of San Diego

The bidder, being first duly sworn, deposes and says that he or she is authorized by the party making the foregoing bid that the bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the bid is genuine and not collusive or sham; that the bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding; that 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, or to secure any advantage against the public body awarding the contract of anyone interested in the proposed contract; that all statements contained in the bid are true; and further, that 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, or paid, and will not pay, any fee to any corporation, partnership, company association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

CONTRACTOR CERTIFICATION

DRUG-FREE WORKPLACE

I hereby certify that I am familiar with the requirements of San Diego City Council Policy No. 100-17 regarding Drug-Free Workplace as outlined in the WHITEBOOK, Section 7-13.3, "Drug-Free Workplace", of the project specifications, and that;

This company_has in place a drug-free workplace program that complies with said policy. I further certify that each subcontract agreement for this project contains language which indicates the subcontractor's agreement to abide by the provisions of subdivisions a) through c) of the policy as outlined.

CONTRACTOR CERTIFICATION

AMERICAN WITH DISABILITIES ACT (ADA) COMPLIANCE CERTIFICATION

I hereby certify that I am familiar with the requirements of San Diego City Council Policy No. 100-4 regarding the American With Disabilities Act (ADA) outlined in the WHITEBOOK, Section 7-13.2, "American With Disabilities Act", of the project specifications, and that;

This company has in place workplace program that complies with said policy. I further certify that each subcontract agreement for this project contains language which indicates the subcontractor's agreement to abide by the provisions of the policy as outlined.

CONTRACTOR CERTIFICATION

CONTRACTOR STANDARDS – PLEDGE OF COMPLIANCE

I declare under penalty of perjury that I am authorized to make this certification on behalf of the company submitting this bid/proposal, that as Contractor, I am familiar with the requirements of City of San Diego Municipal Code § 22.3004 regarding Contractor Standards as outlined in the WHITEBOOK, Section 7-13.4, ("Contractor Standards"), of the project specifications, and that Contractor has complied with those requirements.

I further certify that each of the Contractor's subcontractors whose subcontracts are greater than $50,000 in value has completed a Pledge of Compliance attesting under penalty of perjury of having complied with City of San Diego Municipal Code § 22.3004.

AFFIDAVIT OF DISPOSAL

(To be submitted upon completion of Construction pursuant to the contracts Certificate of Completion)

WHEREAS, on the _____ DAY OF _____, 2_____ the undersigned entered into and executed a contract with the City of San Diego, a municipal corporation, for:

_____

(Name of Project or Task)

as particularly described in said contract and identified as Bid No. _____ ; SAP No. (WBS/IO/CC) _____; and **WHEREAS**, the specification of said contract requires the Contractor to affirm that "all brush, trash, debris, and surplus materials resulting from this project have been disposed of in a legal manner"; and **WHEREAS**, said contract has been completed and all surplus materials disposed of:

_____

_____

NOW, THEREFORE, in consideration of the final payment by the City of San Diego to said Contractor under the terms of said contract, the undersigned Contractor, does hereby affirm that all surplus materials as described in said contract have been disposed of at the following location(s)

_____

_____

and that they have been disposed of according to all applicable laws and regulations.

Dated this _____ DAY OF _____, _____.

_____ Contractor

by

ATTEST:

State of _____ County of _____

On this_____ DAY OF _____, 2_____, before the undersigned, a Notary Public in and for said County and State, duly commissioned and sworn, personally appeared_____ _____ known to me to be the _____ Contractor named in the foregoing Release, and whose name is subscribed thereto, and acknowledged to me that said Contractor executed the said Release.

Notary Public in and for said County and State

ELECTRONICALLY SUBMITTED FORMS

THE FOLLOWING FORMS MUST BE SUBMITTED IN PDF FORMAT WITH BID SUBMISSION

The following forms are to be completed by the bidder and submitted (uploaded) electronically with the bid in PlanetBids.

A. **BID BOND – See Instructions to Bidders, Bidders Guarantee of Good Faith (Bid Security) for further instructions**

B. **CONTRACTOR'S CERTIFICATION OF PENDING ACTIONS**

C. **EQUAL BENEFITS ORDINANCE - CERTIFICATION OF COMPLIANCE**

Bids will not be accepted until ALL forms are submitted as part of the bid submittal

BID BOND

See Instructions to Bidders, Bidder Guarantee of Good Faith (Bid Security)

KNOW ALL MEN BY THESE PRESENTS,

That L.H. Woods & Sons, Inc. as Principal, and

Western Surety Company as Surety, are

held and firmly bound unto The City of San Diego hereinafter called "OWNER," in the sum of **10% OF THE TOTAL BID AMOUNT** for the payment of which sum, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, said Principal has submitted a Bid to said OWNER to perform the WORK required under the bidding schedule(s) of the OWNER's Contract Documents entitled

Tierrasanta pump station Project No. K-16-1431-DBB-3, SAP No. S-12040

NOW THEREFORE, if said Principal is awarded a contract by said OWNER and, within the time and in the manner required in the "Notice Inviting Bids" enters into a written Agreement on the form of agreement bound with said Contract Documents, furnishes the required certificates of insurance, and furnishes the required Performance Bond and Payment Bond, then this obligation shall be null and void, otherwise it shall remain in full force and effect. In the event suit is brought upon this bond by said OWNER and OWNER prevails, said Surety shall pay all costs incurred by said OWNER in such suit, including a reasonable attorney's fee to be fixed by the court.

SIGNED AND SEALED, this 01st day of August, 2016

L.H. Woods & Sons, Inc. (SEAL)
(Principal)

By: _____
(Signature)

Western Surety Company (SEAL)
(Surety)

By: _____
Edith Ganibay, Attorney-in-Fact
(Signature)

(SEAL AND NOTARIAL ACKNOWLEDGEMENT OF SURETY)

CALIFORNIA ALL-PURPOSE ACKNOWLEDGMENT CIVIL CODE § 1189

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of California)
County of Orange)

On 08/01/2016 before me, R. Rivas, Notary Public,
Date *Here Insert Name and Title of the Officer*

personally appeared Edith Garibay
Name(s) of Signer(s)

who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature
Signature of Notary Public

R. RIVAS
Commission # 2128505
Notary Public - California
Orange County
My Comm. Expires Oct 28, 2019

Place Notary Seal Above

OPTIONAL

Though this section is optional, completing this information can deter alteration of the document or fraudulent reattachment of this form to an unintended document.

Description of Attached Document

Title or Type of Document: _____ Document Date: _____

Number of Pages: _____ Signer(s) Other Than Named Above: None

Capacity(ies) Claimed by Signer(s)

Signer's Name: Edith Garibay	Signer's Name:
☐ Corporate Officer — Title(s):	☐ Corporate Officer — Title(s):
☐ Partner — ☐ Limited ☐ General	☐ Partner — ☐ Limited ☐ General
☐ Individual ☒ Attorney in Fact	☐ Individual ☐ Attorney in Fact
☐ Trustee ☐ Guardian or Conservator	☐ Trustee ☐ Guardian or Conservator
☐ Other:	☐ Other:
Signer Is Representing:	Signer Is Representing:

©2014 National Notary Association • www.NationalNotary.org • 1-800-US NOTARY (1-800-876-6827) Item #5907

Western Surety Company

POWER OF ATTORNEY APPOINTING INDIVIDUAL ATTORNEY-IN-FACT

Know All Men By These Presents, That WESTERN SURETY COMPANY, a South Dakota corporation, is a duly organized and existing corporation having its principal office in the City of Sioux Falls, and State of South Dakota, and that it does by virtue of the signature and seal herein affixed hereby make, constitute and appoint

William R Curtis, Rosa E Rivas, Eugene T Zondlo, Edith Garibay, Individually

of Irvine, CA, its true and lawful Attorney(s)-in-Fact with full power and authority hereby conferred to sign, seal and execute for and on its behalf bonds, undertakings and other obligatory instruments of similar nature

- In Unlimited Amounts -

and to bind it thereby as fully and to the same extent as if such instruments were signed by a duly authorized officer of the corporation and all the acts of said Attorney, pursuant to the authority hereby given, are hereby ratified and confirmed.

This Power of Attorney is made and executed pursuant to and by authority of the By-Law printed on the reverse hereof, duly adopted, as indicated, by the shareholders of the corporation.

In Witness Whereof, WESTERN SURETY COMPANY has caused these presents to be signed by its Vice President and its corporate seal to be hereto affixed on this 8th day of July, 2016.

WESTERN SURETY COMPANY

Paul T. Bruflat, Vice President

State of South Dakota
County of Minnehaha } ss

On this 8th day of July, 2016, before me personally came Paul T. Bruflat, to me known, who, being by me duly sworn, did depose and say: that he resides in the City of Sioux Falls, State of South Dakota; that he is the Vice President of WESTERN SURETY COMPANY described in and which executed the above instrument; that he knows the seal of said corporation; that the seal affixed to the said instrument is such corporate seal; that it was so affixed pursuant to authority given by the Board of Directors of said corporation and that he signed his name thereto pursuant to like authority, and acknowledges same to be the act and deed of said corporation.

My commission expires
June 23, 2021

J. MOHR
NOTARY PUBLIC
SOUTH DAKOTA

J. Mohr, Notary Public

CERTIFICATE

I, L. Nelson, Assistant Secretary of WESTERN SURETY COMPANY do hereby certify that the Power of Attorney hereinabove set forth is still in force, and further certify that the By-Law of the corporation printed on the reverse hereof is still in force. In testimony whereof I have hereunto subscribed my name and affixed the seal of the said corporation this 01st day of August, 2016.

WESTERN SURETY COMPANY

L. Nelson, Assistant Secretary

Form F4280-7-2012

CALIFORNIA ALL-PURPOSE ACKNOWLEDGMENT **CIVIL CODE § 1189**

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of California)
County of San Diego)

On 8/1/2016 before me, Leslie A. Brazier, Notary Public,
Date *Here Insert Name and Title of the Officer*

personally appeared James D. Woods, Jr.
Name(s) of Signer(s)

who proved to me on the basis of satisfactory evidence to be the person(~~s~~) whose name(~~s~~) is/~~are~~ subscribed to the within instrument and acknowledged to me that he/~~she~~/~~they~~ executed the same in his/~~her~~/~~their~~ authorized capacity(~~ies~~), and that by his/~~her~~/~~their~~ signature(~~s~~) on the instrument the person(~~s~~), or the entity upon behalf of which the person(~~s~~) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature
Signature of Notary Public

LESLIE A. BRAZIER
Notary Public - California
San Diego County
Commission # 2151949
My Comm. Expires May 3, 2020

Place Notary Seal Above

OPTIONAL

Though this section is optional, completing this information can deter alteration of the document or fraudulent reattachment of this form to an unintended document.

Description of Attached Document

Title or Type of Document: Bid Bond Document Date: August 1, 2016
Number of Pages: 3 Signer(s) Other Than Named Above:

Capacity(ies) Claimed by Signer(s)

Signer's Name: James D. Woods, Jr.	Signer's Name:
☒ Corporate Officer — Title(s):	☐ Corporate Officer — Title(s):
☐ Partner — ☐ Limited ☐ General	☐ Partner — ☐ Limited ☐ General
☐ Individual ☐ Attorney in Fact	☐ Individual ☐ Attorney in Fact
☐ Trustee ☐ Guardian or Conservator	☐ Trustee ☐ Guardian or Conservator
☐ Other:	☐ Other:
Signer Is Representing: L.H. Woods & Sons, Inc.	Signer Is Representing:

©2014 National Notary Association • www.NationalNotary.org • 1-800-US NOTARY (1-800-876-6827) Item #5907

CONTRACTOR'S CERTIFICATION OF PENDING ACTIONS

As part of its bid or proposal (Non-Price Proposal in the case of Design-Build contracts), the Bidder shall provide to the City a list of all instances within the past 10 years where a complaint was filed or pending against the Bidder in a legal or administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors or suppliers, and a description of the status or resolution of that complaint, including any remedial action taken.

CHECK ONE BOX ONLY.

☑ The undersigned certifies that within the past 10 years the Bidder has NOT been the subject of a complaint or pending action in a legal administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors or suppliers.

☐ The undersigned certifies that within the past 10 years the Bidder has been the subject of a complaint or pending action in a legal administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors or suppliers. A description of the status or resolution of that complaint, including any remedial action taken and the applicable dates is as follows:

DATE OF CLAIM	LOCATION	DESCRIPTION OF CLAIM	LITIGATION (Y/N)	STATUS	RESOLUTION/REMEDIAL ACTION TAKEN

Contractor Name: L.H. Woods & Sons, Inc.

Certified By James D. Woods, Jr. Title President

Name

Date 8-9-16

Signature

USE ADDITIONAL FORMS AS NECESSARY

EQUAL BENEFITS ORDINANCE

CERTIFICATION OF COMPLIANCE

For additional information, contact:
CITY OF SAN DIEGO
EQUAL BENEFITS PROGRAM
202 C Street, MS 9A, San Diego, CA 92101

COMPANY INFORMATION

Company Name: L.H. Woods & Sons, Inc.
Contact Name: Leslie A. Brazier
Company Address: 2115 La Mirada Drive Vista CA 92081
Contact Phone: (760) 599-5500, ext. 214
Contact Email: lbrazier@lhwoods.com

CONTRACT INFORMATION

Contract Title: City of San Diego Tierrasanta Pump Station
Start Date: Sept. 2016
Contract Number (if no number, state location): K-16-1431-DBB-3
End Date: Jan. 2018

SUMMARY OF EQUAL BENEFITS ORDINANCE REQUIREMENTS

The Equal Benefits Ordinance [EBO] requires the City to enter into contracts only with contractors who certify they will provide and maintain equal benefits as defined in SDMC §22.4302 for the duration of the contract. To comply:

- Contractor shall offer equal benefits to employees with spouses and employees with domestic partners.
  - Benefits include health, dental, vision insurance; pension/401(k) plans; bereavement, family, parental leave; discounts, child care; travel/relocation expenses; employee assistance programs; credit union membership; or any other benefit.
  - Any benefit not offer an employee with a spouse, is not required to be offered to an employee with a domestic partner.
- Contractor shall post notice of firm's equal benefits policy in the workplace and notify employees at time of hire and during open enrollment periods.
- Contractor shall allow City access to records, when requested, to confirm compliance with EBO requirements.
- Contractor shall submit *EBO Certification of Compliance*, signed under penalty of perjury, prior to award of contract.

NOTE: This summary is provided for convenience. Full text of the EBO and Rules Implementing the EBO are available at *www.sandiego.gov/administration.*

CONTRACTOR EQUAL BENEFITS ORDINANCE CERTIFICATION

Please indicate your firm's compliance status with the EBO. The City may request supporting documentation.

☑ I affirm **compliance** with the EBO because my firm *(contractor must select one reason)*:

- ☒ Provides equal benefits to spouses and domestic partners.
- ☐ Provides no benefits to spouses or domestic partners.
- ☐ Has no employees.
- ☐ Has collective bargaining agreement(s) in place prior to January 1, 2011, that has not been renewed or expired.

☐ I request the City's approval to pay affected employees a cash equivalent in lieu of equal benefits and verify my firm made a reasonable effort but is not able to provide equal benefits upon contract award. I agree to notify employees of the availability of a cash equivalent for benefits available to spouses but not domestic partners and to continue to make every reasonable effort to extend all available benefits to domestic partners.

It is unlawful for any contractor to knowingly submit any false information to the City regarding equal benefits or cash equivalent associated with the execution, award, amendment, or administration of any contract. [San Diego Municipal Code §22.4307(a)] Under penalty of perjury under laws of the State of California, I certify the above information is true and correct. I further certify that my firm understands the requirements of the Equal Benefits Ordinance and will provide and maintain equal benefits for the duration of the contract or pay a cash equivalent if authorized by the City.

James D. Woods, Jr. - President		8-9-16
Name/Title of Signatory	Signature	Date

FOR OFFICIAL CITY USE ONLY

Receipt Date: EBO Analyst: ☐ Approved ☐ Not Approved – Reason:

(Rev 02/15/2011

City of San Diego

CITY CONTACT: Michelle Muñoz, Contract Specialist, Email: MichelleM@sandiego.gov
Phone No. (619) 533-3482, Fax No. (619) 533-3633

ADDENDUM "A"

e - Bidding **FOR**

TIERRASANTA PUMP STATION

BID NO.:	**K-16-1431-DBB-3**
SAP NO. (WBS/IO/CC):	**S-12040**
CLIENT DEPARTMENT:	**2013**
COUNCIL DISTRICT:	**7**
PROJECT TYPE:	**BJ**

BID DUE DATE:

2:00 PM
AUGUST 10, 2016
CITY OF SAN DIEGO
PUBLIC WORKS CONTRACTS
1010 SECOND AVENUE, 14th FLOOR, MS 614C
SAN DIEGO, CA 92101

A. CHANGES TO CONTRACT DOCUMENTS

The following changes to the Contract Documents are hereby made effective as though originally issued with the bid package. Bidders are reminded that all previous requirements to this solicitation remain in full force and effect.

THE SUBMITTAL DATE FOR THIS PROJECT HAS BEEN **EXTENDED AS STATED ON THE COVER PAGE**

B. BIDDER's QUESTIONS

Q1. Section 1.1 of the SLBE-ELBE Good Faith Guidelines, it states, "Broadcast solicitation is acceptable." What does the City consider "broadcast"?

A1. The City considers broadcast to mean a single solicitation to a widespread or large group. Solicitation can be made via fax, email, or metered mail.

Q2. Section 7.1 of the SLBE-ELBE Good Faith Guidelines, it states, "When utilizing broadcast method bidder must clearly identify SLBE-ELBE firm on verification document submitted with GFE." Can you clarify what is needed? Is it the SLBE-ELBE company name on each email sent?

A2. Refer to section A.7. of the Small Local Business (SLBE) Program Instructions for Bidders Completing the Good Faith Effort Submittal. Depending on which form of verification is selected by the bidder to show solicitations were sent, it must be clear who the solicitation was sent to.

Q3. The SLBE-ELBE Good Faith Guidelines are dated 2012 – is this the most current version?

A3. Yes, this is the most current version.

James Nagelvoort, Director
Public Works Department

Dated: *July 14, 2016*
San Diego, California

JN/AJ/Lad

City of San Diego

CITY CONTACT: Michelle Muñoz, Contract Specialist, Email: MichelleM@sandiego.gov
Phone No. (619) 533-3482, Fax No. (619) 533-3633

ADDENDUM "B"

e - Bidding **FOR**

TIERRASANTA PUMP STATION

BID NO.:	**K-16-1431-DBB-3**
SAP NO. (WBS/IO/CC):	**S-12040**
CLIENT DEPARTMENT:	**2013**
COUNCIL DISTRICT:	**7**
PROJECT TYPE:	**BJ**

BID DUE DATE:

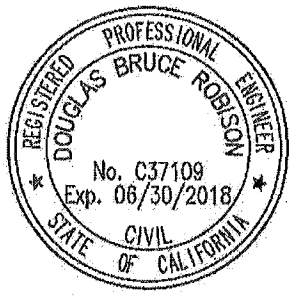
2:00 PM
AUGUST 17, 2016
CITY OF SAN DIEGO
PUBLIC WORKS CONTRACTS
1010 SECOND AVENUE, 14th FLOOR, MS 614C
SAN DIEGO, CA 92101

ENGINEER OF WORK

The engineering Specifications and Special Provisions contained herein have been prepared by or under the direction of the following Registered Engineer:

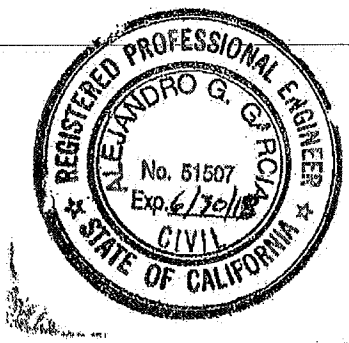
Douglas B. Robison — August 1, 2016 — Seal:

1) Registered Engineer — Date



8/2/16 — Seal

2) For City Engineer — Date



A. CHANGES TO CONTRACT DOCUMENTS

The following changes to the Contract Documents are hereby made effective as though originally issued with the bid package. Bidders are reminded that all previous requirements to this solicitation remain in full force and effect.

THE SUBMITTAL DATE FOR THIS PROJECT HAS BEEN **EXTENDED AS STATED ON THE COVER PAGE.**

B. BIDDER's QUESTIONS

Q1. In regards to the Tierrasanta Pump Station Good Faith Effort Advertising, I am trying to locate NAICS codes for these three trades; Vertical Turbine Pump Manufacturer/Supplier, Surge Tank Manufacturer/Supplier & Standby Generator Manufacturer/Supplier. Can you advise me on this?

A1. Refer to the NAICS Association website for all NAICS codes: https://www.naics.com/.

Q2. Are there any portions of the project that will need to be Bored?

Are the crossings to be Jack & Bored or Directionally Bored? What are the approximate length and diameter of the portions to be bored?

A2. There is no boring included in the work scope for this project.

Q3. Requesting that a pump manufacturer be added to the Spec Section.

A3. Adequate number of manufacturers are listed to provide competition. Contractor is welcome to submit as an "or equal". No change to documents required.

Q4. S11214.1.5.B, Zone 752 P-104 & P-105 - We believe the 80% & 84% value is referring to bowl efficiency, not pump efficiency. Please confirm.

A4. Agreed. Spec 11214 has been Revised.

Q5. S11214.1.5.B, Zone 900 P-201, P-202 & P-203 – We believe the 82% value is referring to bowl efficiency, not pump efficiency. Please confirm.

A5. Agreed. Spec 11214 has been Revised.

Q6. S11214-2.1B.8 – Since the LS bearings are requested to be on 5′ centers in 2.1.B.12, the max column lengths should be changed from 10′ to 5′. The LS bearings are located in bearing retainers that are sandwiched at each column flange location. If 5′ bearing centers are desired, the column lengths must match.

A6. We agree with analysis. If shorter sections are required to meet all parts of the specification, then shorter sections should be provided. No change to documents required.

Q7. S11214.2.3A – All the top name manufacturers have been named in the spec except Floway. Floway has been manufacturing VTPs for 80+ years. Their facility is in Fresno and the foundries they use are in Southern California. They are the only West Coast VTP manufacturer and they have a local presence in Cortech Engineering, a firm that has been doing business with the City for more than 20 years. Please note that Flowserve is listed twice --- once as Flowserve, once as Ingersoll-Dresser. Flowserve bought Ingersoll-Dresser approx. 16 years ago and rebranded it under the Flowserve name. It would be unfair to list them twice. We ask that Ingersoll-Dresser be removed and Floway be added. We understand the City cannot name every manufacturer. But since all the top factories have been listed, we feel it is not a stretch to ask for Floway's inclusion, especially considering their bid would be good for the City given their local presence.

A7. Adequate number of manufacturers are listed to provide competition. Contractor is welcome to submit as an "or equal". No change to documents required.

Q8. Drawing M-8 & related others – HI requires us to size the suction based on a max velocity of 4 ft/sec for an underground suction configuration. This is typically based on the design condition of the pump which in this case would be B&C's Condition B. Based on this, the suction pipe diameter for pumps P-104 & P-105 should be increased to 18″. This will result in velocities right at or slightly above the 4ft/sec mark depending on the wall thickness. A 20″ suction would assure that the velocities are below the 4ft/sec mark. Also, the suction pipe diameter for pumps P-204 & P-205 should be increased from 12″ to 14″ for the same reason as stated above.

A8. The 16" suction pipe for pumps P104 and P105, and associated butterfly valve, will be increased to 20". There are no changes required to the suction pipe diameters for P-204 and P-205.

Q9. Valve Schedule sheet M-13 calls out the pump control & pressure regulating valves to pressure class 150. The Specifications sections 15117 states that the pump control valves shall have 300# flanges, 15114 states that the pressure relief valves shall have 250# flanges. Please confirm if the valves shall have 300# or 150# flanges. The butterfly valve are Class 150#.

A9. 150 # flanges acceptable as long as the valves can withstand the pipe operating and test pressures identified on M-14. See Note on M-13. No change to documents required.

Q10. Item 2/C-3 states detail 3/C-9, it should state Detail 2/C-10.

A10. Agreed. See revised drawings.

Q11. Sheet C-5 "See connection detail 1/C-9 and "Material by contractor 2 & 4 are in conflict.

A11. No conflict was found between Sheet C-5 Item 4 and Detail 1/C-9; however, material list in submitted question does not match the material listing on Sheet C-5. Sheet C-5 Item 2 has been corrected to match Detail 1/C-9. Note that not all fittings that are shown on Detail 1/C-9 are described on Sheet C-5. Valves bypasses are required and shall conform to City of San Diego Standard Drawing SDW154.

Q12. We are requesting that the type of material for the ductwork inside the pump room be specified (aluminum, galvanized steel, ect.) There are is nothing specified on pages H-3 and H-4 of the HVAC drawings or in the specs.

A12. General Note 7 on drawing H1 identified the material as "aluminum".

Q13. We are requesting that the manufacturer/model number be provided for the units specified on page H-1 of the HVAC drawings. There is no manufacturer/model number listed in the schedule and there is no further information in the specs.

A13. Design basis for the units are as follows:

Design basis for the units are as follows:
AHU-01: Trane Voyager
AC-01: Trane Odyssey
CU-01 Trane Idesset014C

Q14. Structural note 9 on sheet S1 says to galvanize all exposed steel. There's quite a bit of steel that hangs outside the building.
The architectural plans say prime & paint. Do you want to paint in lieu of galv?

A14. Note 9 under "Structural Steel" on sheet S-1 is only applicable for structural steel that is not indicated as "prime and paint" in the architectural drawings.

Q15. On Sheet C-11 "Wall C" profile shows all CMU Walls. However on Sheet S-17 profile for wall C shows Partial Concrete Wall?? Please confirm that C-11 has a typo on Wall C and should read concrete on the bottom half and not CMU as indicated.

A15. Wall C should be constructed as shown on sheet S-17.

Q16. The Traffic Control Plans provided per this procurement are missing Stage 13. Please advise if the TC Plans are to include a Stage 13 Traffic Control Plan.

A16. There is no stage 13. The plans go from Stage 12 to stage 14.

Q17. Sheet A2, Slab Plan, shows what appears to be circular openings in the slab inside the pipe trench structure. However, in review of the mechanical piping plans, there does not appear to be any pipe penetrations in the slab at these locations. Please clarify if the circular openings shown at the pipe trench structure on Sheet A2 are for the grating or for the trench structure floor slab.

A17. Circles shown represent penetrations to the trench grating (not shown) and should be ignored.

Q18. The plans do not specify thicknesses of the proposed AC paving and aggregate base. Construction Note #2 on drawing C-2 states the AC/Base is per the Geotechnical Report. The Geotechnical Report provides no guidance on paving section thicknesses. Please advise.

A18. Intent is for 4" AC over 8" AB.

Q19. Sheet C-2 states the Via Dominque Pump is to be protected in place. Once construction is complete for the new pump station is the Via Dominique Pump Station required to be demolished.

A19. No. The Via Dominque Station will remain in place.

Q20. What is the thickness of the existing AC Paving to be removed at the temporary pump station?

A20. Record drawings indicate 2" AC over 5" CTB.

Q21. What is thickness of the existing Driveway to be removed at the temporary pump station?

A21. Record drawings indicate this a "P.C.C. Commercial Driveway". While the standard drawing from this time is not available, assume a similar thickness of 7.5" as illustrated in City of San Diego Standard Drawing SDG-163.

Q22. Sheet D-2, Footing Detail 1/D-2, The Footing Detail for the Existing Pump Station does not shown a clear definitive width of the existing footing, please provide.

A22. As-built drawings indicate an approximate 8" footing width.

Q23. Please provide a demolition sheet per the existing conditions for the proposed Tierrasanta Pump Station. Please clarify vegetation limits of removal and tree removal.

A23. Limits of work and existing conditions are shown on C-1. Additionally, visual inspection of the proposed site is available from the public ROW.

Q24. Sheet L-4, detail B, Tree Protection, please provide the locations of existing trees to remain that are to be protected per this detail.

A24. L-3 calls out the 5 existing trees that are to remain in place. The callout should be revised to "5" trees (vs. 7). Revised Sheet L-3.

Q25. Sheet L-1, What Major or Minor Contours define the limits of the Bio-retention basin.

A25. Elevation 525.0 is needed for retention and should be considered the boundary of the basin.

Q26. Where is the demolition on-site of the proposed pump station to be paid?

A26. Clearing, grubbing, and stripping of the proposed pump station site shall be included in Bid Item 1 "Construct Tierrasanta Pump Station". The Existing Via Dominque Pump Station, currently located on the site, is to be protected in place as noted on Sheet C-2.

Q27. The plans call out for a monorail system, but I do not see a hoist or crane to be installed per the plans. There is a spec section for Hoists and Crane, but it is not clearly stated if the Hoist and Crane is required for this procurement. Please clarify the quantity, load capacity, and size of crane(s) required for this project if applicable.

A27. Monorail, hoist and trolley are in the contract as they are shown as new work on the contract drawings. There is not a separate bid item for them and therefore we expect that cost to be included in the LS for the pumping station. Refer to Equipment Schedule on drawing M-14 and Spec 14605 for technical requirements.

Q28. Clearly state whether the City requires a chain hoist or wire rope hoist, and if they want manual or electric. Does the monorail have any switches, turntables, or radiuses?

A28. Information regarding the hoist is contained in Spec 14605 and Equipment Schedule on M-14. 14605- 2.01B (1) indicates "rope-type". Spec identifies trolley and hoist motors and electrical control. Monorail details can be found on S-14.

Q29. Please provide a Skylight Detail and schedule to submit to suppliers.

A29. See Sheet A-13 and Specifications.

Q30. Sheet A-5 (37 of 140), Note 6 – All Vents shall be Louvered and covered with ¼" non-combustible corrosion-resistent Metal Mesh with Minimum opening of 1/8" and Maximum opening of ¼".
Please provide a Louver Schedule showing the sizes of each Louver, specification section regarding payment, installation and specific locations of each Louver per the plans

A30. Please disregard note.

Q31. Sheet A-1 (33-140), Construction Note 14, 8' CMU Site Wall O/Retaining Wall. Please clarify what this construction note meaning is.

A31. Please disregard note.

Q32. Sheet C-2 (12 of 140), There is a directional call out with a question mark shown at the Northeast Side of the building, please clarify.

A32. The callout with question mark is pointing to the pad surrounding the air release valve. Refer to Note 29 on M-1 for associated requirements.

Q33. Plans call for 20' of pipe and refers you to detail-1 sheet C-9 witch slows 16" steel pipe going to a 16" MJ butterfly valve, Should this valve be a MJ X Flange valve so we can bolt to the steel pipe?

A33. There is no steel pipe called for on Sheet C-5 or the referenced Detail on C-9. Please check references.

Q34. Plans show a 4" Air & Vac Assembly but there is no bid item for it.

A34. Bid per current quantities on bid item list. Quantities may be adjusted during construction.

Q35. Plans call out for a 16" MJ 90 Bend but Line A is 20" steel, Should this be a 20" welded steel 90?

A35. Confirmed. Callout should specify 20" welded steel 90 degree bend.

Q36. Plans refers you to Detail 2 sheet C-9 there is no detail 2 on sheet C-9, should this be Detail 1 sheet C-10?

A36. Yes. The callout should reference Detail 1 on Sheet C-10

Q37. Plans calls out for a 20"x6" steel tee on the fire hydrant assembly it refers you to detail 2 sheet C-10 and the F.H. assembly is off a 12" steel line.

A37. Correct. The callout should specify 12"X12"x6" STL TEE.

Q38. Line item #60 calls out for a 2" Blow off assembly but there is no 2" Blow Off on the plans, Line item #30 calls out for 3 4" blow off assemblies but plans show 4 assemblies should 1 of these be a 2" assembly?

A38. Bid per current quantities on bid item list. Quantities may be adjusted during construction.

Q39. I notice that in the spec that it calls for the acoustical sound absorptive panels to be Aluminum in construction. These are not normally fabricated in Aluminum. Typically these are steel manufactured.
Can you confirm the construction of the sound barrier walls?

A39. The sound barrier panels specified in Section 10210 shall be aluminum as indicated for better corrosion resistance.

Q40. How long do the pumps need to be, or what the sump depth is. Do they want these pumps to be designed for the future conditions, or the smaller conditions. If I do the smaller conditions, the might not be able to use the same pump in the future.
Any special coating?
What are the material of construction requirement? Any special test?
What is the Total Pump Length (TPL) on these pumps?
Should we use current numbers on this project or any specs that pertain to its future? - Current specs vice future specs?

A40. The operating points for the pumps shall be per Specification 11214. Materials of construction for pump and can shall be per spec 11214 and as indicated on the drawings. Depth of can below inlet is to be determined by the manufacturer.

Q41. Sheet C-2, the plan view of the Jensen precast structures shows a pedestrian grate to be placed on each location. Each grate shown seems to be a different size. Please provide a specific detail providing dimensions of each grate, per this plan sheet, to properly quantify the square foot of each.

A41. Grating dimensions shall be based on the width of the driveway and curbing shown, and the width of the precast unit used. Grating dimension may vary depending on precast manufacturer.

C. NOTICIE INVITING BIDS

1. To Item 7, Subcontracting Participation Percentages, page 4, sub item 7.1.1, **DELETE** in its entirety.

D. SUPPLEMENTARY SPECIAL PROVISIONS

1. To Attachment E, Supplementary Special Provision, Section 2-7, item 4, page 35, **ADD** sub item 3 with the following:

   3. Final Report of Geotechnical Investigation- Tierra Santa Pump Station 5-11-16.

ftp://ftp.sannet.gov/OUT/ECP/AEP/Tierrasanta%20Pump%20Station/Subsurface%20Data%20%20TSPS/

2. To Attachment E, Supplementary Special Provisions Appendices, **ADD** Appendix J, Protecting AMI Devices, pages 13 through 19 of this Addendum.

3. To Attachment E, Technicals, Section 08710 – Finish Hardware, **ADD** Door Hardware, pages 20 through 25 of this addendum.

   For bidding purposes, this addendum Hardware Specification will take precedence over original Hardware Specification regarding approved manufacturers

4. To Attachment E, Technicals, Section 11214 - Vertical turbine Pumps, page 463, Item 1.5.B,**DELETE** in its entirety and **SUBSTITUTE** with the followings:

   B. Design Requirements:
   Equipment provided under this section shall conform to the following:

<u>Pump P-102. P-103 (752 Zone)</u>	
Maximum efficiency, minimum, percent[a]	
Bowl	80
Impeller type	Enclosed
Piping connection size, inches, minimum	
Discharge	6
Operating speed, rpm, maximum	1800
Motor horsepower, maximum	25
<u>Pumps P-104 and P-105 (752 Zone)</u>	
Maximum efficiency, minimum, percent[a]	
Bowl	84
Impeller type	Enclosed
Piping connection size, inches, minimum	
Discharge	12
Operating speed, rpm, maximum	1800
Motor horsepower, maximum	150
<u>Pumps P-201, P-202, P-203 (Zone 900)</u>	
Maximum efficiency, minimum, percent[a]	
Bowl	82
Impeller type	Enclosed
Piping connection size, inches, minimum	
Discharge	6
Operating speed, rpm, maximum	1800
Motor horsepower, maximum	15
<u>Pumps P-204 and P-205 (Zone 900)</u>	
Maximum efficiency, minimum, percent[a]	
Bowl	82

Impeller type	Enclosed
Piping connection size, inches, minimum	
Discharge	10
Operating speed, rpm, maximum	1800
Motor horsepower, maximum	100

NOTES:

[a] The maximum efficiency is the minimum acceptable peak efficiency and is not required to coincide with any specified operating condition in paragraph 11214A-1.5. Pump efficiency shall be within 2 percent of bowl efficiency when calculated at the point of peak bowl efficiency on the pump's head/capacity curve.

E. PLANS

1. To Drawing numbers: 37228-01D (G1), 37228-12-D (C2), 37228-13-D (C-3), 37228-15-D (C-5), 37228-18-D (C-8), 37228-22-D (C-12), 37228-31-D (L3), 37228-73-D (M-2), 37228-75-D (M-4), 37228-76-D (M-5), 337228-79-D (M-8), 37228-84-D (M-13), 37228-130-D (I-3) **DELETE** in their entirety and **REPLACE** with pages 26 through 38 of this Addendum.

2. **ADD** Drawing numbers: 37228-SW-1-D, 37228-SW-2-D with pages 39 and 40 of this Addendum.

James Nagelvoort, Director
Public Works Department

Dated: *August 3, 2016*
San Diego, California

JN/AJ/Lad

APPENDIX J

PROTECTING AMI DEVICES

Protecting AMI Devices in Meter Boxes and on Street Lights

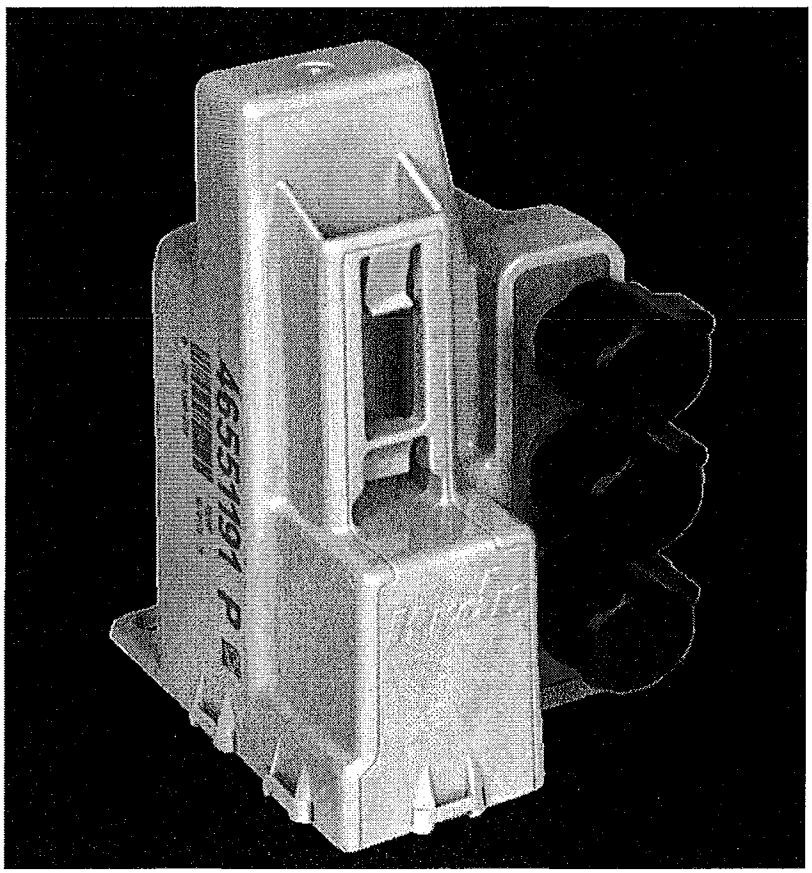
The Public Utilities Department (PUD) has begun the installation of the Advanced Metering Infrastructure (AMI) technology as a new tool to enhance water meter reading accuracy and efficiency, customer service and billing, and to be used by individual accounts to better manage the efficient use of water. **All AMI devices shall be protected per Section 5-2, "Protection", of the 2015 Whitebook.**

AMI technology allows water meters to be read electronically rather than through direct visual inspection by PUD field staff. This will assist PUD staff and customers in managing unusual consumption patterns which could indicate leaks or meter tampering on a customer's property.

Three of the main components of an AMI system are the:

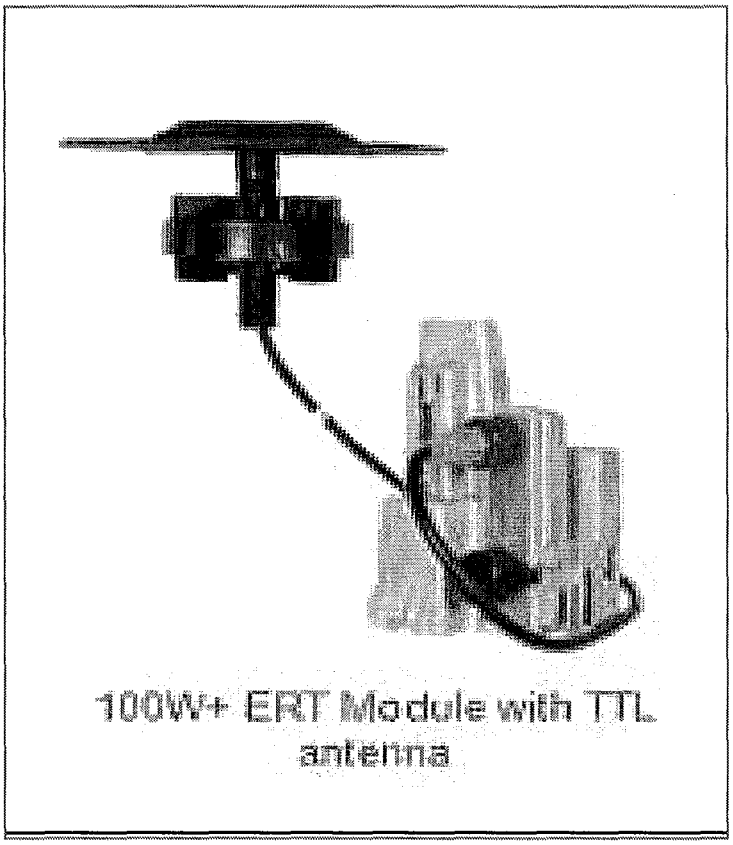
A. Endpoints, see Photo 1:

Photo 1



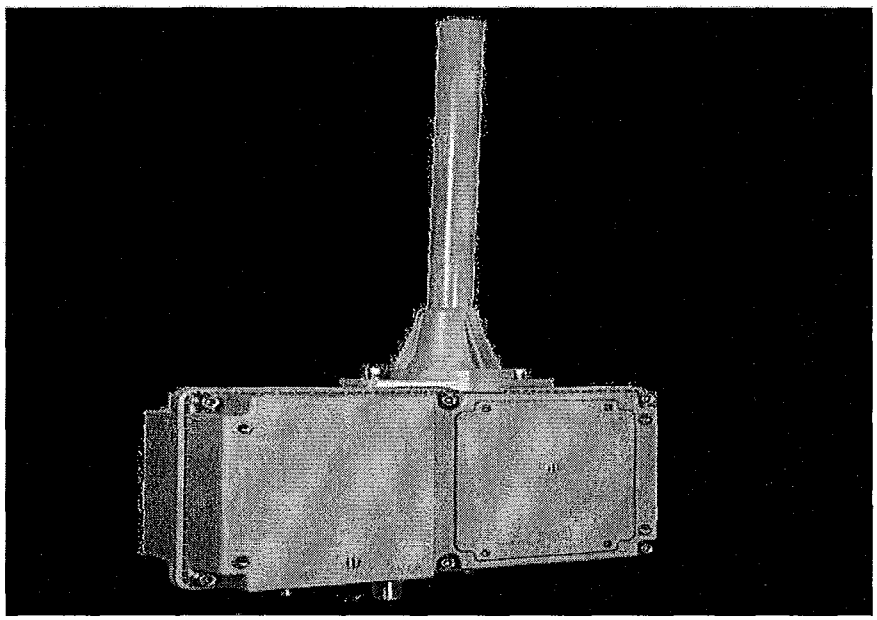
B. AMI Antenna attached to Endpoint (antenna not always required), see Photo 2:

Photo 2



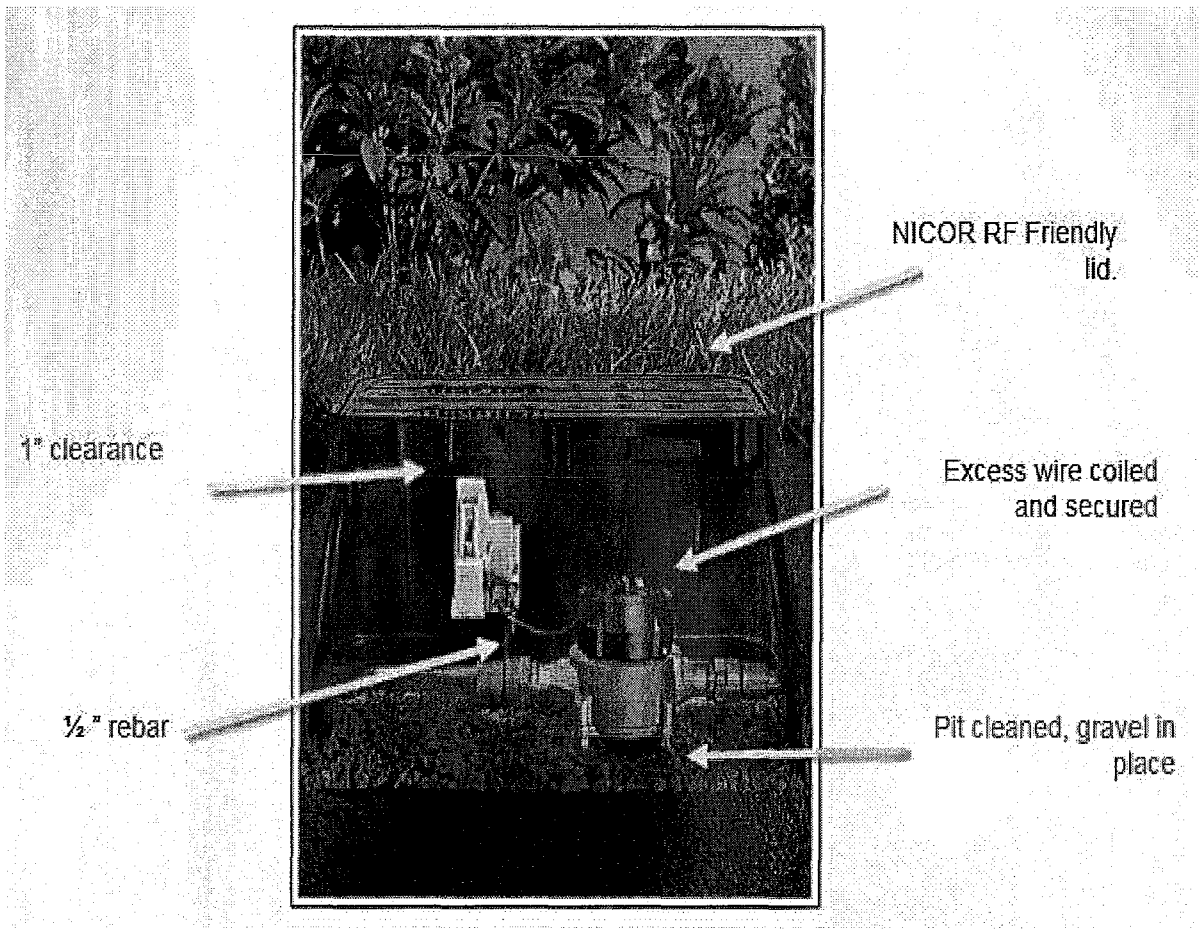
Network Devices, see Photo 3:

Photo 3



AMI endpoints transmit meter information to the AMI system and will soon be on the vast majority of meters in San Diego. These AMI devices provide interval consumption data to the PUD's Customer Support Division. If these devices are damaged or communication is interrupted, this Division will be alerted of the situation. The endpoints are installed in water meter boxes, coffins, and vaults adjacent to the meter. A separate flat round antenna may also be installed through the meter box lid. This antenna is connected to the endpoint via cable. The following proper installation shall be implemented when removing the lid to avoid damaging the antenna, cable, and/or endpoint. Photo 4 below demonstrates a diagram of the connection:

Photo 4



The AMI device ERT/Endpoint/Transmitter shall be positioned and installed as discussed in this Appendix. If the ERT/Endpoint/Transmitter is disturbed, it shall be re-installed and returned to its original installation with the end points pointed upwards as shown below in Photo 5.

The PUD's code compliance staff will issue citations and invoices to you for any damaged AMI devices that are not re-installed as discussed in the Contract Document
Photo 5 below shows a typical installation of an AMI endpoint on a water meter.

Photo 5

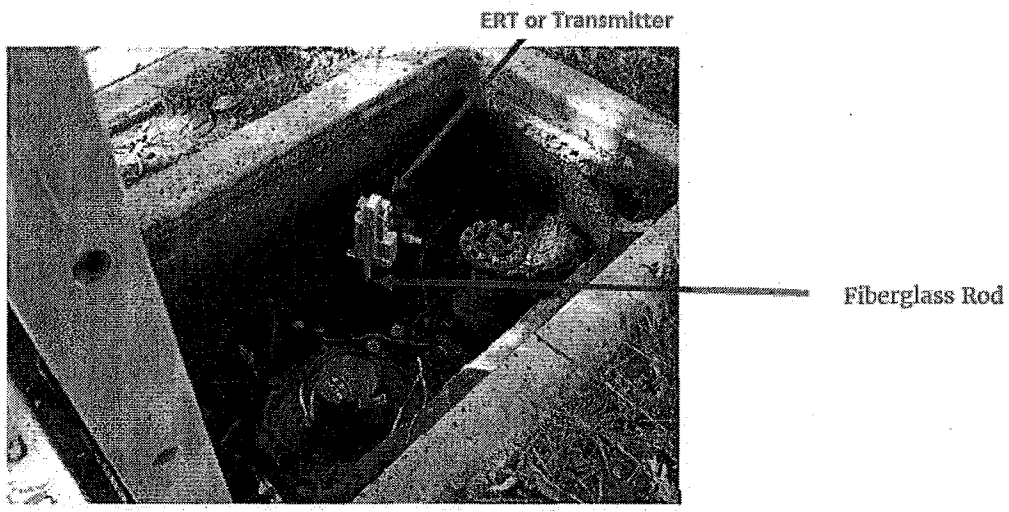
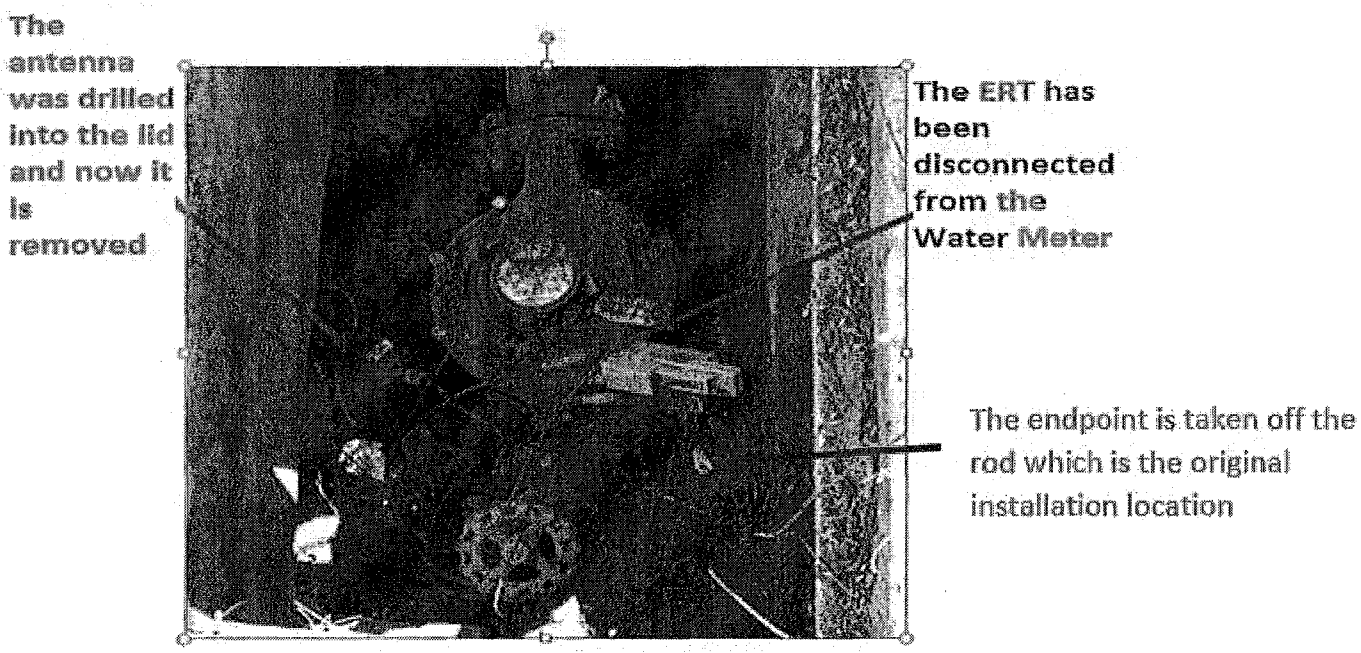


Photo 6 below is an example of disturbance that shall be avoided:

Photo 6



You are responsible when working in and around meter boxes. If you encounter these endpoints, use proper care and do not disconnect them from the registers on top of the water meter. If the lid has an antenna drilled through, do not change or tamper with the lid and inform the Resident Engineer immediately about the location of that lid. Refer to Photo 7 below:

Photo 7

Another component of the AMI system are the Network Devices. The Network Devices are strategically placed units (mainly on street light poles) that collect interval meter reading data from multiple meters for transmission to the Department Control Computer. **If you come across any of these devices on street lights that will be removed or replaced (refer to Photos 8 and 9 below), notify AMI Project Manager Arwa Sayed at (619) 362-0121 immediately.**

Photo 8 shows an installed network device on a street light. On the back of each Network Device is a sticker with contact information. See Photo 9. **Call PUD Water Emergency Repairs at 619-515-3525 if your work will impact these street lights.** These are assets that belong to the City of San Diego and you shall be responsible for any costs of disruption of this network.

Photo 8

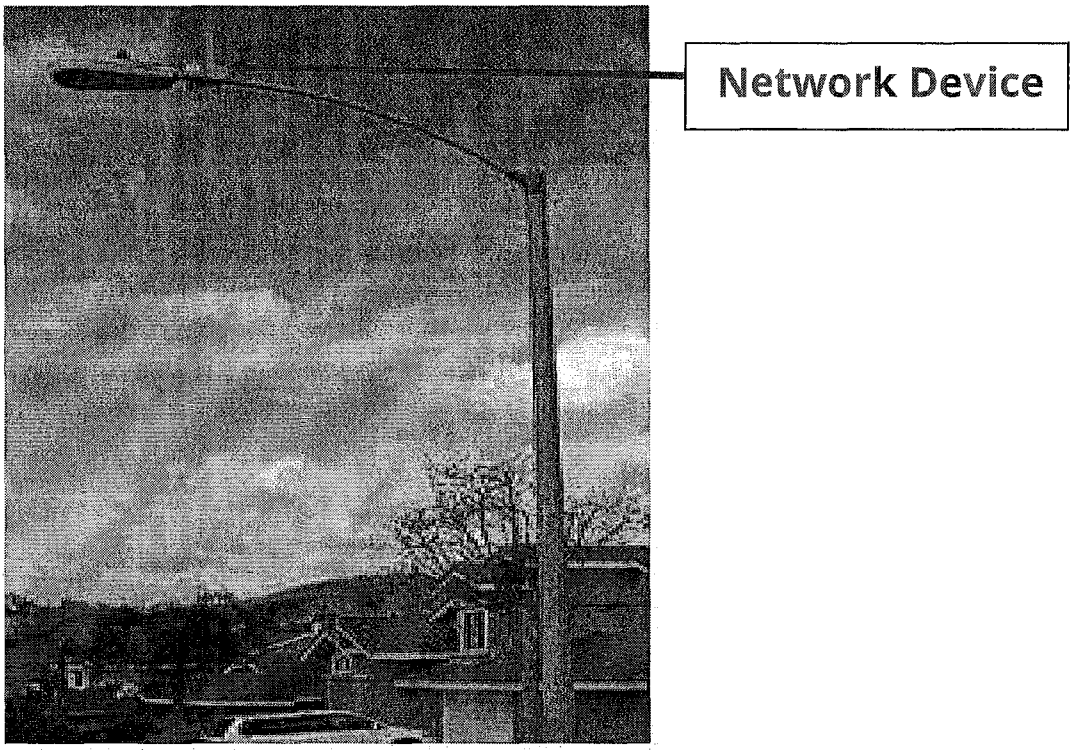


Photo 9

If you encounter any bad installations, disconnected/broken/buried endpoints, or inadvertently damage any AMI devices or cables, notify the Resident Engineer immediately. The Resident Engineer will then immediately contact the AMI Project Manager, Arwa Sayed, at (619) 362-0121.

SECTION 08710 DOOR HARDWARE

Door and Frame prep

Before hardware installation, verify that all doors and frames are properly prepared to receive the specified hardware. Hollow metal frames shall be prepared for ANSI strike plates per A115.1-2 (4-7/8" high), hinge preps will be mortised and reinforced with a minimum of 10 gauge reinforcement material; minimum of 14 gauge reinforcement material for closer. Hollow metal doors shall be properly prepared and reinforced with a minimum of 16 gauge material for either mortised or cylindrical locks as specified. It is preferred that all hollow metal doors receiving door closers have 14 gauge reinforcement. If this is not possible, the use of sex bolts is mandatory. Wood doors shall be factory prepared to receive the scheduled hardware.

Hardware installation

The manufacturer's representative for the locking devices and closing devices must be inspected and approve, in writing, prior to the installation of their product.
Hardware installed incorrectly must be reported to the architect prior to the architect final punch list.

Hanging Devices

Description	Manufacturer	Model/Series	Finish
Mortise Hinge	McKinney	55860 TA 2714 26D NRP at reverse bevel door locks	US 32D
Alternate	Stanley		
Full Surface Hinge	McKinney	57717B TA2714 26D NRP. Use for retrofit doors as appropriate	US 32D
Alternate	Stanley		
Continuous Hinge	Pemko	For high traffic doors	628
Alternate	Markar		
Pivot Hinge	Rixon	180 626 Offset Top Pivot M19 626 Intermediate Pivot	US26D
Alternate	Dorma	75120 626 Offset Top Pivot 75220 626 Intermediate Pivot	

Securing Devices

Description	Manufacturer	Model/Series	Finish
Mortise Lock Set	Best	45H x J Escutcheon lever as selected by architect	626

Lock Function	Room Type
A	Entrance Lock
R	Classroom Function
D	Storeroom Function
N	Passage
L	Privacy

Provide lock functions as required for project as appropriate

No Alternate

Lock Set	Best	93K x D Rose, lever as	626 selected by architect
Lock Function		Lock Type	
AB		Entrance Lock 9K37 AB 53 626	
R		Classroom Function 9K37 RD4D 53 626	
D		Storeroom Function 9K37D14D 53 626	
N		Passage 9K30N14d 53 626	
L		Privacy 9K30L14D 53 626	

Provide lock functions as required for project as appropriate

No Alternate

Cylinders	Best	Mortise 1E74 x RP3 x cam required	626

No Alternate

Key System	Best	See bullets below	626

- Removable interchangeable core
- 7-pin Best "Patented/Standard" Existing Best key system
- 7-pin Best "Patented Peaks/CorMax" New Construction
- Best key system
- 2 keys per lockset
- All cylinder and cores must be manufactured by BEST
- All cores are to be keyed into the existing Best Master key system
- Provide all locksets and cylinders with construction cores for contractor use Permanent cores provided at project completion

No Alternate

Lock Function

Deadbolt Lock/single & cylinder 2 ¾ " BS		8T37KSTK 626	
Deadbolt Lock/single & cylinder 2 3/8 " BS		7T27KSTK 626	
Exit Device	Precision	See bullets below	630

- 2100 Series Rim x 4900 Trim (single door)
- 2800 Series Concealed Vertical Rod
- 2300 Series Mortise
    - Use Escut. w/lever 4900 where applicable
    - Lever handle shall match lockset design
    - Exits with cylinder dogging at all non rated devices
    - Provide "FL" fire rated devices at label openings

No Alternates

Flush Bolts	Trimco	See bullets below	626

Use automatic flush bolts where required by fire code.

- Use automatic flush bolts where required by fire code.
- Provide coordinator and brackets as required to meet fire door

Alternate	Rockwood	3917-12-626 Manual Flush bolts	626

Coordinator	Trimco	Mounting Brackets as required	600
Alternate	Rockwood		

Closing Device

Closer	LCN	See bullets below	689

- 4040XP RW/PA TBSRT
- 4040XP SHCNS TBSRT
- 1461 RW/PA TBSRT
- All door frames to be reinforced
- Provide "SNB" Sex nuts and bolts as needed
- 35-40-EN

Alternate	Sargent		

Automatic Operators
Electro-mechanical

Automatic Operator	Stanley	Magic Force Full Energy	689
	Dorma		689

Stops and Holders

Door Stop	Trimco	Allow for max swing of doors. Backing required at wall stops	630 626
Alternate	Rockwood		
Overhead Stop and Holder	Glynn & Johnson		630
Alternate	Sargent		

Accessories

Pull	Trimco		630
Alternate	Rockwood		
Push Plate	Trimco		630
Alternate	Rockwood		
Kick Plate	Trimco		630
Alternate	Rockwood		

Armor Plate	Trimco		630
Alternate	Rockwood		
Threshold	Pemko	Furnished as detailed on drawings if shown	628
Alternate			
Door Sweep	Pemko	345V	628
Alternate			
Smoke Seal	Pemko	S88 (verify color)	
Alternate			
Weather Seal	Pemko	303_S (at head/Jambs)	628
Alternate			
Astragal	Pemko	357 SP	600
Alternate			

Miscellaneous

Manual Key Control	Telkee	Aristocrat wall mounted AWC series Dual tag system. Key capability to accept all keyed locksets plus 50% expansion.
Stand Alone Electronic Lock	Schlage C100 Trilogy	626 626

A. Deadbolts will be solid stainless steel (without internal riveted actuator), when deadbolt is extended 1", at least 2" will remain in the lock case.

B. All levers will be cast solid levers, hollow levers will not be allowed.

C. Cylindrical lock sets may be used only on interior non-high-traffic openings. Locks will have a replaceable sheer lug which when broken will disable the lever. Clutch mechanisms will not be allowed. Locks will have 7 pin interchangeable cores. Cylindrical locks are not to be used on exterior doors.

D. All doors and hardware must meet Americans with Disabilities Act and Title 24

E. Approved manufactures are Best Access Systems or Folger Adams with Best Lock.

F. Doors in the following locations will have locks which are ANSI series 1000 Grade 1 SECURITY and Grade 1 OPERATIONAL. Locks will meet UL 437 requirements.

1- rooms with narcotics
2- rooms that contain an armory
3- Exterior doors for Police facilities
4- Exterior doors for Court facilities
5- Doors to Judges Chambers
6- Any exterior door which could be in a remote location or subject to high vandalism.

2. Keys and keying

A. All cylinders will be Best 7-pin, interchangeable core and keyed into an existing factory- registered Grand Master key System. All seven pins to be operational.

B. Furnish permanent cores to City Lock shop for final installation unless provided by manufacturer.

C. Temporary cores (construction cores) will be installed by Contractor for security purposes. Temporary cores will be keyed alike and interchangeable with Best cores. Cores provided by manufacturer.

D. Contractor will provide to the City Lock shop copies of Control key and Operating key upon completion.

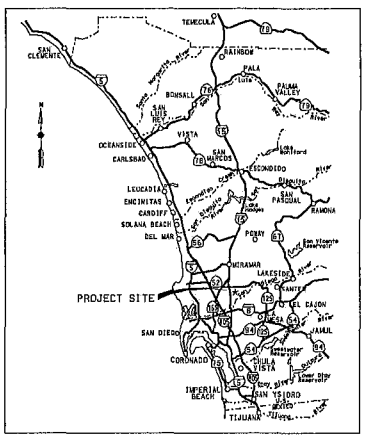
E. All keys and cores will have visual key control.

F. All keys will be stamped "City of San Diego", and "Do Not duplicate".

G. The Electric Meter Room will have SDG&E. lock installed. The cylinder will be keyed to Schlage key way VTQP AA-10. Three keys are provided with lock. All keys are to be turned over to the City of San Diego Lock shop at completion of the project. The contractor will obtain lock from any contracted SDG&E. Locksmith for installation.

TIERRASANTA PUMP STATION

4701 SEDA DRIVE, SAN DIEGO, CA 92124



VICINITY MAP
NTS

LEGAL DESCRIPTION:

ALL THAT PORTION OF LOT 144 OF VILLA DOMINIQUE UNIT NO. 3, IN THE CITY OF SAN DIEGO, COUNTY OF SAN DIEGO; STATE OF CALIFORNIA, ACCORDING TO THE MAP THEREOF NO. 9235, FILED IN THE OFFICE OF THE COUNTY RECORDER OF SAID SAN DIEGO COUNTY ON MAY 30, 1979, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

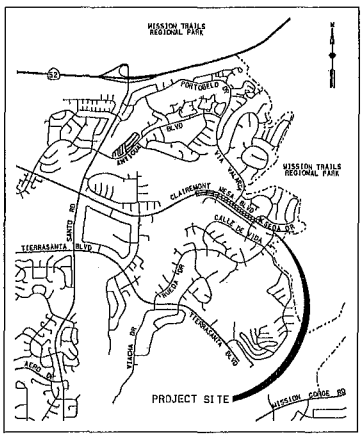
BEGINNING AT A PONT ON THE SOUTHWESTERTLY LINE OF SAID LOT 144, SAID POINT BEING ON THE ARC OF A 1949.00 FOOT RADIUS CURVE, CONCAVE NORTHEASTERLY, A RADIAL BEARS SOUTH 34°07'00" WEST; THENCE LEAVING THE SAID SOUTHWESTERLY LOT OF 144 NORTH 35°41'36" EAST 225.23 FEET TO A POINT ON THE NORTHERLY LINE OF SAID LOT 144, SAID POINT BEING ON THE ARC OF A 220.00 FOOT RADIUS CURVE, CONVAGE SOUTHERLY, A RADIAL BEARS NORTH 15°15'00" EAST; THENCE EASTERLY ALONG THE SAID NORTHERLY LINE OF LOT 144 AND ALONG THE ARC OF SAID CURVE THROUGH A CENTRAL ANGLE OF 05°28'10" A DISTANCE OF 21.00 FEET, A RADIAL BEARS NORTH 20°44'10" EAST; THENCE LEAVING SAID NORTHERLY LINE OF LOT 144 SOUTH 35°41'36" WEST 230.96 FEET TO A POINT ON THE SAID SOUTHWESTERLY LINE OF LOT 144, SAID POINT BEING ON THE SAID ARC OF A 1949.00 FOOT RADIUS CURVE, CONCAVE NORTHEASTERLY, A RADIAL BEARS SOUTH 33°31'42" WEST; THENCE NORTHWESTERLY ALONG THE SAID SOUTHEWESTERLY LINE OF LOT 144 AND ALONG THE ARC OF SAID CURVE THROUGH A CENTRAL ANGLE OF 00°35'18" A DISTANCE OF 20.01 FEET TO THE POINT OF BEGINNING.

PTS Project No. 417982

MAY 2016

I HEREBY DECLARE THAT I AM THE ENGINEER OF WORK FOR THIS PROJECT THAT I HAVE EXERCISED RESPONSIBLE CHARGE OVER THE DESIGN OF THE PROJECT AS DEFINED IN SECTION 6703 OF THE BUSINESS AND PROFESSIONS CODE AND THAT THE DESIGN IS CONSISTENT WITH CURRENT STANDARDS. I UNDERSTAND THAT THE CHECK OF PROJECT DRAWINGS AND SPECIFICATIONS BY THE CITY OF SAN DIEGO IS CONFINED TO A REVIEW ONLY AND DOES NOT RELIEVE ME, AS ENGINEER OF WORK, OF MY RESPONSIBILITIES FOR PROJECT DESIGN.

Douglas B. Robison 7/11/2016
DOUGLAS BRUCE ROBISON, CA PE C37109, EXP. 06/30/2018 DATE



LOCATION MAP
NTS

CONSTRUCTION STORM WATER PROTECTION NOTES

1. TOTAL SITE DISTURBANCE AREA (ACRES) - 0.88
   HYDROLOGIC UNIT/WATERSHED - SAN DIEGO RIVER
   HYDROLOGIC SUBAREA - MISSION SAN DIEGO
2. THE CONTRACTOR SHALL COMPLY WITH THE REQUIREMENTS OF THE
   ■ WPCP
   THE PROJECT IS SUBJECT TO MUNICIPAL STORM WATER PERMIT ORDER NO. R9-2013-000 AS AMENDED BY R9-2015-0001 AND R9-2015-0100
   ☐ SWPP
   THE PROJECT IS SUBJECT TO MUNICIPAL STORM WATER PERMIT ORDER NO. R9-2013-0001 AS AMENDED BY R9-2015-001 AND R9-2015-0100 AND AND CONSTRUCTION GENERAL PERMIT NO. 2009-0009-DWQ AS AMENDED BY ORDER 2010-0014-DWQ AND 2012-006-DWQ
   TRADITIONAL RISK LEVEL ☐ 2☐ 3☐
   LUP: TYPE 1☐ 2☐ 3☐
3. CONSTRUCTION SITE PRIORITY
   ☐ ASBS ☐ HIGH ☐ MEDIUM ■ LOW

CONSTRUCTION CHANGE / ADDENDUM			
CHANGE	DATE	AFFECTED OR ADDED SHEET NUMBERS	APPROVAL NO.
B	7-26-16	C-2, C-3, C-5, C-9, M-2, M-4, M-5, M-8, M-13, M-3	

WARNING
0 1"
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

CITY OF SAN DIEGO
PUBLIC WORKS PROJECT

AS-BUILT INFORMATION

MATERIALS	MANUFACTURER
PIPE CL 235 (WATER)	-
PIPE SDR 35 (SEWER)	-
GATE VALVES	-
FIRE HYDRANTS	-

CONSTRUCTION SITE STORM WATER PRIORITY INSPECTION FREQUENCY: HIGH ___ MEDIUM ___ LOW ___

SPEC. NO.

CONSULTANT

Brown AND Caldwell
9665 Chesapeake Drive, Suite 201
San Diego, CA 92123
Tel: 858-514-8822
Fax: 858-514-8833

REGISTERED PROFESSIONAL ENGINEER DOUGLAS BRUCE ROBISON No. C37109 Exp. 06/30/2018 Civil STATE OF CALIFORNIA
7/25/2016

CONTRACTOR ___ DATE STARTED ___
INSPECTOR ___ DATE COMPLETED ___

G-1

PLANS FOR THE CONSTRUCTION OF
TIERRASANTA PUMP STATION
TITLE SHEET

CITY OF SAN DIEGO, CALIFORNIA
PUBLIC WORKS DEPARTMENT
SHEET 01 OF 140 SHEETS

WBS 5-12040

DWAYNE ABBEY
PROJECT MANAGER
MARYAM KARGAR
PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FAMO
ORIGINAL	BC			
ADDENDUM B	BC		7-26-16	

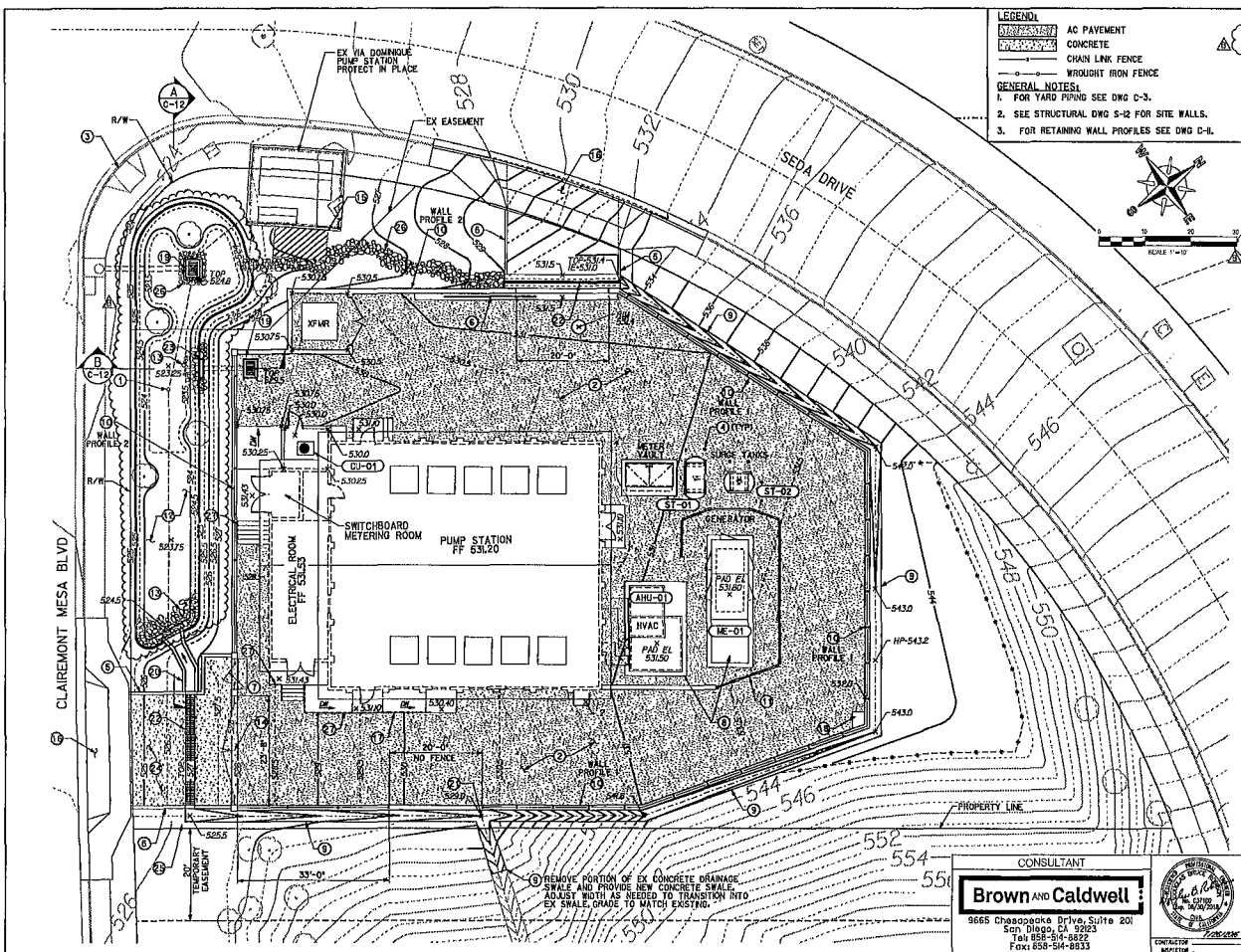
238-1743
COST CENTER(S)
6304401-1978444
GOBS CONTRACT(S)
37228-01-D

ADDENDUM B

TIERRASANTA PUMP STATION

P:\Projects\San Diego Water Dept. City of (CA)\142840 - Tierrasanta Pump Station\CADD\2-SHEETS\01-GENERAL\37228-001.dgn
26-JUL-2016 10:02
thorencio
Project & XRFs
Tierrasanta Pump Station

ADDENDUM "B"



LEGEND:

- AC PAVEMENT
- CONCRETE
- CHAIN LINK FENCE
- WROUGHT IRON FENCE

GENERAL NOTES:

1. FOR YARD PIPING SEE DWG C-3.
2. SEE STRUCTURAL DWG S-12 FOR SITE WALLS.
3. FOR RETAINING WALL PROFILES SEE DWG C-11.

SCALE 1"=10'

CONSTRUCTION NOTES:

1. 6" DIA UNDERDRAIN WITH CLEANOUT PER SAN DIEGO STORM WATER STANDARDS
2. AC PAVEMENT OVER CLASS 2 AGGREGATE BASE PER GEOTECHNICAL REPORT
3. CURB RAMP PER DETAIL 1, DWG C-17
4. TYPE "A" PROTECTION POST PER SDRSD W14-04
5. 6" CURB PER SDSD SDG-150
6. 24'-0" WIDE MOTORIZED ROLLING GATE PER ARCHITECTURAL DWGS
7. 4'-0" WIDE ACCESS GATE PER ARCHITECTURAL DWGS
8. THICKENED CONCRETE SLAB PER STRUCTURAL DWGS
9. 2'-6" WIDE TYPE "A" DRAINAGE DITCH PER SDSD SDD-106
10. SITE WALLS PER STRUCTURAL DWGS AND DWG C-11
11. SOUND ATTENUATION WALL PER STRUCTURAL DWGS
12. BMP-1 BIOFILTRATION BASIN PER SECTION A, DWG C-12
13. RIP-RAP SLOPE PROTECTION PER SDRSD D-40, NO. 2 BACKING ROCK
14. 24'-0" WIDE DOUBLE SWING GATE PER ARCHITECTURAL DWGS
15. REMOVE AND DISPOSE OF EXISTING ENGINE GENERATOR, FUEL TANK, CONCRETE PAD, AND ASSOCIATED WIRING. EXPOSED ELECTRICAL CONDUITS SHALL BE REMOVED DOWN TO BURIED ELBOW. REMAINING BURIED CONDUITS SHALL BE ABANDONED IN PLACE. CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING AND PAYING ALL PERMITS TO REMOVE AND DISPOSE OF THE GENERATOR, TANK, PIPING, AND ANY HAZARDOUS MATERIAL. CONTRACTOR SHALL ENSURE THAT ANY AND ALL REQUIREMENTS ARE DONE THAT IS NECESSARY TO ACQUIRE THE PERMITS.
16. 24'-0" WIDE COMMERCIAL CONCRETE DRIVEWAY PER SDSD SDG-163
17. PEDESTRIAN RAMP AND PROTECTIVE RAILING PER SDSD SDM-15
18. ANTENNA PER ELECTRICAL DWGS
19. TYPE "F" CATCH BASIN PER SDRSD D-29
20. CONCRETE SPILLWAY PER DETAIL 1, DWG C-13
21. V-DITCH INTERSECTION PER DETAIL 2, DWG C-13
22. INSTALL PRECAST CONCRETE GRATED DRAINAGE TRENCH WITH H-20 LOADED TRAFFIC AND PEDESTRIAN GRATE. NENSSEN MODEL 2222 OR APPROVED EQUAL. FORM INLET AND OUTLET TO MATCH TRENCH CROSS SECTION. TAPER DRAINAGE DITCH AS NEEDED.
23. TYPE "A" STRAIGHT HEADWALL PER SDRSD D-30
24. 7" PORTLAND CONCRETE PAVEMENT PER SSPWC 302-6
25. CONCRETE SPLASH WALL, SEE DWG C-13 AND STRUCTURAL DWGS
26. RIP-RAP PROTECTION PER SDRSD D-40, NO. 2 BACKING ROCK
27. RAILING AND STAIR HANDRAIL PER SDSD SDM-18, AROUND PLATFORM AND STAIRS

C-2

TIERRASANTA PUMP STATION
CIVIL
SITE
GRADING AND DRAINAGE PLAN

CIVIL SITE GRADING AND DRAINAGE PLAN

CITY OF SAN DIEGO, CALIFORNIA
PUBLIC WORKS DEPARTMENT
SHEET 12 OF 140 SHEETS

WBS 5-12040

DESCRIPTION	BY	APPROVED	DATE	FRAME
ORIGINAL	BC			
ADDENDUM B	BC		7-26-18	

DRAWN BY DRAYNE ABBEY
PROJECT MANAGER
MARYAM KARGAR
PROJECT ENGINEER
238-1743
CITY ENGINEER
6304407-3878444
CITY PROJECT MANAGER
37228-12-D
DATE STARTED
DATE COMPLETED

CONSULTANT
Brown AND Caldwell
9665 Chesapeake Drive, Suite 201
San Diego, CA 92123
Tel: 858-514-8822
Fax: 858-514-8833

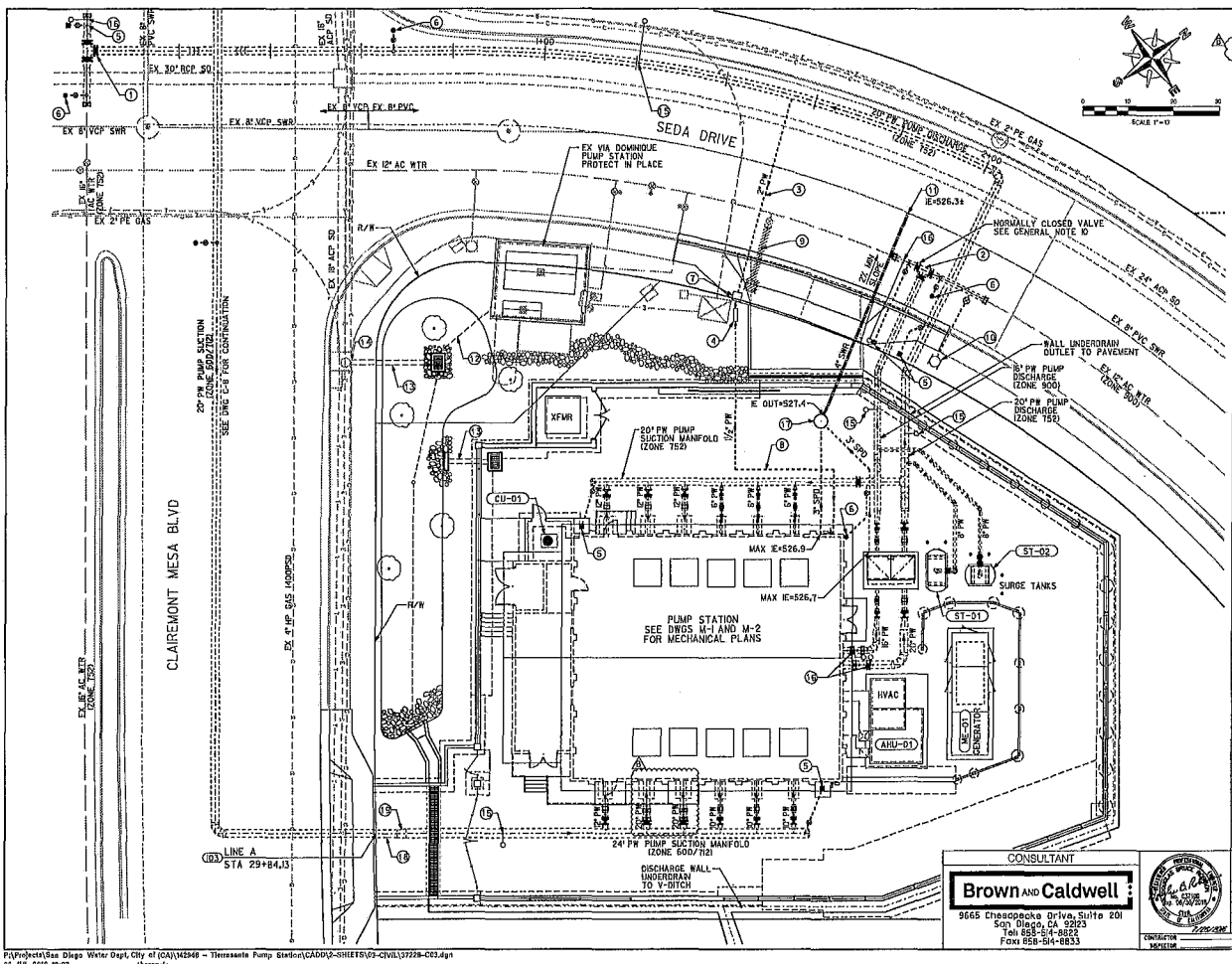
CONTRACTOR
INSPECTOR

ADDENDUM B

Page 37 of 40

P:\Projects\San Diego Water Dept, City of (CA)\142346 - Tierrasanta Pump Station\CADD\B-SHEETS\03-CIVIL\37228-C02.dgn
29-JUL-2018 10:03 theresenia
August 3, 2018
Tierrasanta Pump Station

ADDENDUM "B"



CONSTRUCTION NOTES:

1. SEE CONNECTION DETAIL 2, DWG C-9
2. SEE CONNECTION DETAIL 2, DWG C-10
3. 2" WATER SERVICE CONNECTION PER SDSD SDW-149
4. 2" BACKFLOW PREVENTER PER SDSD SDW-155
5. 4" COMBINATION AIR RELEASE/AIR VACUUM VALVE PER SDSD SDW-160
6. TYPE "B" 4" BLOW-OFF ASSEMBLY PER SDSD SDW-145
7. WATER METER BOX PER SDSD SDW-135 AND SDW-137
8. 1/2" UTILITY WATER PIPELINE, FIELD ROUTE TO EQUIPMENT AND HOSE BIBBS
9. REMOVE AND DISPOSE OF EXISTING FIRE HYDRANT, PLUG EXISTING LINE PER SDRSD WF-03
10. INSTALL NEW FIRE HYDRANT PER SDRSD WF-01
11. SEWER LATERAL CONNECTION PER SDS-105
12. CONNECT AC DISCHARGE LINE TO CATCH BASIN
13. 12" RCP DRAIN (225OD)
14. CONNECT 12" RCP PIPE TO EX SD INLET PER DETAIL 1, DWG C-14
15. CATHODIC PROTECTION 2-WIRE TEST STATION WITH 2-ANODES PER DETAIL 1, DWG CP-1
16. CATHODIC PROTECTION 2-WIRE TEST STATION PER DETAIL 3, DWG CP-1
17. MANHOLE 4'x3' DIAMETER PER SDS-107, UPSTREAM PIPE IS PRESSURIZED SUMP PUMP DISCHARGE PER SPECIFICATION SECTION 02646, DOWNSTREAM PIPE IS GRAVITY SEWER PER SPECIFICATION SECTION 02644.
18. 20" CML&TW STEEL
19. 24" x 20" CML&TW STEEL, PE, ECCENTRIC REDUCER, FOT

GENERAL NOTES:

1. FOR SITE GRADING AND DRAINAGE PLAN SEE DWG C-2.
2. FOR ELECTRICAL CONDUITS SEE DWG E-3.
3. SEE MECHANICAL DWGS M-1 AND M-2 FOR PUMP STATION SUCTION AND DISCHARGE PIPING MATERIALS LIST. SEE DWG M-14 FOR MATERIALS.
4. FOR CATHODIC PROTECTION DETAILS SEE DWGS CP-1 AND CP-2.
5. FOR HVAC EQUIPMENT LAYOUT SEE DWGS H-3 AND H-4.
6. ALL BURIED VALVES SHALL HAVE A VALVE CAN PER SDSD SDW-153.
7. FOR VALVE BALL-OUTS SEE MECHANICAL AND INSTRUMENTATION DWGS.
8. ALL BURIED PIPE SHALL BE CML&TW STEEL UNLESS NOTED OTHERWISE.
9. CONTRACTOR SHALL FIELD VERIFY VERTICAL AND HORIZONTAL LOCATION OF ALL EXISTING PIPELINES PRIOR TO PIPE FABRICATION.
10. VALVE CAN CAP FOR NORMALLY CLOSED VALES SHALL BE PAINTED RED.

C-3

TIERRASANTA PUMP STATION
CIVIL
SITE
YARD PIPING PLAN

CITY OF SAN DIEGO, CALIFORNIA
PUBLIC WORKS DEPARTMENT
SHEET 13 OF 140 SHEETS

WBS S-12040

DWAYNE ABBEY
PROJECT MANAGER

GANYAM KARGAR
PROJECT ENGINEER

238-1743
COMM COORDINATOR

6304407-3126444
CIVIL COORDINATOR

37228-13-D

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	BC			
ADDENDUM B	BC		1-26-16	

CONSULTANT
Brown AND Caldwell
9665 Chesapeake Drive, Suite 201
San Diego, CA 92123
Tel: 858-514-8822
Fax: 858-514-8833

CONTRACTOR
MONIKER

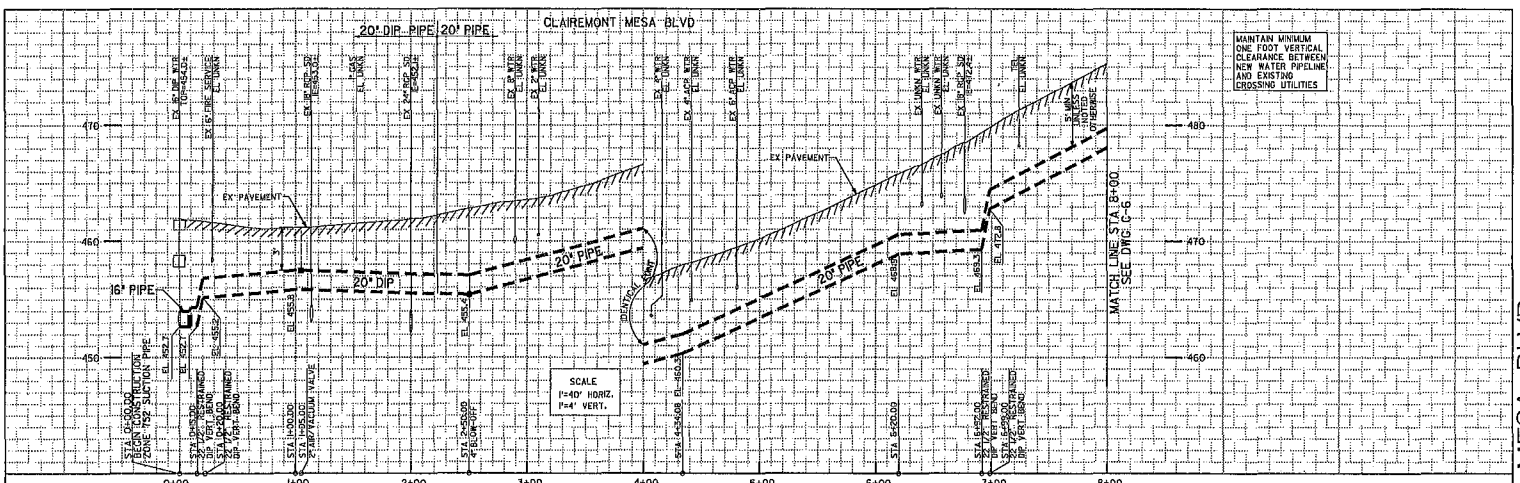
DATE STARTED
DATE COMPLETED

CIVIL YARD PIPING PLAN

ADDENDUM B

P:\Projects\San Diego Water Dept, City of (CA)\142940 - Tierrasanta Pump Station\CADD\2-SHEETS\03-CIVIL\37228-C03.dgn
24-JUL-2015 16:03
Approved By
Tierrasanta Pump Station

ADDENDUM "B"



(1)(100) BY CITY FORCES AHD OF CONTRACTOR
STA 0+00.00
CUT AND PLUG:
EX 16" DIP WTR, 13' LT
EX 16" DIP WTR, 10' RT
RECONNECT AFTER NEW MAIN HAS BEEN ACCEPTED.

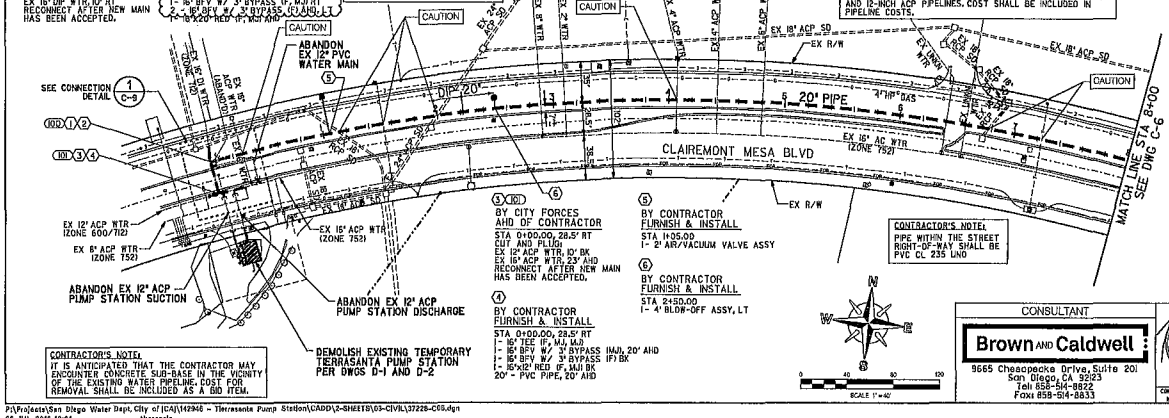
(2) BY CONTRACTOR FURNISH & INSTALL
STA 0+00.00
BEGIN CONSTRUCTION
16" TEE (F)
1 - 16" BFV W/ 3" BYPASS (F) AND LT
2 - 16" BFV W/ 3" BYPASS (F) AND LT
1 - 16x20 RED (F) MJ AND

CAUTION
4" HP GAS! CONTRACTOR TO VERIFY EXACT LOCATION AND MUST NOTIFY SDG&E THREE (3) WEEKS IN ADVANCE PRIOR TO EXCAVATION
SDG&E STANDBY REQUIRED

CONTRACTOR'S NOTE:
FOR DETAILED THRUST BLOCK INFORMATION SEE DETAIL 3, DWG C-14.

CONTRACTOR'S NOTE:
CONTRACTOR SHALL POTHOLE AND LOCATE EXISTING UTILITIES AS NEEDED TO VERIFY EXISTING CONDITIONS TO ALLOW FOR ANY FIELD ADJUSTMENTS THAT MAY BE REQUIRED TO MAKE THE CONNECTION TO EXISTING PIPELINES. CONTRACTOR SHALL PROVIDE VERTICAL AND HORIZONTAL BENDS AS NEEDED FOR FIELD FIT UP TO CONNECT TO EX 16-INCH DIP, 16-INCH ACP, AND 12-INCH ACP PIPELINES. COST SHALL BE INCLUDED IN PIPELINE COSTS.

REFERENCE:
WATER: 15933-5-D, 16397-1-D, 18560-5-D, 21074-4-D, 23692-13-D, 25371-3-D, 26544-3-D
SEWER: NONE
STORM DRAIN: 15933-10-D, 21077-4-D
GAS:
ELECTRIC:
CABLE TV:
TELEPHONE:
IMPROVEMENTS: 15933-5-D, 16397-1-D
100' SCALE/FIELD BOOK:
THOMAS BROS.:
HDL:



(3)(100) BY CITY FORCES AHD OF CONTRACTOR
STA 0+00.00, 28.5' RT
CUT AND PLUG:
EX 12" ACP WTR, 10' BK
EX 16" ACP WTR, 23' AHD
RECONNECT AFTER NEW MAIN HAS BEEN ACCEPTED.

(4) BY CONTRACTOR FURNISH & INSTALL
STA 0+00.00, 28.5' RT
1 - 16" TEE (F, MJ, MJ)
1 - 16" BFV W/ 3" BYPASS (MJ), 20' AHD
1 - 16" BFV W/ 3" BYPASS (F) BK
1 - 16"x12" RED (F, MJ) BK
20' - PVC PIPE, 20' AHD

(5) BY CONTRACTOR FURNISH & INSTALL
STA 1+05.00
1 - 2" AIR/VACUUM VALVE ASSY

(6) BY CONTRACTOR FURNISH & INSTALL
STA 2+50.00
1 - 4" BLOW-OFF ASSY, LT

CONTRACTOR'S NOTE:
PIPE WITHIN THE STREET RIGHT-OF-WAY SHALL BE PVC CL 235 UNO

CONTRACTOR'S NOTE:
IT IS ANTICIPATED THAT THE CONTRACTOR MAY ENCOUNTER CONCRETE SUB-BASE IN THE VICINITY OF THE EXISTING WATER PIPELINE. COST FOR REMOVAL SHALL BE INCLUDED AS A BID ITEM.

SCALE 1"=40'

CONSULTANT
Brown AND Caldwell
9665 Chesapeake Drive, Suite 201
San Diego, CA 92123
Tel: 858-514-8822
Fax: 858-514-8833

CONTRACTOR
INSPECTOR

C-5

TIERRASANTA PUMP STATION
CLAIREMONT MESA BLVD
PLAN AND PROFILE
ZONE 752 SUCTION PIPE
STA 0+00 TO STA 8+00

CITY OF SAN DIEGO, CALIFORNIA
PUBLIC WORKS DEPARTMENT
SHEET 15 OF 140 SHEETS

WBS S-12040

DWAYNE ABBEY
PROJECT MANAGER

MARYAM KARGAR
PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILE NUMBER
ORIGINAL	BC			238-1137/238-1143
ADDENDUM B	BC		7-26-16	COST TOWN/ZONE 6595401-1676444 6304401-1176444

DATE STARTED
DATE COMPLETED

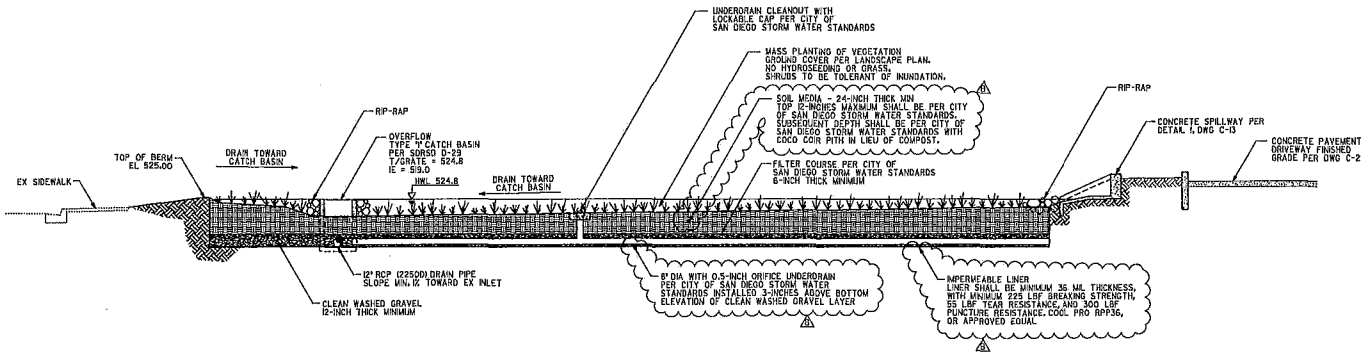
37228-15-D

ADDENDUM B

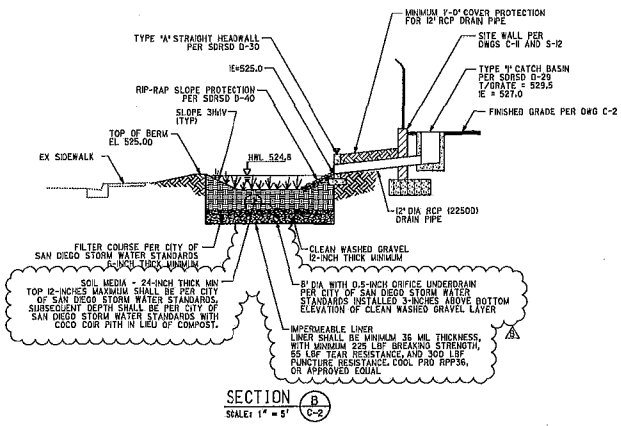
CLAIREMONT MESA BLVD

P:\Projects\San Diego Water Dept. City of (CA)\142940 - Tierrasanta Pump Station\CADD\2-SHEETS\03-CIVIL\37228-C05.dgn
26-JUL-2016 10:04 thernandez
August 3, 2016
Tierrasanta Pump Station

ADDENDUM "B"



SECTION A C-2
SCALE: 1" = 5'



SECTION B C-2
SCALE: 1" = 5'

SCALE 1"=5'

C-12

TIERRASANTA PUMP STATION
CIVIL
BIOFILTRATION BASIN SECTIONS

CITY OF SAN DIEGO, CALIFORNIA
PUBLIC WORKS DEPARTMENT
SHEET 22 OF 110 SHEETS

WBS S-12040

DWAYNE ABBEY
PROJECT MANAGER

MARYAM KARGAR
PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	BC			
ADDENDUM B	BC		7-26-16	

238-1743
CITY COORDINATE

6304407-1676444
CGS COORDINATE

37228-22-D

CONSULTANT

Brown AND Caldwell
9665 Chesapeake Drive, Suite 201
San Diego, CA 92123
Tel: 858-514-8822
Fax: 858-514-8833

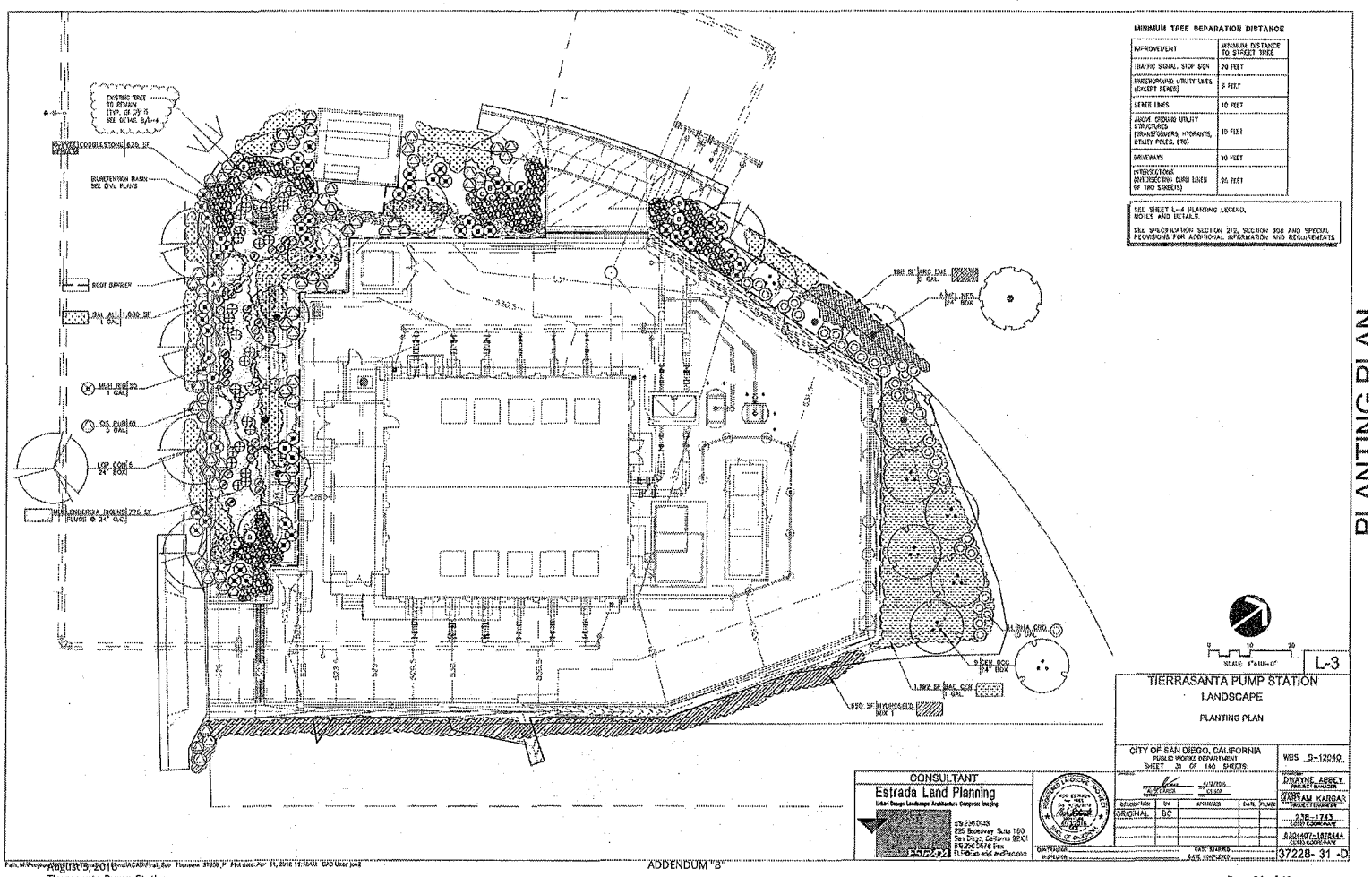
CONTRACTOR
INSPECTOR
DATE STARTED
DATE COMPLETED

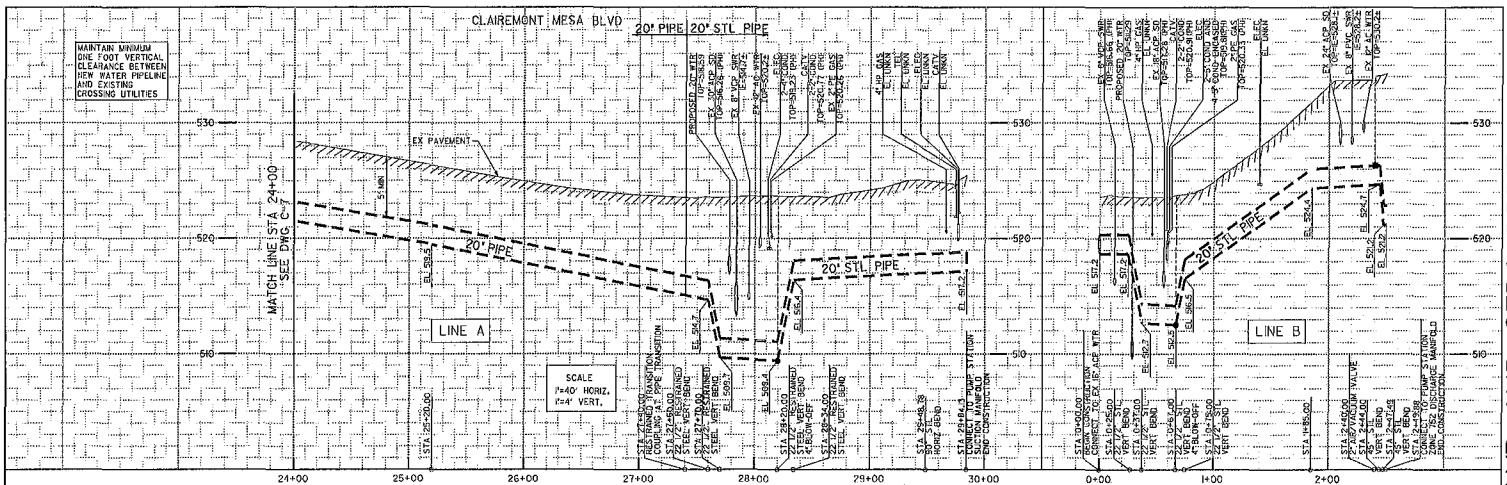
CIVIL BIOFILTRATION BASIN SECTIONS

ADDENDUM B

P:\Projects\San Diego Water Dept. City of (CA)\142946 - Tierrasanta Pump Station\CADD\3-SHEETS\05-CIVIL\37228-C12.dgn
26-JUL-2016 10:05 thetonda
Aigital X 2000
Tierrasanta Pump Station

ADDENDUM "B"


EXISTING TREE TO REMAIN
COBBLESTONE 626 SF
BIORETENTION BASIN SEE CIVIL PLANS
BODY BARRIER
JAN ALI 1,000 SF 1 GAL
MUH RIGIDA 1 GAL
OS PUMILIO 5 GAL
LIP CORIS 24" BOX
MUH EMERSLEYA RIGIDA 776 SF 1 PLUGS @ 24" O.C.
198 SF BAC DAE 5 GAL
ALNUS RHO 24" BOX
ALBUCA CRIN 5 GAL
BAUH CORN 24" BOX
1,392 SF BAC CON 5 GAL
850 SF HYDROSEED MIX 1
SCALE 1"=10'-0"
L-3
TIERRASANTA PUMP STATION
LANDSCAPE
PLANTING PLAN
CITY OF SAN DIEGO, CALIFORNIA
PUBLIC WORKS DEPARTMENT
SHEET 31 OF 140 SHEETS
WBS B-12040
DWAYNE ABECY PROJECT MANAGER
MARYAM KARBAR PROJECT ENGINEER
ORIGINAL BC
CONSULTANT
Estrada Land Planning
Urban Design Landscape Architecture Computer Imaging
225 Broadway, Suite 1950
San Diego, California 92101
619.236.0048
ELP@estradalandplanning.com
37228- 31 -D
DI ANTINO DI AN



CLAIREMONT MESA BLVD AND SEDA DRIVE

① BY CONTRACTOR
FURNISH AND INSTALL
LINE A
STA 28+20.00
1- 4" BLOW-OFF ASSY, LT

② 102 BY CONTRACTOR
FURNISH & INSTALL
LINE A
~~STA 29+49.78~~
1- 20", 90° STL BEND (PE)

③ 103 BY CONTRACTOR
FURNISH & INSTALL
LINE A
STA 29+84.13
END CONSTRUCTION
CONNECT TO NEW PUMP STATION
ZONE 752 SUCTION MANIFOLD

④ 200 BY CITY FORCES
AND OF CONTRACTOR
LINE B
STA 0+00.00
CUT AND PLUG:
EX 16" AC WTR, 16" LT, RT
RECONNECT AFTER NEW MAIN HAS BEEN ACCEPTED.

⑤ BY CONTRACTOR
FURNISH & INSTALL
LINE B
STA 0+00.00
BEGIN CONSTRUCTION
1- 20" TEE (F)
3 - 20" BFV W 4" BYPASS (F) LT, RT, AHD
2 - 20"x16" STL BED (F), PE) LT, RT
SEE DETAIL 1, DWG C-10

⑥ BY CONTRACTOR
FURNISH AND INSTALL
LINE B
STA 0+67.00
1- 4" BLOW-OFF ASSY, LT

⑦ 202 BY CONTRACTOR
FURNISH AND INSTALL
LINE B
STA 2+03.88
1- 20" 90° STL BEND (PE)

⑧ BY CONTRACTOR
FURNISH AND INSTALL
LINE B
STA 2+40.00
1- 2" AIR/VACUUM VALVE ASSY, RT

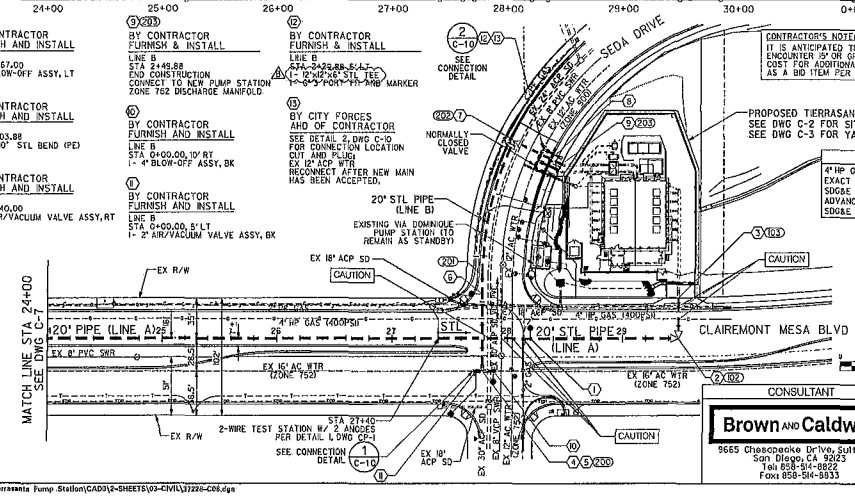
⑨ 203 BY CONTRACTOR
FURNISH & INSTALL
LINE B
STA 2+46.88
END CONSTRUCTION
CONNECT TO NEW PUMP STATION
ZONE 752 DISCHARGE MANIFOLD

⑩ BY CONTRACTOR
FURNISH AND INSTALL
LINE B
STA 0+00.00, 10' RT
1- 4" BLOW-OFF ASSY, BK

⑪ BY CONTRACTOR
FURNISH AND INSTALL
LINE B
STA 0+00.00, 5' LT
1- 2" AIR/VACUUM VALVE ASSY, BK

⑫ BY CONTRACTOR
FURNISH & INSTALL
LINE B
~~STA 3+29.88, 5' LT~~
1- 12"x12"x6" STL TEE
1- 0" 3" PORT TY AMB MARKER

⑬ BY CITY FORCES
AND OF CONTRACTOR
SEE DETAIL 2, DWG C-10
FOR CONNECTION LOCATION
CUT AND PLUG:
EX 12" ACP WTR
RECONNECT AFTER NEW MAIN HAS BEEN ACCEPTED.



CONTRACTOR'S NOTE:
IT IS ANTICIPATED THAT THE CONTRACTOR MAY ENCOUNTER 5' OR GREATER AC THICKNESS. COST FOR ADDITIONAL AC SHALL BE INCLUDED AS A BID ITEM PER SPEC SECTION 300-1.4

CAUTION
4" HP GASI CONTRACTOR TO VERIFY EXACT LOCATION AND MUST NOTIFY SDG&E THREE (3) WEEKS IN ADVANCE PRIOR TO EXCAVATION
SDG&E STANDBY REQUIRED

REFERENCES:
WATER: 15866-17-D, 15933-7-D, 15933-8-D, 17809-5-D, 18293-1-D
SEWER: 15933-5-D, 17809-3-D, 17809-8-D
STORM DRAIN: 15866-27-D, 15933-10-D, 17809-8-D
GAS:
ELECTRIC:
CABLE TV:
TELEPHONE:
IMPROVEMENTS: 15866-17-D, 15933-8-D, 17807-3-D, 17809-3-D, 17809-5-D, 18293-1-D
100' SCALE/FIELD BOOK:
THOMAS BROS.:
HGL:

CONTRACTOR'S NOTE:
PIPE WITHIN THE STREET RIGHT-OF-WAY SHALL BE PVC CL 235 UNO

CONTRACTOR'S NOTE:
FOR DETAILED THRUST BLOCK INFORMATION SEE DETAIL 3, DWG C-14.

CONTRACTOR'S NOTE:
STEEL PIPE LINING AND COATING SHALL BE PER CITY OF SAN DIEGO SSPWC SECTION 207-10.4.7

C-8

TIERRASANTA PUMP STATION
CLAIREMONT MESA BLVD
PLAN AND PROFILE
ZONE 752 SUCTION PIPE
STA 24+00 TO STA 29+84.13
AND ZONE 752 DISCHARGE PIPE

CITY OF SAN DIEGO, CALIFORNIA
PUBLIC WORKS DEPARTMENT
SHEET 18 OF 140 SHEETS

WBS S-12040

PROJECT MANAGER: DWAYNE ABBEY
DESIGNED BY: MARYAM KARGAR
PROJECT ENGINEER: 238-1743
PROJECT DESIGNER: 6104401-1878464
CITY DOCUMENT NO. 37228-18-D

DESCRIPTION	BY	APPROVED	DATE	FRANCHISE
ORIGINAL	BC			
ADDENDUM "B"	DC		7-26-16	

CONTRACTOR
SUPERVISOR
DATE STARTED
DATE COMPLETED

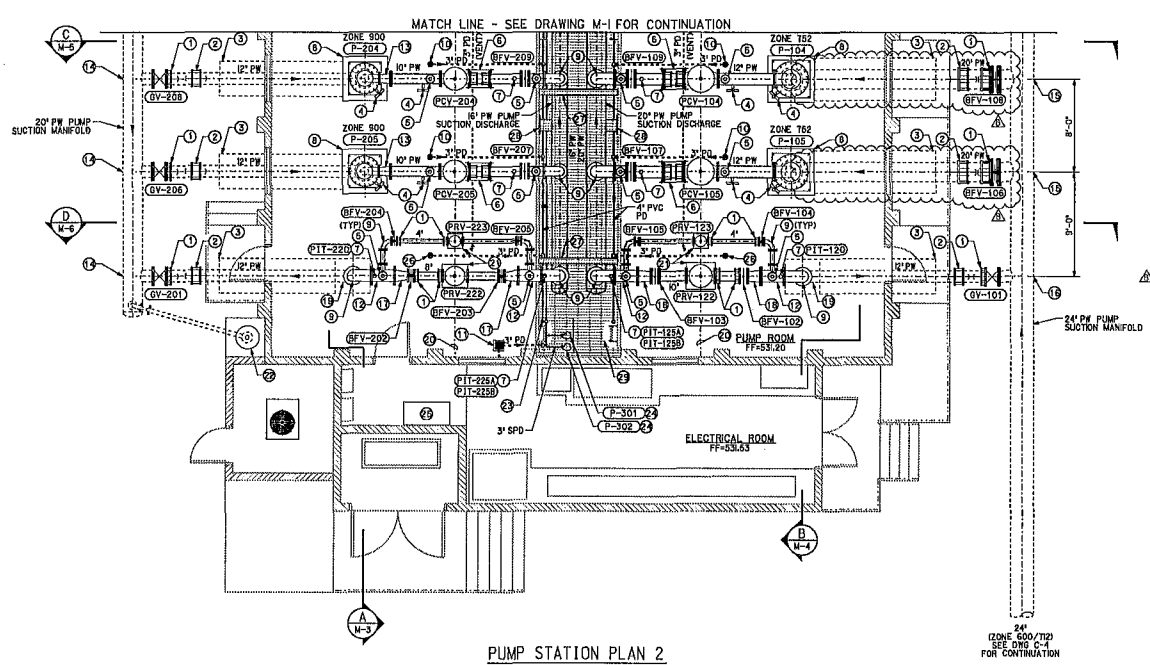
CONSULTANT
Brown AND Caldwell
9665 Chesapeake Drive, Suite 201
San Diego, CA 92123
Tel: 858-514-8822
Fax: 858-514-8833

REGISTERED PROFESSIONAL ENGINEER
No. 72241
Exp. 06/30/2016
CIVIL
STATE OF CALIFORNIA
7/26/2016

ADDENDUM B

P_PWP:\Projects\San Diego Water Dept, City of (CA)\142946 - Tierrasanta Pump Station\CADD\2-SHEETS\03-CIVIL\37228-C08.dgn
26-JUL-2016 15:33
August 3, 2016
Tierrasanta Pump Station
rkulnys

ADDENDUM "B"



PUMP STATION PLAN 2

SCALE: 1/4"=1'-0"

MATERIALS LIST:

1. STEEL FLANGED COUPLING ADAPTER, RESTRAINED, SEE PLAN FOR SIZE
2. BAKER SERIES 216 INSULATING COUPLING W/ NEOPRENE SLEEVE, RESTRAINED. USE INSULATING COLLARED SLEEVES TO PROVIDE DIELECTRIC ISOLATION OF THE RESTRAINT RODS. SEE PLAN FOR SIZE. WITH 4-WIRE TEST STATION PER DETAIL 4, DWG CP-1
3. CONCRETE ENCASEMENT PER DETAIL 7, DWG M-10
4. PRESSURE GAUGE AND SWITCH PER DETAIL 1, DWG M-7
5. AIR RELEASE VALVE PER DETAIL 2, DWG M-7
6. STEEL EQUIPMENT CONNECTION FITTING, RESTRAINED, ROMAC STYLE ECF-400 OR APPROVED EQUAL, SEE PLAN FOR SIZE
7. CORP STOP W/ PRESSURE GAUGE PER DETAIL 6, DWG M-7
8. PUMP BARREL REINFORCED CONCRETE ENCASEMENT PER DETAIL 1, DWG M-8
9. CML STEEL FLANGED 90° BEND, SEE PLAN FOR SIZE
10. EQUIPMENT DRAIN PER DETAIL 5, DWG M-7 WITH TRAP
11. FLOOR SINK, SEE DWG H-4
12. 12"x4" STEEL FLANGED TEE
13. STEEL CONCENTRIC FLANGED REDUCER
14. 20"x12" CML&TW STEEL, PE TEE
15. 24"x20" CML&TW STEEL, PE TEE
16. 24"x12" CML&TW STEEL, PE TEE
17. 12"x8" STEEL ECCENTRIC FLANGED REDUCER, FOT
18. 12"x10" STEEL ECCENTRIC FLANGED REDUCER, FOT
19. 12" STEEL, 5-PIECE, 90° BEND
20. MONORAIL PER STRUCTURAL
21. CONCRETE VALVE SUPPORT PER DETAIL 4, DWG M-11
22. 4" COMBINATION AIR RELEASE/AIR VACUUM VALVE PER SOSD SDW-160
23. ROUTE 4" PD INTO TRENCH SUMP AND DISCHARGE BELOW SUMP GRATING (TYP)
24. SUMP PUMP PER SPECIFICATION SECTION 11346. SUMP PUMP DISCHARGE PIPE AND VALVES PER SPECIFICATION SECTION 02645 AND DWG I-8. SUPPORT 3" SPD ON SUMP WALL. PENETRATE SUMP GRATING NORTHEAST OF TRENCH LADDER. CONTINUE 3" SPD ON TRENCH WALL BELOW 4" PD. MAINTAIN RISE ON DISCHARGE PIPE TO HIGH POINT AT MANHOLE DISCHARGE. CHECK VALVE: PVC SWING WITH TOP ACCESS COVER; SS BOLTS AND NUTS, EPDM SEALS
25. PROVIDE METAL WELDED HEAVY DUTY STORAGE CABINET WITH REMOVABLE SHELVES 48"Wx24"Dx78"H. LOCATE PER CITY DIRECTION.
26. FLOOR DRAIN PER DETAIL 4, DWG M-7 WITH TRAP
27. W10X22 PIPE SUPPORT BEAM. TOP OF STEEL BEAM TO BE 6-INCHES LOWER THAN POUR JOINT. PIPE SUPPORT BEAM CONNECTION PER DETAIL 5, DWG M-12. PIPE SUPPORT HANGER PER DETAIL 3, DWG M-12.
28. LATERAL PIPE BRACE PER DETAIL 6, DWG M-12
29. GRATING PER STRUCTURAL DWGS

GENERAL NOTES:

1. PAINT ALL EXPOSED PIPING INSIDE BUILDING PER SPECIFICATION SECTION 09900.
2. FOR PIPE MATERIAL SEE SCHEDULE ON DWG M-14.
3. FOR HVAC LAYOUT SEE DWGS H-3 AND H-4.

SCALE 1/4"=1'-0"

CONSULTANT

Brown AND Caldwell

9665 Chesapeake Drive, Suite 201
San Diego, CA 92123
Tel: 858-514-8822
Fax: 858-514-8833

CONTRACTOR
DIRECTOR

DATE STARTED
DATE COMPLETED

M-2

TIERRASANTA PUMP STATION
MECHANICAL
PUMP STATION PLAN 2

CITY OF SAN DIEGO, CALIFORNIA
PUBLIC WORKS DEPARTMENT
SHEET 73 OF 110 SHEETS

WBS S-12040

DWAYNE ABBEY
PROJECT MANAGER

VARTAN KARGAR
PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	ENGR.
ORIGINAL	BC			
ADDENDUM 1	BC		1-25-16	

238-1743
TOTAL CONTRACT

6304407-1878444
WORK ORDER NUMBER

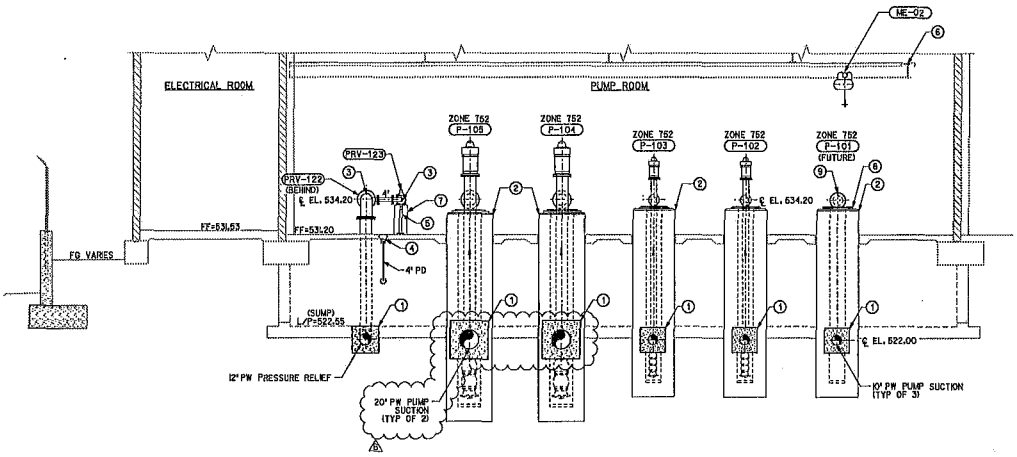
37228-73-D

MECHANICAL PUMP STATION PLAN 2

ADDENDUM B

P:\Projects\San Diego Water Dept, City of (CA)\142946 - Tierrasanta Pump Station\CADD\2-SHEETS\07-MECHANICAL\37228-M02.dgn
28-JUL-2015 09:57
theresela
Tierrasanta Pump Station

ADDENDUM "B"



SECTION B/M-1 B/M-2
1/4"=1'-0"

MATERIALS LIST:

1. CONCRETE ENCASEMENT PER DETAIL 7, DWG M-10
2. PUMP BARREL REINFORCED CONCRETE ENCASEMENT PER DETAIL 1, DWG M-8
3. CML STEEL FLANGED 90° BEND, SEE PLAN FOR SIZE
4. FLOOR DRAIN PER DETAIL 4, DWG M-7
5. ADJUSTABLE PIPE SUPPORT PER DETAIL 1, DWG M-11
6. MONORAIL PER STRUCTURAL
7. CONCRETE VALVE SUPPORT PER DETAIL 4, DWG M-11
8. BLIND FLANGE OR PLATE COVERING THE BARREL OPENING FOR THE FUTURE PUMP
9. 10" BLIND FLANGE

GENERAL NOTES:

1. PAINT ALL EXPOSED PIPING INSIDE BUILDING PER SPECIFICATION SECTION 09800.
2. FOR PIPE MATERIAL SEE SCHEDULE ON DWG M-14.
3. FOR HVAC LAYOUT SEE DWGS H-3 AND H-4.
4. SLOPE TRENCH FLOOR TO SUMP, SEE DWG S-20.

M-4

TIERRASANTA PUMP STATION
MECHANICAL
PUMP STATION SECTION 2

MECHANICAL PUMP STATION SECTION 2

CITY OF SAN DIEGO, CALIFORNIA
PUBLIC WORKS DEPARTMENT
SHEET 15 OF 140 SHEETS

WBS 5-12040

DESIGNED DMAYNE ABBEY PROJECT MANAGER
DRAWN MARYAM KARGAR PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	BC			
ADDENDUM B	BC		1-26-16	

238-1743 CSDW CONTRACT NO.
6304401-1876441 CSDES PROJECT NO.
37228-75-D

CONSULTANT
Brown AND Caldwell
9665 Chesapeake Drive, Suite 201
San Diego, CA 92123
Tel: 858-514-8822
Fax: 858-514-8833

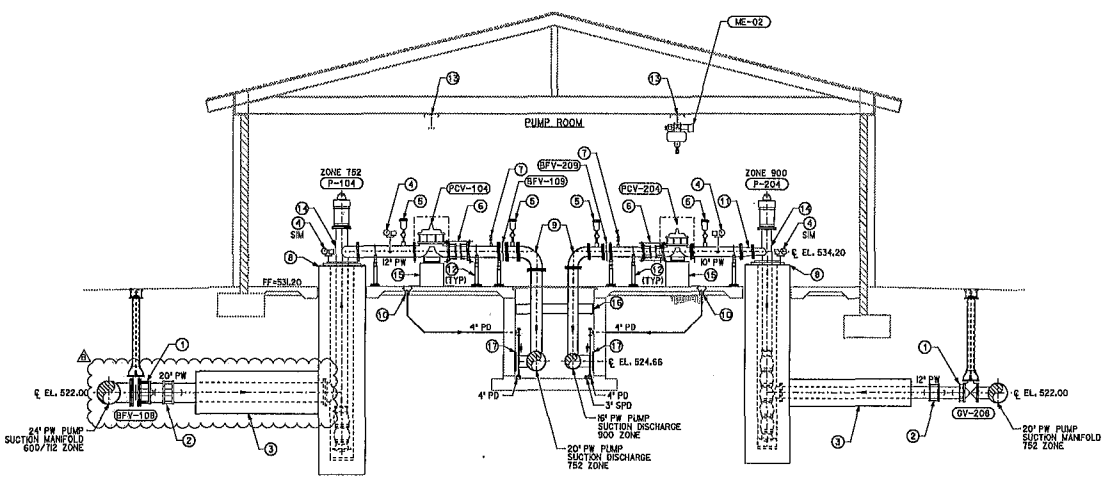
CONTRACTOR
INSPECTOR
DATE STARTED
DATE COMPLETED

SCALE 1/4"=1'-0"

P:\Projects\San Diego Water Dept, City of (CA)\142946 - Tierrasanta Pump Station\CADD\2-SHEETS\07-MECHANICAL\37228-M04.dgn
26-JUL-2016 09:58 thereesia
August 3, 2016
Tierrasanta Pump Station

ADDENDUM "B"

ADDENDUM B



SECTION C M-2
1/4"=1'-0"

MATERIALS LIST:

1. STEEL FLANGED COUPLING ADAPTER, RESTRAINED, SEE PLAN FOR SIZE
2. BAKER SERIES 216 INSULATING COUPLING W/ NEOPRENE SLEEVE, RESTRAINED, SEE PLAN FOR SIZE, W/ 4-WIRE TEST STATION PER DETAIL 4, DWG CP-01, COAT W/ WAX TAPE EXTENDING 6' ONTO ADJACENT PIPE.
3. CONCRETE ENCASEMENT PER DETAIL 7, DWG M-10
4. PRESSURE GAUGE AND SWITCH PER DETAIL 1, DWG M-7
5. AIR RELEASE VALVE PER DETAIL 2, DWG M-7
6. STEEL EQUIPMENT CONNECTION FITTING, RESTRAINED, ROMAC STYLE ECF-400 OR APPROVED EQUAL, SEE PLAN FOR SIZE
7. CORP STOP W/ PRESSURE GAUGE PER DETAIL 6, DWG M-7
8. PUMP BARREL REINFORCED CONCRETE ENCASEMENT PER DETAIL 1, DWG M-8
9. CML STEEL FLANGED 90° BEND, SEE PLAN FOR SIZE
10. FLOOR DRAIN PER DETAIL 4, DWG M-7
11. 10"x8" STEEL CONCENTRIC FLANGED REDUCER
12. ADJUSTABLE PIPE SUPPORT PER DETAIL 1, DWG M-11
13. MONORAIL PER STRUCTURAL
14. PUMP INSTALLATION PER DETAIL 2, DWG M-8
15. CONCRETE VALVE SUPPORT PER DETAIL 4, DWG M-11
16. W10X22 PIPE SUPPORT BEAM. TOP OF STEEL BEAM TO BE 6-INCHES LOWER THAN POUR JOINT. PIPE SUPPORT BEAM CONNECTION PER DETAIL 5, DWG M-12. PIPE SUPPORT HANGER PER DETAIL 3, DWG M-12.
17. LATERAL PIPE BRACE PER DETAIL 6, DWG M-12

GENERAL NOTES:

1. PAINT ALL EXPOSED PIPING INSIDE BUILDING PER SPECIFICATION SECTION 09900.
2. FOR PIPE MATERIAL SEE SCHEDULE ON DWG M-14.
3. FOR HVAC LAYOUT SEE DWGS H-3 AND H-4.
4. SLOPE TRENCH FLOOR TO SUMP, SEE DWG S-20.

M-5

TIERRASANTA PUMP STATION
MECHANICAL
PUMP STATION SECTION 3

MECHANICAL PUMP STATION SECTION 3

CITY OF SAN DIEGO, CALIFORNIA
PUBLIC WORKS DEPARTMENT
SHEET 76 OF 140 SHEETS

WBS 5-12040

DRAWN BY: DWAYNE ABREY, PROJECT MANAGER
CHECKED BY: MARYAM KARGAR, PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	PA NO.
ORIGINAL	BC			
ADDENDUM B	BC		7-26-16	

238-1143
CITY CONTRACT
6304407-1676444
CPXD COOPERAN
37228-76-D

CONSULTANT
Brown AND Caldwell
9665 Chesapeake Drive, Suite 201
San Diego, CA 92123
Tel: 858-514-8822
Fax: 858-514-8833

CONTRACTOR
INSPECTOR

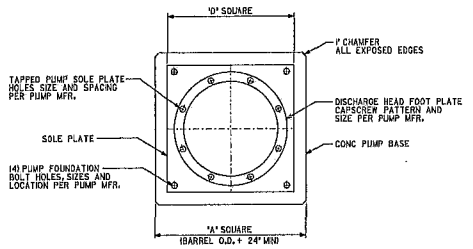
DATE STARTED
DATE COMPLETED

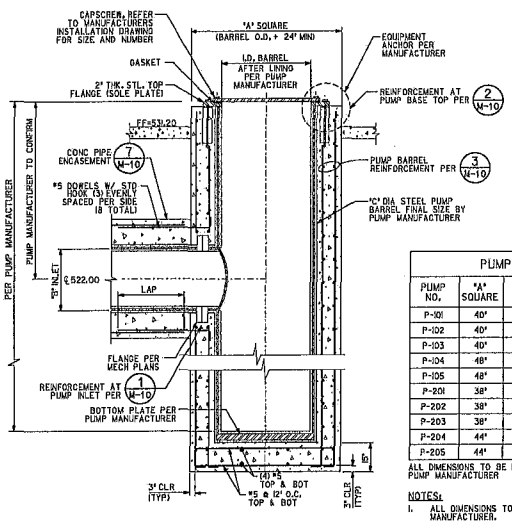
SCALE 1/4"=1'-0"

ADDENDUM B

P:\Projects\San Diego Water Dept. City of (CA)\142946 - Tierrasanta Pump Station\CADD\2-SHEETS\07-MECHANICAL\37228-M09.dgn
26-JUL-2016 08:59 thoremda
August 3, 2016
Tierrasanta Pump Station

ADDENDUM "B"





PUMP BARREL 1 VAR

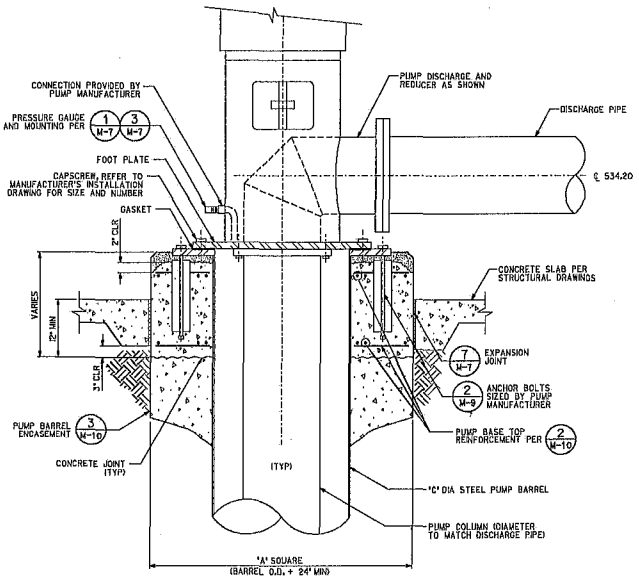
NO SCALE

PUMP BARREL				
PUMP NO.	'A' SQUARE	'B' DIA	'C' DIA	'D' SQUARE
P-101	40'	10'	16'	31"
P-102	40'	10'	16'	31"
P-103	40'	10'	16'	31"
P-104	48'	20' 1	24'	39'
P-105	48'	20' 1	24'	39'
P-201	38'	6'	14'	28'
P-202	38'	6'	14'	28'
P-203	38'	6'	14'	28'
P-204	44'	12'	20'	34'
P-205	44'	12'	20'	34'

ALL DIMENSIONS TO BE FINALIZED BY PUMP MANUFACTURER

NOTES:

1. ALL DIMENSIONS TO BE FINALIZED BY PUMP MANUFACTURER.
2. ALL PUMP BARRELS, INCLUDING BARREL FOR FUTURE PUMP, TO BE MANUFACTURED BY THE SAME FIRM TO PUMP MANUFACTURER'S REQUIREMENTS.
3. ALL PUMP BARRELS, INCLUDING BARREL FOR FUTURE PUMP, TO BE INSTALLED UNDER THE SUPERVISION OF THE PUMP MANUFACTURER.



TYPICAL PUMP CONCRETE SUPPORT BASE 2 VAR

NO SCALE

MECHANICAL DETAILS 2

M-8

TIERRASANTA PUMP STATION
MECHANICAL
DETAILS 2

CITY OF SAN DIEGO, CALIFORNIA
PUBLIC WORKS DEPARTMENT
SHEET 79 OF 140 SHEETS

WBS S-12040

DWAYNE ABBEY
PROJECT MANAGER

MANYAM KARGAR
PROJECT ENGINEER

238-1743
CONST. COORDINATOR

630407-B78444
DESIGN COORDINATOR

37228-79-D

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	BC			
ADDENDUM A	BC		7-26-16	

CONSULTANT

Brown AND Caldwell

9665 Chesapeake Drive, Suite 201
San Diego, CA 92123
Tel: 858-514-8822
Fax: 858-514-8833

CONTRACTOR
INSPECTOR
DATE STARTED
DATE COMPLETED

ADDENDUM B

P:\Projects\San Diego Water Dept, City of (CA)\142946 - Tierrasanta Pump Station\CADD\2-SHEETS\07-MECHANICAL\37228-M08.dgn
26-JUL-2016 09:55 dhernandez
August 3, 2016
Tierrasanta Pump Station

ADDENDUM "B"

ZONE 752 VALVE SCHEDULE

VALVE NO.	DESCRIPTION	VALVE TYPE	SIZE	OPERATOR TYPE	PRESSURE CLASS (PSI)	SPECIFICATION
PCV-101	FUTURE P-101	PUMP CONTROL VALVE				
PCV-102	P-102 PUMP DISCHARGE VALVE	PUMP CONTROL VALVE	8"	N/A	150	15117
PCV-103	P-103 PUMP DISCHARGE VALVE	PUMP CONTROL VALVE	8"	N/A	150	15117
PCV-104	P-104 PUMP DISCHARGE VALVE	PUMP CONTROL VALVE	12"	N/A	150	15117
PCV-105	P-105 PUMP DISCHARGE VALVE	PUMP CONTROL VALVE	12"	N/A	150	15117
GV-101	PRV ISOLATION VALVE	GATE VALVE	12"	MANUAL/BURIED	150	15102
BFV-102	PRV-122 ISOLATION VALVE	BUTTERFLY VALVE	10"	MANUAL/HANDWHEEL	150	15104
BFV-103	PRV-122 ISOLATION VALVE	BUTTERFLY VALVE	10"	MANUAL/HANDWHEEL	150	15104
BFV-104	PRV-123 ISOLATION VALVE	BUTTERFLY VALVE	4"	MANUAL/HANDWHEEL	150	15104
BFV-105	PRV-123 ISOLATION VALVE	BUTTERFLY VALVE	4"	MANUAL/HANDWHEEL	150	15104
BFV-106	P-105 PUMP SUCTION ISOLATION VALVE	BUTTERFLY VALVE 8 (20")	20"	MANUAL/BURIED	150	15104
BFV-107	P-105 PUMP DISCHARGE ISOLATION VALVE	BUTTERFLY VALVE	12"	MANUAL/HANDWHEEL	150	15104
BFV-108	P-104 PUMP SUCTION ISOLATION VALVE	BUTTERFLY VALVE 8 (20")	20"	MANUAL/BURIED	150	15104
BFV-109	P-104 PUMP DISCHARGE ISOLATION VALVE	BUTTERFLY VALVE	12"	MANUAL/HANDWHEEL	150	15104
GV-110	P-103 PUMP SUCTION ISOLATION VALVE	GATE VALVE	10"	MANUAL/BURIED	150	15102
BFV-111	P-103 PUMP DISCHARGE ISOLATION VALVE	BUTTERFLY VALVE	8"	MANUAL/HANDWHEEL	150	15104
GV-112	P-102 PUMP SUCTION ISOLATION VALVE	GATE VALVE	10"	MANUAL/BURIED	150	15104
BFV-113	P-102 PUMP DISCHARGE ISOLATION VALVE	BUTTERFLY VALVE	8"	MANUAL/HANDWHEEL	150	15104
GV-114	P-101 PUMP SUCTION ISOLATION VALVE	GATE VALVE	10"	MANUAL/BURIED	150	15102
BFV-115	P-101 PUMP DISCHARGE ISOLATION VALVE	BUTTERFLY VALVE	8"	MANUAL/HANDWHEEL	150	15104
BFV-116	DISCHARGE HEADER ISOLATION VALVE	BUTTERFLY VALVE	20"	MANUAL/HANDWHEEL	150	16104
GV-117	YARD PIPING ISOLATION VALVE	GATE VALVE	12"	MANUAL/BURIED	150	15102
GV-118	YARD PIPING ISOLATION VALVE	GATE VALVE	12"	MANUAL/BURIED	150	15102
BFV-119	SURGE TANK ST-01 ISOLATION VALVE	BUTTERFLY VALVE	8"	MANUAL/HANDWHEEL	150	15104
PRV-122	SURGE RELIEF VALVE	PRESSURE RELIEF VALVE	10"	N/A	150	15114
PRV-123	SURGE RELIEF VALVE	PRESSURE RELIEF VALVE	4"	N/A	150	15114
SUMP PUMP VALVES						
CHK-301	SUMP PUMP DISCHARGE CHECK VALVE	SWING CHECK VALVE	3"	N/A	150	SEE DWG M-2, NOTE 24
CHK-302	SUMP PUMP DISCHARGE CHECK VALVE	SWING CHECK VALVE	3"	N/A	150	SEE DWG M-1, NOTE 32
BFV-301	SUMP PUMP DISCHARGE ISOLATION VALVE	BUTTERFLY VALVE	3"	MANUAL	150	15104
BFV-302	SUMP PUMP DISCHARGE ISOLATION VALVE	BUTTERFLY VALVE	3"	MANUAL	150	15104

ZONE 900 VALVE SCHEDULE

VALVE NO.	DESCRIPTION	VALVE TYPE	SIZE	OPERATOR TYPE	PRESSURE CLASS (PSI)	SPECIFICATION
PCV-201	P-201 PUMP DISCHARGE VALVE	PUMP CONTROL VALVE	6"	N/A	150	
PCV-202	P-202 PUMP DISCHARGE VALVE	PUMP CONTROL VALVE	6"	N/A	150	15117
PCV-203	P-203 PUMP DISCHARGE VALVE	PUMP CONTROL VALVE	6"	N/A	150	15117
PCV-204	P-204 PUMP DISCHARGE VALVE	PUMP CONTROL VALVE	12"	N/A	150	15117
PCV-205	P-205 PUMP DISCHARGE VALVE	PUMP CONTROL VALVE	12"	N/A	150	15117
GV-201	PRV ISOLATION VALVE	GATE VALVE	12"	MANUAL/BURIED	150	15102
BFV-202	PRV-222 ISOLATION VALVE	BUTTERFLY VALVE	8"	MANUAL/HANDWHEEL	150	15104
BFV-203	PRV-222 ISOLATION VALVE	BUTTERFLY VALVE	8"	MANUAL/HANDWHEEL	150	15104
BFV-204	PRV-223 ISOLATION VALVE	BUTTERFLY VALVE	4"	MANUAL/HANDWHEEL	150	15104
BFV-205	PRV-223 ISOLATION VALVE	BUTTERFLY VALVE	4"	MANUAL/HANDWHEEL	150	15104
GV-206	P-205 PUMP SUCTION ISOLATION VALVE	GATE VALVE	12"	MANUAL/BURIED	150	15102
BFV-207	P-205 PUMP DISCHARGE ISOLATION VALVE	BUTTERFLY VALVE	12"	MANUAL/HANDWHEEL	150	15104
GV-208	P-204 PUMP SUCTION ISOLATION VALVE	GATE VALVE	12"	MANUAL/BURIED	150	15102
BFV-209	P-204 PUMP DISCHARGE ISOLATION VALVE	BUTTERFLY VALVE	12"	MANUAL/HANDWHEEL	150	15104
GV-210	P-203 PUMP SUCTION ISOLATION VALVE	GATE VALVE	6"	MANUAL/BURIED	150	15102
BFV-211	P-203 PUMP DISCHARGE ISOLATION VALVE	BUTTERFLY VALVE	6"	MANUAL/HANDWHEEL	150	15104
GV-212	P-202 PUMP SUCTION ISOLATION VALVE	GATE VALVE	6"	MANUAL/BURIED	150	15102
BFV-213	P-202 PUMP DISCHARGE ISOLATION VALVE	BUTTERFLY VALVE	6"	MANUAL/HANDWHEEL	150	15104
GV-214	P-201 PUMP SUCTION ISOLATION VALVE	GATE VALVE	6"	MANUAL/BURIED	150	15102
BFV-215	P-201 PUMP DISCHARGE ISOLATION VALVE	BUTTERFLY VALVE	6"	MANUAL/HANDWHEEL	150	15104
BFV-216	DISCHARGE HEADER ISOLATION VALVE	BUTTERFLY VALVE	16"	MANUAL/HANDWHEEL	150	15104
GV-217	YARD PIPING ISOLATION VALVE	GATE VALVE	8"	MANUAL/BURIED	150	15102
GV-218	YARD PIPING ISOLATION VALVE	GATE VALVE	8"	MANUAL/BURIED	150	15102
BFV-219	SURGE TANK ST-02 ISOLATION VALVE	BUTTERFLY VALVE	8"	MANUAL/HANDWHEEL	150	15104
BFV-220	YARD PIPING ISOLATION VALVE	BUTTERFLY VALVE	20"	MANUAL/BURIED	150	15104
PRV-222	SURGE RELIEF VALVE	PRESSURE RELIEF VALVE	8"	N/A	150	15114
PRV-223	SURGE RELIEF VALVE	PRESSURE RELIEF VALVE	4"	N/A	150	15114

NOTE:
VALVE PRESSURE CLASSES IDENTIFIED AS PRELIMINARY. CONFIRM ALL VALVES CAN WITHSTAND THE PIPE OPERATING AND TEST PRESSURES IDENTIFIED ON M-14.

MECHANICAL VALVE SCHEDULES

M-13

TIERRASANTA PUMP STATION
MECHANICAL
VALVE SCHEDULES

CITY OF SAN DIEGO, CALIFORNIA
PUBLIC WORKS DEPARTMENT
SHEET 84 OF 140 SHEETS

WBS S-12040

DRAWN BY: DWAYNE ABBEY, PROJECT MANAGER
DESIGNED BY: MARYAM KARGAR, PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FAMES
ORIGINAL	DC			
ADDENDUM B	BC		1-26-16	

238-1743
CITY CONTRACT NO.
6304407-1878444
FGMS CODE/UNITS
37228-84-D

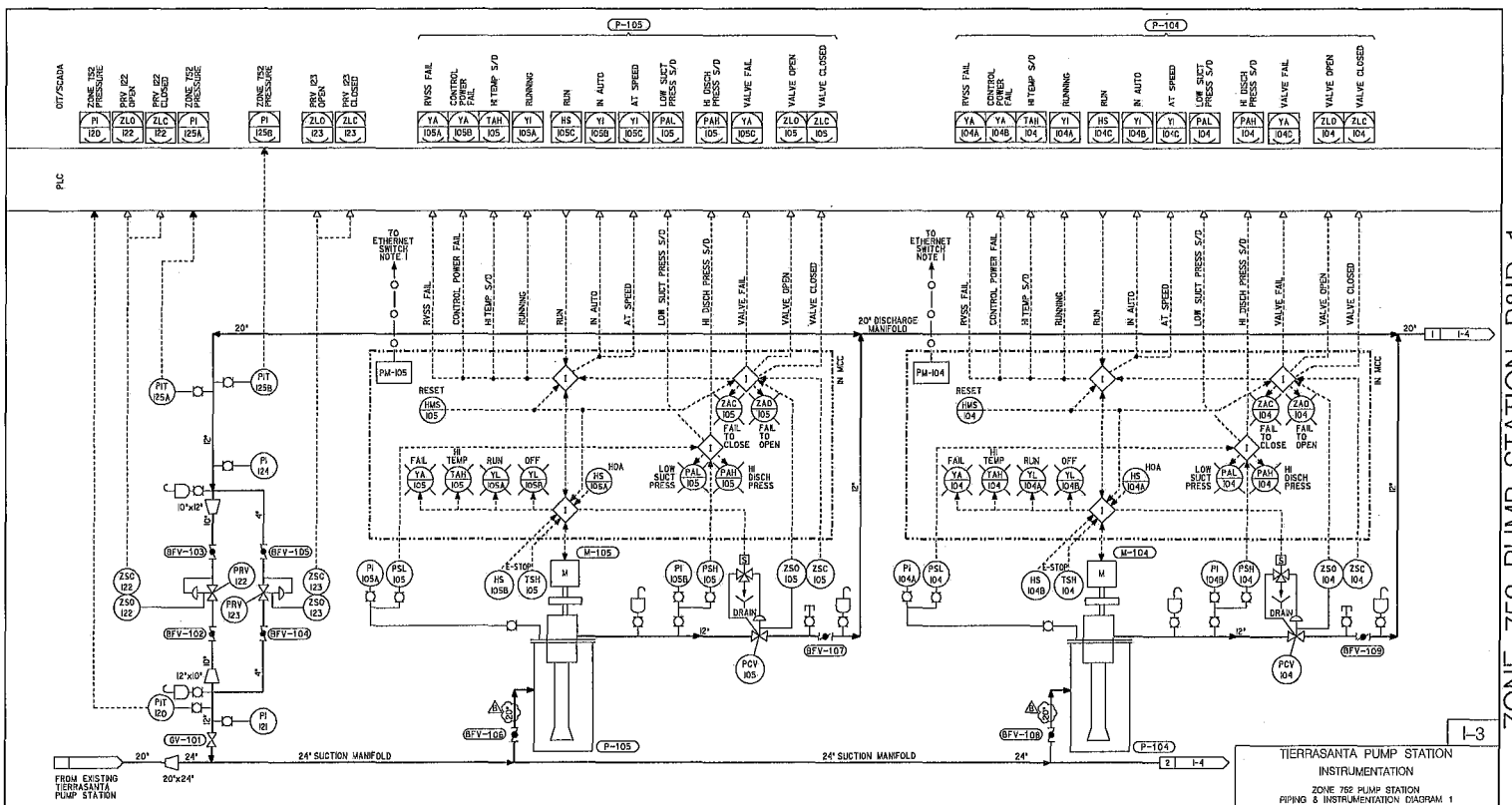
CONSULTANT
Brown AND Caldwell
9665 Chesapeake Drive, Suite 201
San Diego, CA 92123
Tel: 858-514-8822
Fax: 858-514-8833

CONTRACTOR
INSPECTOR
DATE STARTED
DATE COMPLETED

ADDENDUM B

P:\Projects\San Diego Water Dept, City of (CA)\142940 - Tierrasanta Pump Station\CADD\2-SHEETS\07-MECHANICAL\37228-M13.dgn
26-JUL-2016 09:56
therencla
Tierrasanta Pump Station

ADDENDUM "B"

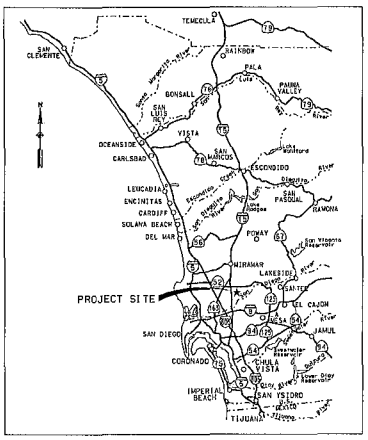


NOTES:

1. SEE SECTION 15301 FOR POWER MONITOR CONFIGURATION REQUIREMENTS TO OIT AND SCADA.

P:\Projects\San Diego Water Dept. City of (CA)\142948 - Terrasanta Pump Station\CADD\2-SHEETS\11-INSTRUMENTATION\37226-103.dgn
26-JUL-2016 10:01 therenela
August 2, 2016
Terrasanta Pump Station

ADDENDUM "B"



VICINITY MAP
NTS

POST CONSTRUCTION BMP CERTIFICATION:

AS THE PROFESSIONAL IN RESPONSIBLE CHARGE FOR THE DESIGN OF THIS PROJECT, I CERTIFY THAT I HAVE INSPECTED ALL CONSTRUCTED LOW IMPACT DEVELOPMENT (LID) SITE DESIGN, SOURCE CONTROL, HYDROMODIFICATION MANAGEMENT, AND TREATMENT CONTROL BMPS REQUIRED PER THE STORM WATER STANDARDS MANUAL AND CONTRACT REQUIREMENTS, AND THAT SAID BMPS HAVE BEEN CONSTRUCTED IN COMPLIANCE WITH THE APPROVED PLANS AND ALL APPLICABLE SPECIFICATIONS, PERMITS, ORDINANCES AND SAN DIEGO REGIONAL MS4 PERMIT.

I UNDERSTAND THAT THIS BMP CERTIFICATION STATEMENT DOES NOT CONSTITUTE AN OPERATION AND MAINTENANCE VERIFICATION.

SIGNATURE: _____

DATE OF SIGNATURE: _____

PRINTED NAME: _____

TITLE: _____

PHONE NUMBER: _____

ENGINEER'S STAMP

SITE DESIGN, SOURCE CONTROL AND POLLUTANT CONTROL BMP
OPERATION & MAINTENANCE PROCEDURE

O&M RESPONSIBLE PARTY DESIGNEE:

BMP DESCRIPTION	INSPECTION FREQUENCY	MAINTENANCE FREQUENCY	MAINTENANCE METHOD	QUANTITY	INCLUDED IN O&M MANUAL	SHEET NUMBER
SITE DESIGN ELEMENTS	ANNUAL, MIN	AS NEEDED	SEE DESCRIPTION BELOW	MULTIPLE	YES [X] NO	L-3
DESCRIPTION: PERIODIC OBSERVATION OF LANDSCAPED SLOPE AREAS SHALL BE PLANNED AND APPROPRIATE MEASURES TAKEN TO ENHANCE GROWTH OF LANDSCAPE PLANTS. ON AN ANNUAL BASIS, DETERMINE IF LANDSCAPE PLANTINGS HAVE SUCCESSFULLY BEEN ESTABLISHED. UTILIZE AN ALTERNATIVE SPECIES IF ORIGINAL LANDSCAPE COVER IS NOT SUCESSFULLY ESTABLISHED AFTER A YEAR. RESEED AND APPLY MULCH TO DAMAGED AREAS; DO NOT USE HYDROSEED.						
SOURCE CONTROL ELEMENTS	ANNUAL, MIN	AS NEEDED	SEE DESCRIPTION BELOW	MULTIPLE	YES [X] NO	C-2
DESCRIPTION: STORM DRAIN INLET STENCILING: MAINTAIN AND PERIODICALLY REPAINT OR REPLACE INLET MARKINGS. LANDSCAPE/OUTDOOR PESTICIDE USE: MAINTAIN LANDSCAPING USING MINIMUM OR NO PESTICIDES. VEHICLE AND EQUIPMENT CLEANING: VERIFY THAT WASHWATER FROM VEHICLE AND EQUIPMENT WASHING OPERATIONS IS NOT DISCHARGED TO THE STORM DRAIN SYSTEM. VEHICLE/EQUIPMENT REPAIR AND MAINTENANCE: VERIFY THAT NO VECHICLE REPAIR OR MAINTENANCE IS BEING DONE OUTDOORS AND VERIFY THAT THERE ARE NO FLOOR DRAINS IN THE VICINITY OF VEHICLE OR EQUIPMENT REPAIR OR MAINTENANCE ACTIVITIES.						
POLLUTANT CONTROL BMP(S)	ANNUAL, MIN	AS NEEDED	SEE DESCRIPTION BELOW	ONE	YES [X] NO	C-2
DESCRIPTION: INSPECT THE FACILITY PERIODICALLY TO VERIFY VEGETATION ESTABLISHMENT AND TO DETERMINE THE RATE OF TRASH AND DEBRIS ACCUMULATION FOR THIS AREA. PROVIDE WEED CONTROL AND REPLANT BARE AREAS AS NECESSARY. INSPECT AFTER SEVERAL STORM EVENTS FOR BANK STABILITY AND DAMAGE TO THE BMP. EROSION RILLS OR GULLIES SHOULD BE CORRECTED AND ANY DAMAGED AREAS REPAIRED. REMOVE ACCUMULATED SEDIMENT WHEN ACCUMULATION REACHES 6-INCHES OR IF RE-SUSPENSION OF SEDIMENT IS OBSERVED. TO AVOID NEGATIVE IMPACTS TO ESTABLISHED VEGETATION, SOIL DISTURBANCE SHOULD ONLY BE PREFORMED WHEN THERE ARE ACTUAL SIGNS OF CLOGGING, RATHER THAN ON A ROUTINE BASIS. REMOVE DEPOSITED SEDIMENTS WITH HAND TOOLS BEFORE SCARIFICATION. FLUSH UNDER DRAIN IF STANDING WATER IS OBSERVED 24-HOURS AFTER A STORM EVENT. ALL STANDING WATER SHOULD BE REMOVED WITHIN 72-HOURS FROM ACCUMULATION. AFTER THE FIRST YEAR, MINIMUM INSPECTION AND MAINTENANCE IS ANNUAL.						
HMP FACILITY (IF SEPERATE)					YES	NO
DESCRIPTION:						
HMP EXCEMPT: NO						

STORM WATER REQUIREMENTS:

1. THIS PROJECT IS SUBJECT TO MUNICIPAL CODE SECTION 4303 AND ORDER NO. R9-2013-001 AS AMENDED BY R9-2015-0100.
2. ALL WORK RELATED TO POST-CONSTRUCTION STORM WATER QUALITY SHALL BE IN ACCORDANCE WITH THE STORM WATER QUALITY MANAGEMENT PLAN ENTITLED:

   PROJECT NAME / WBS OR IO: TIERRASANTA PUMP STATION, WBS S-120400

   PROJECT ADDRESS: 4701 SEDA DRIVE, SAN DIEGO, CA 92124

   PREPARED BY: AMY S. NEAL, P.E.

   DATE PREPARED: JULY 6, 2016
3. POST CONSTRUCTION BMPS ARE REQUIRED. SEE SHEET(S): C-2

DECLARATION OF RESPONSIBLE CHARGE:

I HEREBY DECLARE THAT I AM THE ENGINEER OF WORK AND THAT I HAVE EXERCISED RESPONSIBLE CHARGE OVER THE DESIGN OF THE PERMANENT STORM WATER BMPS AS DEFINED IN SECTION 6703 OF THE BUSINESS AND PROFESSIONS CODE AND THAT THE DESIGN IS CONSISTENT WITH CURRENT STANDARDS. I UNDERSTAND THAT THE CHECK OF PROJECT DRAWINGS AND SPECIFICATIONS BY THE CITY OF SAN DIEGO IS CONFINED TO A REVIEW ONLY AND DOES NOT RELIEVE ME, AS ENGINEER OF WORK, OF MY RESPONSIBILITIES FOR PROJECT DESIGN.

Amy Neal

AMY S. NEAL CA PE C71803, EXP. 12/31/2017 — 7/06/2016

BMP MAP COVER SHEET

SW-1

TIERRASANTA PUMP STATION

BMP MAP FOR PRIORITY DEVELOPMENT PROJECT

FOR PRIORITY DEVELOPMENT PROJECTS

CONSULTANT

Brown AND Caldwell
9665 Chesapeake Drive, Suite 201
San Diego, CA 92123
Tel: 858-514-8822
Fax: 858-514-8833

REGISTERED PROFESSIONAL ENGINEER — AMY S. NEAL — C071803 — Exp. 12/31/2017 — CIVIL — STATE OF CALIFORNIA

CITY OF SAN DIEGO, CALIFORNIA
PUBLIC WORKS DEPARTMENT
SHEET 1 OF 3 SHEETS

CHECK		DATE 7/25/2016	
TOP DEP ENGINEER	ALEX GARCIA	DATE	CS1507
PROJ ENGR		REG #	

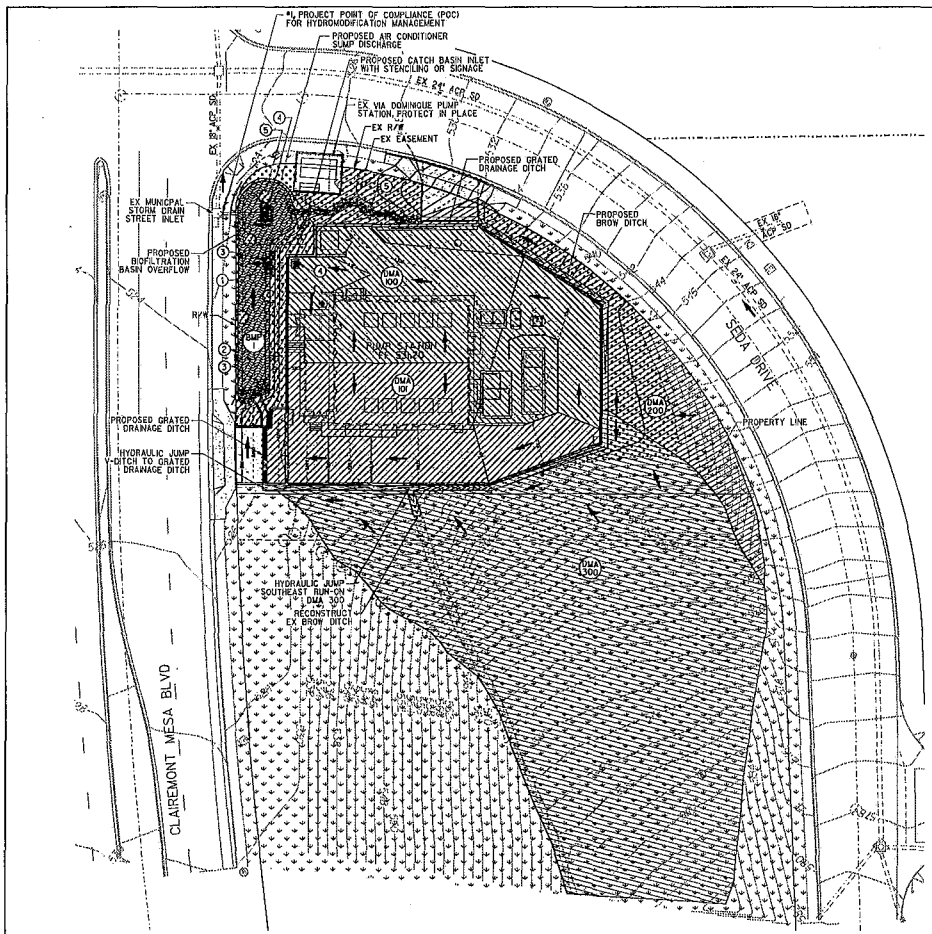
DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	BC			
ADDENDUM B	BC		7-11-16	

WBS S-12040
SUBMITTED DWAYNE ABBEY PROJECT MANAGER
DESIGNED MARYAM KARGAR PROJECT ENGINEER
238-1743 PROJECT ENGINEER PHONE
6304407-1878444 CITY FACILITY ID
CONTRACTOR INSPECTOR — DATE STARTED — DATE COMPLETED
37228-SW1-D

ADENDUM B

IP_PWP:z:\Projects\San Diego Water Dept, City of (CA)\142845 - Tierrasanta Pump Station\CADD\2-SHEETS\SW-STORMWATER\37228-SW1.dgn
27-JUL-2016 13:41 rkulsy#
Aligned 3: 2016
Tierrasanta Pump Station

ADENDUM "B"



LEGEND:

- IMPERVIOUS SURFACE
- BIOFILTRATION BASIN
- LANDSCAPED AREA
- EXISTING VEGETATION TO BE PRESERVED

DRAINAGE MANAGEMENT AREA (DMA)				
DMA	AREA	DRAINAGE AREA	COVER	TYPE
100		8,302	IMPERVIOUS	DRAINS TO BMP
101		5,619	IMPERVIOUS	DRAINS TO BMP
200		4,891	PERVIOUS	DRAINS TO BMP
300		24,266	PERVIOUS	DRAINS TO BMP

BMP			
BMP	AREA	SURFACE AREA	BMP TYPE
1		2,510	BIO RETENTION BASIN

STORM WATER NOTES:

1. GROUNDWATER TABLE BENEATH THE SITE IS UNKNOWN BUT ESTIMATED TO BE IN EXCESS OF 100-FEET.
2. UNDERLYING SOIL BELONGS TO NRCS TYPE D.

STORM WATER KEYNOTES:

1. 6" DIA UNDERDRAIN WITH CLEANOUT PER SAN DIEGO STORM WATER STANDARDS
2. BMP-1 BIOFILTRATION BASIN PER SECTION A, DWG C-12
3. RIP-RAP SLOPE PROTECTION PER SDRSD D-40, NO. 2 BACKING ROCK
4. TYPE 'H' CATCH BASIN PER SDRSD D-29
5. RIP-RAP PROTECTION PER SDRSD D-40, NO. 2 BACKING ROCK

BMP SITE PLAN

SW-2

TIERRASANTA PUMP STATION

STORM WATER
DMA /HMP EXHIBIT

FOR PRIORITY DEVELOPMENT PROJECTS

CONSULTANT

Brown AND Caldwell
9665 Chesapeake Drive, Suite 201
San Diego, CA 92123
Tel: 858-514-8822
Fax: 858-514-8833

CITY OF SAN DIEGO, CALIFORNIA
PUBLIC WORKS DEPARTMENT
SHEET 2 OF 3 SHEETS

FOR CITY ENGINEER: ALEX GARCIA
PROJ ENGR: C51507

WBS S-12040
DRAWN BY: DWAYNE ABBEY
PROJECT MANAGER
MARYAM KARGAR
PROJECT ENGINEER
239-1743
CITY CONTRACT NO.
5304407-5878443
OCMO COORDINATE
37228-SW2-D

DESCRIPTION	BY	APPROVED	DATE	TRACKING
ORIGINAL	BC			
ADDENDUM B	BC		7-9-16	

CONTRACTOR
INSPECTOR
DATE STARTED
DATE COMPLETED

ADDENDUM B

P:\PWPro\Projects\San Diego Water Dept. City of (CA)\142846 - Tierrasanta Pump Station\CADD\2-SHEETS\SW-STORMWATER\37228-SW2.dgn
27-JUL-2016 13:28
rkolaya
Tierrasanta Pump Station

Bid Results for Project Tierrasanta Pump Station (K-16-1431-DBB-3)
Issued on 06/22/2016
Bid Due on August 17, 2016 2:00 PM (Pacific)
Exported on 08/18/2016

VendorID	Company Name	Address	City	ZipCode	Contact	Phone	Fax	Email	Vendor Type
302350	L. H. Woods and Sons, Inc.	2115 La Mirada Dr.	Vista	92081	Chuck Wilson	760-599-5500	760-599-5510	office@lhwoods.com	PQUAL,Local

Respondee	Respondee Title	Respondee Phone	Respondee Email
steve barry	estimator	760-213-7381	sbarry@lhwoods.com

Bid Format	Submitted Date	Delivery Method	Responsive	Status	Confirmation #	Ranking
Electronic	August 17, 2016 1:56:48 PM (Pacific)			Submitted	86833	0

Attachments		
File Title	File Name	File Type
CCPA	Tierrasanta Pump Station Bid Forms CCPA.pdf	General Attachments
EBO	Tierrasanta Pump Station Bid Forms EBO.pdf	General Attachments
Bid bond	Tierrasanta Pump Station Bid Forms BID BOND.pdf	Bid Bond

Line Items

Item Num	Section	Item Code	Reference	Description	Unit of Measure	Quantity	Unit Price	Line Total
1	Main Bid	237110	1025	Construct Tierrasanta Pump Station	LS	1	$7,315,018.00	$7,315,018.00
2	Main Bid	238910	1025	Demolition of Tierrasanta Temporary Pump Station	LS	1	$45,000.00	$45,000.00
3	Main Bid	541690	707-3	Paleontological Monitoring Program	LS	1	$7,000.00	$7,000.00
4	Main Bid	541690	707-5	Paleontological Mitigation and Excavation	CY	1725	$16.00	$27,600.00
5	Main Bid	236220	7-5.3	Permits - Type I	AL	1	$30,000.00	$30,000.00
6	Main Bid	238210	1025	Security Surveillance and Access Control System Type 1	AL	1	$100,000.00	$100,000.00
7	Main Bid	541330	701-13.9.5	Water Pollution Control Program Development	LS	1	$2,000.00	$2,000.00
8	Main Bid	237990	701-13.9.5	Water Pollution Control Program Implementation	LS	1	$50,000.00	$50,000.00
9	Main Bid	524126	2-4.1	Bonds (Payment and Performance)	LS	1	$75,000.00	$75,000.00
10	Main Bid	237110	9-3.4.1	Mobilization	LS	1	$750,000.00	$750,000.00
11	Main Bid		9-3.5	Field Orders - Type II	AL	1	$404,620.00	$404,620.00
12	Main Bid	237310	7-10.2.6	Traffic Control	LS	1	$60,000.00	$60,000.00
13	Main Bid	238990	7-9.1.1	Video Recording of Existing Conditions	LS	1	$1,000.00	$1,000.00
14	Main Bid	541820	7-16.4	Exclusive Community Liaison Services	LS	1	$3,200.00	$3,200.00
15	Main Bid	237310	306-1.1.6	Trench and Shoring	LS	1	$30,000.00	$30,000.00
16	Main Bid	237310	303-5.10.2	Curb Ramp Type A with Stainless Steel Detectable Warning Tiles	EA	6	$4,000.00	$24,000.00
17	Main Bid	237310	303-5.10.2	Curb Ramp Type B with Stainless Steel Detectable Warning Tiles	EA	3	$4,000.00	$12,000.00
18	Main Bid	237310	303-5.10.2	Curb Ramp Type C1 with Stainless Steel Detectable Warning Tiles	EA	1	$4,000.00	$4,000.00
19	Main Bid	237310	303-5.9	Additional Sidewalk Removal and Replacement	SF	1000	$10.00	$10,000.00
20	Main Bid	237310	303-5.9	Additional Curb and Gutter Removal and Replacement	LF	100	$110.00	$11,000.00
21	Main Bid	237110	306-1.6	16-Inch Water Main Class 235	LF	132	$350.00	$46,200.00
22	Main Bid	237110	306-1.6	20-Inch Water Main Class 235	LF	2530	$150.00	$379,500.00
23	Main Bid	237110	306-1.6	16-Inch Steel Water Main	LF	63	$300.00	$18,900.00
24	Main Bid	237110	306-1.6	20-Inch Steel Water Main	LF	494	$600.00	$296,400.00
25	Main Bid	237110	306-5.3	Removal or Abandonment of Existing Water Facilities (18-Inch ACP)	LF	35	$210.00	$7,350.00
26	Main Bid	237110	306-1.6	6-Inch Fire Hydrant Assembly & Marker	EA	1	$13,000.00	$13,000.00
27	Main Bid	237110	306-14.1	2-Inch Water Service	EA	1	$18,000.00	$18,000.00
28	Main Bid	237110	306-1.6	16-Inch Butterfly Valve, Class 250B	EA	11	$6,000.00	$66,000.00
29	Main Bid	237110	306-1.6	20-Inch Butterfly Valve, Class 250B	EA	5	$8,000.00	$40,000.00
30	Main Bid	237110	306-18	4-Inch Blowoff Valve Assembly	EA	3	$10,000.00	$30,000.00

31	Main Bid	237110	306-19	2-Inch Air and Vacuum Assembly, Class 250	EA	5	$12,000.00	$60,000.00
32	Main Bid	237110	600-1.3.2.10	12-Inch Connection to Existing System by Contractor	EA	3	$12,000.00	$36,000.00
33	Main Bid	237110	600-1.3.2.10	16-Inch Connection to Existing System by Contractor	EA	5	$13,000.00	$65,000.00
34	Main Bid	237110	600-1.4.9	12-Inch Cut and Plug of the Existing System by Contractor	EA	7	$1,600.00	$11,200.00
35	Main Bid	237110	600-1.4.9	18-Inch Cut and Plug of the Existing System by Contractor	EA	2	$2,700.00	$5,400.00
36	Main Bid	237110	306-1.6	Thrust Blocks and Anchor Blocks	EA	15	$3,500.00	$52,500.00
37	Main Bid	237110	306-1.2.1.1	Additional Bedding	CY	300	$31.00	$9,300.00
38	Main Bid	237110	306-1.6	Imported Backfill	TON	553	$13.00	$7,189.00
39	Main Bid	237310	302-4.12.4	Type III RMPS (Slurry Seal)	SF	117725	$0.60	$70,635.00
40	Main Bid	237310	302-5.9	1-1/2 Inch Asphalt Concrete Overlay and Striping	TON	60	$440.00	$26,400.00
41	Main Bid	237310	302-1.12	Cold Mill AC Pavement (1 ½")	SF	2000	$7.50	$15,000.00
42	Main Bid	237310	306-1.5.1	Temporary Resurfacing	TON	128	$300.00	$38,400.00
43	Main Bid	237310	302-3.2	Asphalt Pavement Repair	TON	1030	$250.00	$257,500.00
44	Main Bid	237310	300-1.4	Additional Pavement Removal & Disposal	CY	70	$70.00	$4,900.00
45	Main Bid	237310	302-5.2.1	Pavement Restoration Adjacent to Trench	SF	2000	$10.00	$20,000.00
46	Main Bid	237310	302-7.4	Pavement Fabric	SY	638	$10.00	$6,380.00
47	Main Bid	237310	302-14.5	Crack Seal	LB	200	$22.00	$4,400.00
48	Main Bid	237310	302-1.12	Traffic Detector Loop Replacement	EA	8	$620.00	$4,960.00
49	Main Bid	237110	708-6	Handling and Disposal of Non-friable Asbestos Material	LF	1000	$55.00	$55,000.00
50	Main Bid	237310	302-5.2.1	Pavement Adjacent to Trench	CY	300	$150.00	$45,000.00
51	Main Bid	238190	9-3.1	Cathodic Protection System	LS	1	$55,000.00	$55,000.00
52	Main Bid	237110	306-1.6	Water Valve Bypass for T-Mainline 16" and Larger	EA	4	$12,000.00	$48,000.00
53	Main Bid	237310	303-5.9	Commericial Concrete Driveway 24' Wide	EA	2	$8,000.00	$16,000.00
54	Main Bid	237310	301-1.7	Adjusting Existing Manhole Frame & Cover to Grade	EA	1	$1,000.00	$1,000.00
55	Main Bid	237310	301-1.7	Adjusting Existing Gate Valve Cover to Grade	EA	3	$700.00	$2,100.00
56	Main Bid	237310	7-10.2.6	Portable Changeable Message Signs (PCMS) - Type I	LS	1	$7,500.00	$7,500.00
57	Main Bid	237110	306-1.6	20-Inch Ductile Iron Pipe, Class 250	LF	250	$320.00	$80,000.00
58	Main Bid	237110	306-1.6	12-Inch Steel Water Main	LF	30	$1,080.00	$32,400.00
59	Main Bid	238210	307-2	Pedestrian Push Buttons	EA	3	$1,500.00	$4,500.00
60	Main Bid	237110	306-18	2-Inch Blowoff Valve Assembly	EA	1	$11,000.00	$11,000.00
61	Main Bid	237110	600-1.4.9	16-Inch Cut and Plug of the Existing System by Contractor	EA	5	$2,300.00	$11,500.00
62	Main Bid	237310	302-4.12.4	Type I over Type III RMPS (Slurry Seal)	SF	12227	$0.65	$7,947.55
63	Main Bid	237310	306-1.6	4-Inch Sewer Lateral Connection	LF	30	$670.00	$20,100.00
64	Main Bid	561730	9-3.1	Bio Retention Basin	LS	1	$26,000.45	$26,000.45
							Subtotal	**$10,995,000.00**
							Total	**$10,995,000.00**

Subcontractors							
Name	**Description**	**License Num**	**Amount**	**Type**	**Address**	**City**	**ZipCode**
Speedway Constructors, Inc.	Bldg/ Walls/Pump	855764	$2,450,000.00	CADIR,ELBE,LAT,MALE,MBE,PQUAL,SDB	2565 Chalcedony St.	San Diego	92109
Pavement Coatings Co.	Slurry Sealing	303609	$82,318.00	PQUAL	10240 San Sevaine Way	Jurupa Valley	91752
Janus Corporation	ACP Abatement	572682	$53,600.00	PQUAL	1220 Keystone Way	Vista	92081
Hurricane & Poway Fence Co., Inc.	Fence	891123	$72,144.00	CAU,FEM,CADIR,WOSB	209 10th(Hwy 78) Street	Ramona	92065
MC Painting	Painting/Coating	695478	$122,902.00	WBE	2525 Ramona Dr.	Vista	92084
HARDY & HARPER INC	AC Paving	215952	$122,902.00		1312 E WARNER AVE	SANTA ANA	92705
Coast Landscaping Inc.	Landscaping	353359	$103,284.00	CAU,MALE,SLBE	2230 La Mirada Dr Ste B	Vista	92081
Neal Electric Corp	ELECTRICAL	802588	$970,000.00	PQUAL	13250 Kirkham Way	Poway	92064

Self-Performance
63.83%