LOS OSOS WASTEWATER PROJECT
COLLECTION SYSTEM PUMP STATIONS
LOS OSOS, CA
CONTRACT NO. 300448.08.01.PS

VOLUME 1A

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Volume 1A

Divisions 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 13, 15, and 16

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ADVERTISEMENT FOR BIDS

County of San Luis Obispo
Department of Public Works and Transportation
1050 Monterey Street
Room 207, County Government Center
San Luis Obispo, CA 93408

Separate sealed Bids for the construction of the

LOS OSOS WASTEWATER PROJECT
COLLECTION SYSTEM PUMP STATIONS
LOS OSOS, CA
CONTRACT NO. 300448.08.01.PS

The Los Osos Wastewater Project (LOWWP) will provide wastewater collection, conveyance, treatment, and recycled water reuse for the community of Los Osos that is currently unsewered and utilizes septic tanks. The LOWWP consists of area construction divided into four geographical areas (Area A, Area B, Area C, and Area D), Pump Station construction, Midtown site restoration, water recycling facility, and roadway improvement, including storm drainage facilities. This Contract consists of pump station construction.

Pump Station Work includes, but is not limited to, the following:

1. Nine sewage lift stations equipped with submersible solids-handling pumps.
2. Twelve 'pocket pumps stations' equipped with submersible grinder-type sewage pumps.
3. Each of the sewage lift stations will be equipped with back-up generators, associated system controls, valves, and accessories. The pocket pumps stations will have associated system controls, valves, and accessories.

Bids will be received by the County of San Luis Obispo at the at the office of the Clerk of the Board of Supervisors of the County of San Luis Obispo at 1055 Monterey Street, Room D-120, San Luis Obispo, CA 93408, until 3:00 p.m. (Local Time) Thursday June 21, 2012, and then at said office publicly opened and read aloud.

The Bidding Documents may be examined at the following locations:

Office of the Clerk of the Board of Supervisors of the County of San Luis Obispo at 1055 Monterey Street, Room D-120, San Luis Obispo, CA 93408

Department of Public Works and Transportation, at 1050 Monterey Street, Room 207, County Government Center, San Luis Obispo, CA 93408 (hereafter, also the "Public Works Department" or "Department")

Copies of the Bidding Documents may be obtained at the County of San Luis Obispo Department of Public Works and Transportation located at 1050 Monterey Street, Room 207, County Government Center, San Luis Obispo, CA 93408 upon payment of $ 188.58 (tax included) for each set (non-refundable).

Copies of full size Drawing may be purchased separately from:

ASAP Reprographics
3121 South Higuera Street
San Luis Obispo, CA 93401.
(805) 543-3144

Questions concerning these documents should be directed to:

http://www.slocounty.ca.gov/PW/Design_Division/Projects_Out_To_Bid.htm

Bidders are notified that financing for this Project is provided pursuant to the Consolidated Farm and Rural Development Act (7 U.S.C. Section 1921 et seq.) and that as allowed in Public Contract Code Section 22300, this Contract does not provide for substitution of securities for any monies withheld by the Owner to ensure performance under this Contract. Bidders are further notified that this Contract does not permit retainage to be placed in escrow nor to be invested for the benefit of the Contractor.

Bidders are notified that financing for this Project is provided in part by Clean Water State Revolving Funds through an agreement with the State Water Resources Control Board. The contents of the Contract Documents do not necessarily reflect the views and policies of the State Water Resources Control Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use, (Gov. Code § 7550, 40 CFR § 31 .20.).

Prospective Bidders shall be licensed Contractors in the State of California and shall be skilled and regularly engaged in the general class or type of work called for under the Contract. Each Bidder shall have a Class A California Contractor's license.

This Contract is funded in whole or in part using funds from the American Recovery and Reinvestment Act (ARRA). Section 1605 of the ARRA prohibits the use of these funds unless all iron, steel, and manufactured goods are produced in the United States. All iron and steel manufacturing processes must take place in the United States, except for metallurgical processes involving refinement of steel additives. There is no requirement for the origin of components and subcomponents of manufactured goods. Products listed at 48 CFR 25.104(a) have been determined to be unavailable in the United States and if required for this Project may be purchased from foreign sources. No unauthorized use of foreign iron, steel, and/or manufactured goods will be allowed on this Project.

Section 1606 of the ARRA requires compliance with the Davis-Bacon and Related Acts and adherence to the current U.S. Department of Labor Wage Decision. The Contractor must comply with the minimum rates for wages for laborers and mechanics as determined by the Secretary of Labor in accordance with the provisions of the Davis-Bacon and Related Acts. The Contract provisions and related matters set forth in 29 CFR Part 5- Section 5.5 are hereby made a part of this Contract. Attention is called to the fact that not less than the minimum salaries and wages set forth in the Contract Documents must be paid on this Project. The Wage Decision, including modification, must be posted by the Contractor on the Site.

Bidders are notified that the higher of either the Davis-Bacon or the California State prevailing wage rate shall apply.

Copies of the Prevailing Wage Schedules may be obtained from the U.S Department of Labor, www.wdol.gov/dba.aspx#0.

Each Bid shall be made in accordance with the Bidding Documents, and no Bid will be received unless it is made on Bid forms included in the Bidding Documents. Each Bid must be accompanied by cash, certified check, or cashier's check or Bidder's Bond made payable to the County of San Luis Obispo for an amount equal to at least ten percent (10%) of the total amount of the Bid.

While the General Conditions herein (Section 00700) are similar to the EJCDC C-700 Standard General Conditions (2007 Edition) in many respects, the General Conditions also differ from said EJCDC document in many respects in order to conform with Federal, State, and County requirements. A copy of the differences between the General Conditions herein and said EJCDC document is available upon request.

Owner reserves the right to reject any or all Bids, and to waive discrepancies, irregularities, informalities or any other errors in the Bids or bidding, if to do so seems to best serve the public interest, so long as the error does not constitute a material error.

Bidders are notified of the requirements and submittal deadlines for written requests for approval of substitute materials or equipment identified in Paragraph 11.01 of Section 00200, Instructions to Bidders, and Paragraph 6.05 of Section 00700, Standard General Conditions.

By order of the Board of Supervisors of the County of San Luis Obispo

_____ _____

(Date) Deputy Clerk of the Board of Supervisors

SECTION 00110

SIGNATURES AND STAMPS

The Contract Documents for Los Osos Wastewater Project, Collection System Pump Stations, Contract No 300448.08.01.PS, presented herein have been prepared by or under the direction of the following registered engineers:

PREPARED BY:
(For Division 0)

Jeff B West

DESIGN ENGINEER

REGISTERED PROFESSIONAL ENGINEER
JEFF B. WERST
C 47971
EXP 12-31-13
CIVIL
STATE OF CALIFORNIA

5/1/12
DATE

RECOMMENDED FOR APPROVAL AND ADVERSTING BY:

John Waddell

PROJECT MANAGER

REGISTERED PROFESSIONAL ENGINEER
JOHN ISAAC WADDELL
No. 66646
Exp. 9/30/12
CIVIL
STATE OF CALIFORNIA

5/1/12
DATE

Dave Flynn

DEPUTY DIRECTOR OF PUBLIC WORKS

5/2/12
DATE

APPROVED BY:

Peter Jay

PUBLIC WORKS DIRECTOR

5/3/2012
DATE

END OF SECTION

SECTION 00200

INSTRUCTIONS TO BIDDERS

ARTICLE 1 - INTRODUCTION

1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions. While the General Conditions herein (Section 00700) are similar to the EJCDC C-700 Standard General Conditions (2007 Edition) in many respects, the General Conditions also differ from said EJCDC document in many respects in order to conform with Federal, State, and County requirements. A copy of the differences between the General Conditions herein and said EJCDC document is available upon request.

ARTICLE 2 - COPIES OF BIDDING DOCUMENTS

2.01 Complete sets of the Bidding Documents in the number and for the purchase price, stated in the Advertisement for Bids may be obtained from the Public Works Department.

2.02 Complete sets of Bidding Documents shall be used in preparing Bids; neither Owner nor Designer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

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

2.04 Bidding Documents are available for download from the following website:

http://www.slocounty.ca.gov/PW/Design_Division/PROJECTs_Out_To_BID.htm

ARTICLE 3 - BLANK

ARTICLE 4 - EXAMINATION OF BIDDING DOCUMENTS, OTHER RELATED DATA, AND SITE

4.01 Subsurface and Physical Conditions

A. The General Conditions identify:

1. Those reports of explorations and tests of subsurface conditions at or contiguous to the Site, if any, that Designer has used in preparing the Bidding Documents.

2. Those drawings of physical conditions in or relating to existing surface and subsurface structures at or contiguous to the Site (except Underground Facilities), if any, that Designer has used in preparing the Bidding Documents.

B. Copies of reports and drawings referenced in Paragraph 4.01.A, if any, will be made available by Owner to any Bidder for download from the following website:

http://www.slocounty.ca.gov/PW/Design_Division/Projects_Out_To_Bid.htm

Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Bidder is entitled to rely is described in Paragraph 4.02 of the General Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any "technical data" or any other data, interpretations, opinions or information contained in such reports or shown or indicated in such drawings.

4.02 Underground Facilities

A. Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site is based upon information and data furnished to Owner and Designer by owners of such Underground Facilities, including Owner, or others, unless otherwise specified in the Drawings and Specifications.

4.03 Hazardous Environmental Condition

A. The General Conditions identify those reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that Designer has used in preparing the Bidding Documents.

B. Copies of reports and drawings referenced in Paragraph 4.03.A, if any, will be made available by Owner to any Bidder. for download on the following website:

http://www.slocounty.ca.gov/PW/Design_Division/Projects_Out_To_Bid.htm.

Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Bidder is entitled to rely is described in Paragraph 4.06 of the General Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any "technical data" or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

4.04 Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated conditions appear in Paragraphs 4.02, 4.03, and 4.04 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work appear in Paragraph 4.06 of the General Conditions.

4.05 On request, Owner will provide Bidder access to the Site to conduct such examinations, investigations, explorations, tests, and studies as Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies. Bidder shall comply with all applicable Laws and Regulations relative to locating of excavation and utility.

4.06 Additional Owner Provided Information

A. Reference is made to the General Conditions for the identification of the general nature of other work, if any, that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) that relates to the Work contemplated by these Bidding Documents. On request, Owner will provide to each Bidder for examination access to or copies of available documents (other than portions thereof related to price) for such other work.

B. Paragraph 6.13.C of the General Conditions states that if an Owner Safety program exists it will be noted in the Specifications.

4.07 It is the responsibility of each Bidder before submitting a Bid to:

A. Examine and carefully study the Bidding Documents, the other related data identified in the Bidding Documents, and any Addenda;

B. Visit the Site and become familiar with and satisfy Bidder as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;

C. Become familiar with and satisfy Bidder as to all Federal, State, and local Laws and Regulations that may affect cost, progress, and performance of the Work;

D. Carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site, if any, and all drawings of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities), if any, that have been identified in Paragraph 4.02 of the General Conditions as containing reliable "technical data," and (2) reports and drawings of Hazardous Environmental Conditions, if any, at the Site that have been identified in Paragraph 4.06 of the General Conditions as containing reliable "technical data.";

E. Obtain and carefully study (or accept consequences of not doing so) all additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents, and safety precautions and programs incident thereto;

F. Agree at the time of submitting its Bid that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents;

G. Become aware of the general nature of the work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents;

H. Correlate the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents;

I. Promptly give Owner written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Owner is acceptable to Bidder; and

J. Determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work.

4.08 The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article 4, that without exception the Bid is premised upon performing and furnishing the Work required by the Bidding Documents and applying any specific means, methods, techniques sequences, and procedures of construction that may be shown or indicated or expressly required by the Bidding Documents, that Bidder has given Owner written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in the Bidding Documents and the written resolutions thereof by Owner are acceptable to Bidder, and that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

ARTICLE 5 - PRE-BID CONFERENCE

5.01 A pre-Bid conference will be held at 10:00 a.m. local time on Thursday, May 31, 2012 at the City/County Library Community Room at 995 Palm Street, San Luis Obispo, CA 93401. Representatives of Owner, Engineer, and Designer will be present to discuss the Project. Bidders are encouraged to attend and participate in the conference. Owner will transmit to all prospective Bidders of record such Addenda as Owner considers necessary in response to questions arising at the conference. Oral statements may not be relied upon and will not be binding or legally effective.

ARTICLE 6 - SITE AND OTHER AREAS

6.01 The Site is identified in the Bidding Documents. Easements for permanent structures or permanent changes in existing facilities are to be obtained and paid for by Owner unless otherwise provided in the Bidding Documents. Except for those areas identified in the Bidding Documents as temporary staging areas, all additional lands and access thereto required for temporary construction facilities, construction equipment, or storage of materials and equipment to be incorporated in the Work are to be obtained and paid for by Contractor.

ARTICLE 7 - INTERPRETATIONS AND ADDENDA

7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to Owner in writing. at the following website:

http://www.slocounty.ca.gov/PW/Design_Division/Projects_Out_To_Bid.htm.

Interpretations or clarifications considered necessary by Owner in response to such questions will be issued by Addenda faxed or emailed to all parties recorded by Owner as having received the Bidding Documents and made available on the following website:

http://www.slocounty.ca.gov/PW/Design_Division/Projects_Out_To_Bid.htm.

Questions received less than five days prior to the date for opening of Bids may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

7.02 Addenda may be issued to clarify, correct, or change the Bidding Documents as deemed advisable by Owner.

ARTICLE 8 - BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of 10 percent of Bidder's maximum Bid price and in the form of a certified check or bank money order or a Bid bond (Section 00430) issued by a surety meeting the requirements of Paragraphs 5.01 and 5.02 of the General Conditions.

8.02 The Bid security of the Successful Bidder will be retained until such Bidder has executed the Contract Documents, furnished the required Contract security and met the other conditions of the Notice of Award, whereupon the Bid security will be returned. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required Contract security within 15 days after the Notice of Award, Owner may annul the Notice of Award and the Bid security of that Bidder will be forfeited. The Bid security of other Bidders will be retained by Owner until the award of the Contract to the Successful Bidder.

ARTICLE 9 - CONTRACT TIMES

9.01 The dates by which the Work is to be substantially completed and ready for final payment are set forth in the Agreement.

ARTICLE 10 - LIQUIDATED DAMAGES

10.01 Provisions for liquidated damages are set forth in the Agreement.

ARTICLE 11 - SUBSTITUTE AND "OR-EQUAL" ITEMS

11.01 The Contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents, or "or-equal" materials and equipment as described in Paragraph 6.05 of the General Conditions, or those substitute materials and equipment approved by Owner and identified by Addendum. The materials and equipment described in the Bidding Documents establish a standard of required type, function and quality to be met by any proposed substitute or "or-equal" item. Request for clarification of materials and equipment considered "or-equal" prior to the Effective Date of Agreement must be received by the Owner at the office of the County Clerk, 1055 Monterey Street, D-120, San Luis Obispo, CA 93408, no later than 4:00 p.m. on June 6, 2012. No item of material or equipment will be considered by Owner as a substitute unless

written request for approval has been submitted by Bidder and has been received by Owner at the office of the County Clerk, 1055 Monterey Street, D-120, San Luis Obispo, CA 93408, no later than 4:00 p.m. on June 11, 2012. Each such request shall conform to the requirements of Paragraph 6.05 of the General Conditions. The burden of proof of the merit of the proposed item is upon Bidder. Owner's decision of approval or disapproval of a proposed item will be final. If Owner approves any proposed substitute item, such approval will be set forth in an Addendum issued to all prospective Bidders. Bidders shall not rely upon approvals made in any other manner.

ARTICLE 12 - BLANK

ARTICLE 13 - PREPARATION OF BID

13.01 The Bid Form is included with the Bidding Documents. Additional copies may be obtained from Owner.

13.02 All blanks on the Bid Form shall be completed in ink and the Bid signed in ink. Erasures or alterations shall be initialed in ink by the person signing the Bid Form. A Bid price shall be indicated for each Bid Item listed therein.

13.03 A Bid by a corporation shall be executed in the corporate name by the president or a vice-president or other corporate officer accompanied by evidence of authority to sign. The corporate seal shall be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation shall be provided on the Bid Form.

13.04 A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership shall be provided on the Bid Form.

13.05 A Bid by a limited liability company shall be executed in the name of the firm by a member and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm shall be shown.

13.06 A Bid by an individual shall show the Bidder's name and business address.

13.07 A Bid by a joint venture shall be executed by each joint venturer in the manner indicated on the Bid Form. The official address of the joint venture must be provided on the Bid Form.

13.08 All names shall be printed in ink below the signatures.

13.09 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers and dates of which shall be filled in on the Bid Form.

13.10 The postal and email addresses and telephone number for communications regarding the Bid shall be shown.

13.11 The Bid shall contain evidence of Bidder's authority and qualification to do business in the state or locality where the Project is located or Bidder shall covenant in writing to obtain such qualification prior to award of the Contract and attach such covenant to the Bid Form. Bidder's state contractor license number shall also be shown on the Bid Form.

ARTICLE 14 - BASIS OF BID; COMPARISON OF BIDS

14.01 *Unit Price*

A. Bidders shall submit a Bid for each unit basis item of work a unit price and a total for the item, or for each lump sum item a total for the item for each item of Work listed in the Bid schedule.

B. The total of all bid prices will be the sum of the products of the estimated quantity of each item and the corresponding unit price. The final quantities and Contract Price will be determined in accordance with Paragraph 11.03 of the General Conditions.

C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between words and figures will be resolved in favor of the words.

ARTICLE 15 - SUBMITTAL OF BID

15.01 With each copy of the Bidding Documents, a Bidder is furnished one separate unbound copy of the Bid Form, and the Bid bond form. The unbound copy of the Bid Form is to be completed and submitted with all of the attachments outlined in Article 7 of the Bid Form.

15.02 A Bid shall be submitted no later than the date and time prescribed and at the place indicated in the Advertisement for Bids and shall be enclosed in an opaque sealed envelope plainly marked with the Project title, the name and address of Bidder, and shall be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate envelope plainly marked on the outside with the notation "BID ENCLOSED." When using the mail or other delivery system, the Bidder is totally responsible for the mail or other delivery system delivering the Bid at the place and prior to the time indicated in the Advertisement for Bid. A mailed Bid shall be addressed to Owner at the address in Article 1.01 of the Bid Form.

ARTICLE 16 - MODIFICATION AND WITHDRAWAL OF BID

16.01 A Bid may be modified or withdrawn prior to the date and time for opening of bids by an appropriate document duly executed in the manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids.

16.02 If within 5 days after Bids are opened, any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid or negotiated, that Bidder will be disqualified from further bidding on the Work. This provision to withdraw a Bid without forfeiting the Bid security does not apply to Bidder's errors in judgment in preparing the Bid, or to carelessness in inspecting the site of Work or in reading the Drawings and Specifications.

ARTICLE 17 - OPENING OF BIDS

17.01 Bids will be opened at the time and place indicated in the Advertisement for Bids and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the Bids and alternates, if any, will be made available to Bidders after the opening of Bids.

ARTICLE 18 - BIDS TO REMAIN SUBJECT TO ACCEPTANCE

18.01 All Bids will remain subject to acceptance for the period of time stated in the Bid Form, but Owner may, at its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 19 – EVALUATION OF BIDS AND AWARD OF CONTRACT

19.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner further reserves the right to reject the Bid of any Bidder whom it finds, after reasonable inquiry and evaluation, to be non-responsible. Owner also reserves the right to reject any or all bids, and to waive discrepancies, irregularities, informalities, or any other error in the bids or bidding, if to do so seems to best serve the public interest.

19.02 More than one Bid for the same Work from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing that any Bidder has an interest in more than one Bid for the Work may be cause for disqualification of that Bidder and the rejection of all Bids in which that Bidder has an interest.

19.03 In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices and other data, as may be requested in the Bid Form or prior to the Notice of Award.

19.04 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, and financial ability of Bidders, proposed Subcontractors, Suppliers, individuals, or entities to perform the Work in accordance with the Contract Documents.

19.06 If the Contract is to be awarded, Owner will award the Contract to the responsible Bidder whose Bid, conforming with all the material terms and conditions of the Instructions to Bidders, is the lowest price.

ARTICLE 20 - CONTRACT SECURITY AND INSURANCE

20.01 Article 5 of the General Conditions sets forth Owner's requirements as to performance and payment bonds and insurance. When the Successful Bidder delivers the executed Agreement to Owner, it shall be accompanied by properly executed bonds pursuant to the forms set forth in Section 00610 and 00615. Said bond forms are not Contract Documents, and are attached for reference purposes only.

When the Successful Bidder delivers the executed Agreement to Owner, it shall also be accompanied by certificates of insurance for all of the insurance which Contractor is required to purchase and maintain in accordance with Article 5 of the General Conditions.

ARTICLE 21 - SIGNING OF AGREEMENT

21.01 When Owner gives a Notice of Award to the Successful Bidder, it shall be accompanied by the required number of unsigned counterparts of the Agreement with the other Contract Documents which are identified in the Agreement as attached thereto. Within 15 days thereafter, Successful Bidder shall sign and deliver the required number of counterparts of the Agreement and attached documents to Owner. Within ten days thereafter, Owner shall deliver one fully signed counterpart to Successful Bidder with a complete set of the Drawings with appropriate identification.

21.02 This Contract is expected to be funded in part with funds provided by the United States Department of Agriculture, Rural Utilities Service (RUS) and the State Water Resources Control Board. Refer to the General Conditions for Federal Requirements.

21.03 Concurrence by RUS in the Contract is required before the Contract is effective.

ARTICLE 22 - SALES AND USE TAXES

22.01 Contractor shall pay all California sales, use and other taxes as specified in Paragraph 6.10 of the General Conditions.

ARTICLE 23- WORKERS' COMPENSATION REQUIREMENTS

23.01 As required by Section 1860 of the California Labor Code and in accordance with the provisions of Section 3700 of the Labor Code, every Contractor will be required to secure the payment of workers' compensation to its employees.

23.02 In accordance with Section 1861 of the California Labor Code, the Contractor shall furnish the Owner with a statement as follows: "I am 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 I will comply with such provisions before commencing the performance of the work of this Contract."

ARTICLE 24 – SUBCONTRACTOR LISTING LAW

24.01 In accordance with Section 4104 of the California Public Contract Code, each Bidder, in his or her Bid, shall set forth the name and the location of the place of business of each Subcontractor who will perform Work or labor or render service to the prime Contractor in or about the construction of the Work or improvement, or a Subcontractor licensed by the State of California who, under subcontract to the prime Contractor, specially fabricates and installs a portion of the work or improvement according to detailed drawings contained in the Drawings and Specifications, in an amount in excess of one-half of one percent of the prime Contractor's total Bid.

24.02 In accordance with Section 4107 of the California Public Contract Code, no Contractor whose Bid is accepted shall without consent of the Owner either: (a) substitute a person as a Subcontractor in place of the Subcontractor listed in the original Bid; or (b) permit a subcontract to be voluntarily assigned or transferred or allow it to be performed by anyone other than the original Subcontractor listed in the original Bid; or (c) sublet or

subcontract any portion of the Work in excess of one-half of one percent of the prime Contractor's total Bid as to which his or her original Bid did not designate a Subcontractor.

24.03 Penalties for failure to comply with the foregoing sections of the California Public Contract Code are set forth in Sections 4106, 4110, and 4111 of the Public Contract Code. A prime Contractor violating this law violates his or her Contract and the awarding authority may exercise the option, in its own discretion, of (1) canceling his or her contract or (2) assessing the prime Contractor a penalty in an amount of not more than 10 percent of the amount of the subcontract involved, and this penalty shall be deposited in the fund out of which the prime Contract is awarded. In any proceedings under this section the prime Contractor shall be entitled to a public hearing and to 5 day's notice of the time and place thereof.

ARTICLE 25 – RURAL UTILITIES SERVICE REQUIREMENTS

25.01 Bidders are advised that funding for this Project is being provided in whole or in part by the United States Department of Agriculture, Rural Utilities Service which will review and approve the Contract award, Contract Agreement, partial and final payments, and Contract Change Orders.

25.02 Payment and retainage will comply with the Contract Agreement Paragraph 6.02 "Progress Payments; Retainage." Bidders are notified that this Contract does not permit retainage to be placed in escrow nor to be invested for the benefit of the Contractor.

25.03 Bidders are notified that financing for this Project is provided pursuant to the Consolidated Farm and Rural Development Act (7 U.S.C. Section 1921 et seq.), and that as allowed in Public Contract Code Section 22300, this Contract does not provide for substitution of securities for any monies withheld by the Owner to ensure performance under the Contract.

25.04 Bidders are notified of the requirement for affirmative action to ensure equal employment opportunity (Executive Order No. 11246) as set forth in the Equal Opportunity Requirements found in paragraph 18.10 of the General Conditions.

ARTICLE 26 – AMERICAN RECOVERY AND REINVESTMENT ACT OF 2009

26.01 This Contract is funded in whole or in part using funds from the American Recovery and Reinvestment Act (ARRA). Section 1605 of the ARRA prohibits the use of these funds unless all iron, steel, and manufactured goods are produced in the United States. All iron and steel manufacturing processes must take place in the United States, except for metallurgical processes involving refinement of steel additives. There is no requirement for the origin of components and subcomponents of manufactured goods. Products listed at 48 CFR 25.104(a) have been determined to be unavailable in the United States and if required for this Project may be purchased from foreign sources. No unauthorized use of foreign iron, steel, and/or manufactured goods will be allowed on this Project.

26.02 Section 1606 of the ARRA requires compliance with the Davis-Bacon and Related Acts and adherence to the current U.S. Department of Labor Wage Decision. The Contractor must comply with the minimum rates for wages for laborers and mechanics as

determined by the Secretary of Labor in accordance with the provisions of the Davis-Bacon and Related Acts. The Contract provisions and related matters set forth in 29 CFR Part 5- Section 5.5 are hereby made a part of this Contract. Attention is called to the fact that not less than the minimum salaries and wages set forth in the Contract Documents must be paid on this Project. The Wage Decision, including modification, must be posted by the Contractor at the Site.

26.03 This is a Public Works Project subject to the rate of prevailing wages as established by the California Department of Industrial Relations, Bidders are notified that the higher of either the Davis-Bacon or the State prevailing wage rate shall apply.

ARTICLE 27 – STATE WATER RESOURCES CONTROL BOARD REQUIREMENTS

27.01 This Contract is funded in part by the Clean Water State Revolving Fund through an agreement with the State Water Resources Control Board, The contents of the Contract Documents do not necessarily reflect the views and policies of the State Water Resources Control Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use, (Gov. Code § 7550, 40 CFR § 31 .20.)

27.02 Bidders are hereby notified of the requirement for good faith efforts to ensure Disadvantaged Business Enterprises have the opportunity to participate on this Contract (40 CFR part 33) as set forth in the Disadvantaged Business Enterprises Program Requirements found in Paragraph 18.06 of the General Conditions.

27.03 Bidders are hereby notified of the requirement to comply with the provisions of the Fair Employment and Housing Act (Gov. Code §12990 (a-I) et seq.) as set forth in Paragraph 18.15 of the General Conditions.

27.04 Bidders are hereby notified of the prohibition of subcontracting with debarred entities set forth in Paragraph 18.16 of the General Conditions.

ARTICLE 28 – ESCROW BID DOCUMENTS

Bidders are hereby notified of the requirements to submit Escrow Bid Documents as set forth in the General Requirements

ARTICLE 29 – BID PROTESTS

Any Bid protest must be submitted in writing to the Department of Public Works, Room 207,County Government Center, 976 Osos Street, San Luis Obispo, CA 93408; Attention: Design Engineer before 5 p.m. of the 7th business day following Bid opening.

The initial protest document shall contain a complete statement of the basis for the protest and all evidence and documents supporting the protest available to the protesting party. The protest shall refer to the specific portion of the document which forms the basis for the protest. The protest shall include the name, address and telephone number of the person representing the protesting party. The party filing the protest shall concurrently transmit a copy of the initial protest document and any attached documentation to all other parties with a direct financial interest which may be adversely affected by the outcome of the protest. Such parties shall include all

other Bidders who appear to have a reasonable prospect of receiving an award depending upon the outcome of the protest. The County Board of Supervisors will issue a decision on the protest.

The procedure and time limits set forth in this paragraph are mandatory and are the Bidder's sole and exclusive remedy in the event of Bid protest and failure to comply with these procedures shall constitute a waiver of any right to further pursue the Bid protest, including filing a Government Code Claim or legal proceedings.

END OF SECTION

SECTION 00300

WAGE REQUIREMENTS

Notice is hereby given that, pursuant to 1773 of the Labor Code of the State of California, the Owner has obtained from the Director of the Department of Industrial Relations the general prevailing rate of per diem wages and the general prevailing rate for holidays and overtime work for each craft, classification, or type of worker required to execute the Contract. A copy of said prevailing rate of per diem wages is on file in the principal office of the Owner, to which reference is hereby made for further particulars. Said prevailing rate of per diem wages will be made available to any interested party upon request, and a copy thereof shall be posted at each Project Site by the Contractor.

Statutory Penalty for Failure to Pay Minimum Wages: In accordance with 1775 of the California Labor Code, the Contractor shall as a penalty to the State of political subdivision on whose behalf a Contract is made or awarded, forfeit fifty dollars ($50.00) for each calendar day or portion thereof, for each worker paid less than the stipulated prevailing rate for any public work done under the Contract by the Contractor or by any Subcontractor under the Contractor.

Statutory Penalty for Unauthorized Overtime Work: In accordance with 1813 of the California Labor Code, the Contractor shall as a penalty to the State or political subdivision on whose behalf the Contract is made or awarded, forfeit twenty-five dollars ($25.00) for each worker employed in the execution of the Contract by the Contractor or by any Subcontractor for each calendar day during which said worker is required or permitted to work more than eight hours in any one calendar day and forty hours in any one calendar week in violation of 1810-1815 of the California Labor Code.

Apprenticeship Requirements: Contractor agrees to comply with 1777.5, 1777.6 and 1777.7 of the California Labor Code relating to the employment of apprentices. The responsibility for compliance with these provisions is fixed with the prime contractor for all apprenticeship occupations. Under these sections of the law, Contractors and Subcontractors must employ apprentices in apprenticeship occupations, where journeymen in the craft are employed on the public work, in a ratio of not less than one apprentice hour for each five journeymen hours (unless an exemption is granted in accordance with 1777.5) and Contractors and Subcontractors shall not discriminate among otherwise qualified employees as indentured apprentices on any public work solely on the ground of race, religious creed, color, national origin, ancestry, sex, or age, except as provided in 3077 of the Labor Code. Only apprentices, as defined in 3077, which provides that an apprentice must be at least 16 years of age, who are in training under apprenticeship standards and who have signed written apprentice agreements will be employed on public works in apprenticeship occupations.

Payroll Records: Contractor shall keep accurate payroll records on forms provided by the Division of Labor Standards Enforcement, or alternatively, the Contractor shall keep accurate payroll records containing the same information. Said information shall include, but not be limited to, a record of the name, address, social security number, work classification, straight time and overtime hours worked each day and week, and actual per diem wages paid to each journeyman, apprentice, or worker employed by the Contractor. Such record shall be made available for inspection at all reasonable hours, and a copy shall be made available to employee or his authorized representative, the Division of Labor Standards Enforcement, and the Division

of Apprenticeship Standards in compliance with California Labor Code, Section 1776. Upon written notice from the Owner or the Division of Labor Standards Enforcement, the Contractor shall, within ten (10) days, file with the Owner a certified copy of the payroll records. The Contractor shall cause an identical clause to be included in every subcontract for the Work.

END OF SECTION

SECTION 00410

BID FORM

LOS OSOS WASTEWATER PROJECT
COLLECTION SYSTEM PUMP STATIONS
LOS OSOS, CA
CONTRACT NO. 300448.08.01.PS

ARTICLE 1- BID RECIPIENT

1.01 This Bid is submitted to: Office of the County Clerk
1055 Monterey Street, Room D-120
San Luis Obispo, CA 93408

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2- BIDDERS ACKNOWLEDGEMENTS

2.01 Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

ARTICLE 3- BIDDER'S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

A. Bidder has examined and carefully studied the Bidding Documents, the other related data identified in the Bidding Documents, and the following Addenda, receipt of which is hereby acknowledged.

Addendum No.	Addendum Date
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

B. Bidder has visited the Site and become familiar with and is satisfied as to the general, local and Site conditions that may affect cost, progress, and performance of the Work.

C. Bidder is familiar with and is satisfied as to all Federal, State and local Laws and Regulations that may affect cost, progress and performance of the Work.

D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site, if any, and all drawings of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities), if any, that have been identified in Paragraph 4.02 of the General Conditions as containing reliable "technical data," and (2) reports and drawings of Hazardous Environmental Conditions, if any, at the Site that have been identified in Paragraph 4.06 of the General Conditions as containing reliable "technical data."

E. Bidder has considered the information known to Bidder; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying the specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents, if any, when applicable; and (3) Bidder's safety precautions and programs.

F. Based on the information and observations referred to in Paragraph 3.01.E above, Bidder does not consider that any further examinations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents.

G. Bidder is aware of the general nature of the Work to be performed by Owner and others at the Site, if any, that relates to the Work as indicated in the Bidding Documents.

H. Bidder has given Owner written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution thereof by Owner is acceptable to Bidder.

I. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which this Bid is submitted.

J. Bidder will submit written evidence of its authority to do business in the State or other jurisdiction where the Project is located not later than the date of its execution of the Agreement.

ARTICLE 4- BIDDER'S CERTIFICATION

4.01 Bidder further represents that:

A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any agreement or rules of any group, association, organization, or corporation;

B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;

C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and

D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process.

2. "fraudulent practice" means an intentional misrepresentation of facts made to (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

ARTICLE 5- BASIS OF BID

5.01 Bidder will complete the Work in accordance with the Contract Documents for the prices indicated in the Bid Schedule:

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	BID UNIT PRICE	BID PRICE
1	MOBILIZATION	1	LUMP SUM	LUMP SUM	
2	SHEETING, SHORING, AND BRACING	1	LUMP SUM	LUMP SUM	
3	DEWATERING	1	LUMP SUM	LUMP SUM	
4	SITE PREPARATION	1	LUMP SUM	LUMP SUM	
5	HOT MIX ASPHALT PAVEMENT	403	TON		
6	AGGREGATE BASE	498	CUBIC YARD		
7	TRAFFIC CONTROL	1	LUMP SUM	LUMP SUM	
8	POCKET PUMP STATIONS	12	EACH		
9	DUPLEX PUMP STATION	7	EACH		
10	TRIPLEX PUMP STATION	2	EACH		
11	STANDBY POWER BUILDINGS	8	EACH		
12	INSTALL NATIVE VEGETATION	31,635	SQUARE FOOT		
				TOTAL BID	

Unit Prices have been computed in accordance with Paragraph 11.03.B of the General Conditions.

Bidder acknowledges that estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Bid items will be based on actual quantities, determined as provided in the Contract Documents

ARTICLE 6- TIME OF COMPLETION

6.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 14.07 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.

6.02 Bidder accepts the provisions of the Agreement as to liquidated damage.

ARTICLE 7- ATTACHMENTS TO THIS BID

7.01 The following documents are attached to and made a condition of this Bid and must be signed and submitted with the Bid:

A. Section 00420 – Non-Collusion Affidavit

B. Required Bid security in the form of a Bid Bond (Section 00430) or Certified Check (circle type of security provided)

C. Section 00440 – If Bid amount exceeds $10,000, signed Compliance Statement/Certifications of Nonsegregated Facilities RD 400-6). Refer to specific equal opportunity requirements set forth in the General Conditions.

D. Section 00450 – If Bid amount exceeds $25,000, signed Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion- Lower Tiered Covered Transactions (AD-1048)

E. Section 00460 – If Bid amount exceeds $100,000, signed RD Instruction 1940-Q, Exhibit A-1, Certification for Contracts, Grant, and Loans. Refer to paragraph 18.11 of the General Conditions;

F. Section 00470 – Workers Compensation Certification

G. Section 00480 – List of Subcontractors

H. Section 00485 – Bidders List

I. Section 00490 – Good Faith Effort Documentation Summary Form

J. Section 00495 – Disadvantaged Business Enterprise Contactor - Subcontractor Certification

ARTICLE 8- DEFINED TERMS

8.01 The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders and the General Conditions.

ARTICLE 9 – CALIFORNIA CONTRACTOR'S LICENSE INFORMATION

9.01 The undersigned Bidder is licensed in accordance with Chapter 9, Division 3 of the California Business and Professions Code and section 3300 of the California Public Contract Code, and the laws of California.

Bidders Valid California Contractor's License No. _____ Class _____

Expiration Date: _____

Bidder has contracted under this license number for _____ years.

ARTICLE 10- BID SUBMITTAL

10.01 This Bid is submitted by: _____

The undersigned hereby states that all representation made herein are made under the penalty of perjury.

If Bidder is:

An Individual

Name (typed or printed): _____

By: _____
(Individual's signature)

Doing business as: _____

A Partnership

Partnership Name: _____ (SEAL)

By: _____
(Signature of general partner – attach evidence of authority to sign)

Name (typed or printed): _____

A Corporation

Corporation Name: _____ (SEAL)

State of Incorporation: _____

Type (General Business, Professional, Service, Limited Liability): _____

By: _____
(Signature – attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

Attest: _____
(Signature of Corporate Secretary)

Date of Qualification to do business in California is ____________.

A Joint Venture

Name of Joint Venturer: _____

First Joint Venturer Name: _____ (SEAL)

By: _____
(Signature of first joint venture partner – attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

Second Joint Venturer Name: _____ (SEAL)

By: _____
(Signature of second joint venture partner – attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

(Each joint venturer must sign. The manner of signing for each individual, partnership, and corporation that is a party to the joint venture should be in the manner indicated above.)

Bidder's Business address: _____

_____

Business Phone No. (_____)_____

Business FAX No. (_____)_____

Business E-Mail Address: _____

Employer's Tax ID No.: _____

DUNS No.: _____

Phone and FAX Numbers, and Address for receipt of official communications, if different from Business contact information:

_____

_____

9.02 Bid submitted on _____, 2012.

END OF SECTION

SECTION 00420

NON COLLUSION AFFIDAVIT TO BE EXECUTED BY BIDDER AND SUBMITTED WITH BID
(Public Contract Code Section 7106)

State of California
County of County of San Luis Obispo
_____, being first duly sworn, deposes and says that he or she is _____of _____ , 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 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.

By _____

Subscribed and sworn to before me on _____
(date)

_____
(Notary Public)

(SEAL)

END OF SECTION

BID BOND

Any singular reference to Bidder, Surety, Owner or other party shall be considered plural where applicable.

BIDDER *(Name and Address)*:

SURETY *(Name and Address of Principal Place of Business)*:

OWNER *(Name and Address)*:

BID

Bid Due Date:

Description *(Project Name and Include Location)*:

BOND

Bond Number:

Date *(Not earlier than Bid due date)*:

Penal sum _____ $ _____

(Words) (Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

BIDDER	**SURETY**
_____ (Seal)	_____ (Seal)
Bidder's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	By: _____
Signature	Signature (Attach Power of Attorney)
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	Attest: _____
Signature	Signature
_____	_____
Title	Title

Note: Above addresses are to be used for giving any required notice. Provide execution by any additional parties, such as joint venturers, if necessary.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond shall be Owner's sole and exclusive remedy upon default of Bidder.

2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.

3. This obligation shall be null and void if:

3.1 Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or

3.2 All Bids are rejected by Owner, or

3.3 Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).

4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.

5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from Bid due date without Surety's written consent.

6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after Bid due date.

7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.

8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.

9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.

10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.

11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

END OF SECTION

SECTION 00440

COMPLIANCE STATEMENT

This statement relates to a proposed contract
with _____

_____

(Name of borrower or grantee)

who expects to finance the contract with assistance from either the Rural Housing Service (RHS), Rural Business-Cooperative Service (RBS), or the Rural Utilities Service (RUS) or their successor agencies, United States Department of Agriculture (whether by a loan, grant, loan insurance, guarantee, or other form of financial assistance). I am the undersigned bidder or prospective contractor. I represent that:

1. I **[ ]** have, **[ ]** have not, participated in a previous contract or subcontract subject to Executive Order 11246 (regarding equal employment opportunity) or a preceding similar Executive Order.

2. If I have participated in such a contract or subcontract, I **[ ]** have, **[ ]** have not, filed all compliance reports that I have been required to file in connection with the contract or subcontract.

If the proposed contract is for $50,000 or more and I have 50 or more employees, I also represent that:

3. I **[ ]** have, **[ ]** have not, previously had contracts subject to the written affirmative action program requirements of the Secretary of Labor.

4. If I have participated in such a contract or subcontract, I **[ ]** have, **[ ]** have not, developed and placed on file at each establishment affirmative action programs as required by the rules and regulations of the Secretary of Labor.

I understand that if I have failed to file any compliance reports that have been required of me, I am not eligible and will not be eligible to have my bid considered or to enter into the proposed contract unless and until I make an arrangement regarding such reports that is satisfactory to either the RHS, RBS, or RUS, or to the office where the reports are required to be filed.

I also certify that I do not maintain or provide for my employees any segregated facilities at any of my establishments, and that I do not permit my employees to perform their services at any location, under my control, where segregated facilities are maintained. I certify further that I will not maintain or provide for my employees any segregated facilities at any of my establishments, and that I will not permit my employees to perform their services at any location, under my control, where segregated facilities are maintained. I agree that a breach of this certification is a violation of the Equal Opportunity clause in my contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas,

parking lots, drinking fountains, recreation or entertainment areas, transportation and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, creed, color, or national origin, because of habit, local custom, or otherwise. I further agree that (except where I have obtained identical certifications from proposed subcontractors prior to the award of subcontracts exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity clause; that I will retain such certifications in my files; and that I will forward the following notice to such proposed subcontractors (except where the proposed subcontractors have submitted identical certifications for specific time periods): (See Reverse).

RD 400-6 (Rev. 2-98)

NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENTS FOR CERTIFICATIONS OF NON-SEGREGATED FACILITIES

A certification of Nonsegregated Facilities, as required by the May 9, 1967, order (32F.R. 7439, May 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted prior to the award of a subcontract exceeding $10,000 which is not exempt from the provisions of the Equal Opportunity Clause. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semiannually, or annually)

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

Date**:**_____ _____

Signature of Bidder or Prospective Contractor

_____

Address (including Zip Code)

END OF SECTION

SECTION 00450

CERTIFICATION REGARDING DEBARMENT

U.S. DEPARTMENT OF AGRICULTURE

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – Lower Tier Covered Transactions.

This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 7 CFR Part 3017.510, Participants' responsibilities. The regulations were published as Part IV of the January 30, 1989, Federal Register (pages 4722-4733). Copies of the regulations may be obtained by contacting the Department of Agriculture agency with which this transaction originated.

(BEFORE COMPLETING CERTIFICATION, READ INSTRUCTIONS ON NEXT PAGE)

(1) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.

(2) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Organization Name PR/Award Number or Project Name

Name(s) and Title(s) of Authorized Representative(s)

Signature(s) Date

Form AD-1048 (1/92)

Instructions for Certification

1. By signing and submitting this form, the prospective lower tier participant is providing the certification set out on the reverse side in accordance with these instructions.

2. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

3. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

4. The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "person," "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations.

5. The prospective lower tier participant agrees by submitting this form that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.

6. The prospective lower tier participant further agrees by submitting this form that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – Lower Tier Covered Transactions," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.

7. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that it is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principles. Each participant may, but is not required to, check the Nonprocurement List.

8. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

9. Except for transactions authorized under paragraph 5 of these instructions, if a participant in a covered transaction knowingly entered into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

Form AD-1048 (1/92)

END OF SECTION

SECTION 00460

CERTIFICATION FOR CONTRACTS, GRANTS AND LOANS

RD Instruction 1940-Q
Exhibit A-1

The undersigned certifies, to the best of his or her knowledge and belief, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant or Federal loan, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant or loan.

2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant or loan, the undersigned shall complete and submit Standard From – LLL, "Disclosure of Lobbying Activities," in accordance with its instructions.

3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including contracts, subcontracts, and subgrants under grants and loans) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

_____ _____

(Signature) (Date)

_____

(Name)

_____

(Title)

(08-21-91) PN 171

END OF SECTION

SECTION 00470

CONTRACTOR'S CERTIFICATION REGARDING WORKERS' COMPENSATION INSURANCE

State of California

County of San Luis Obispo

I am aware of the provisions of Section 3700 of the 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 commending the performance of the work of this Contract.

_____
(Name of Bidder)

_____
(Signature)

_____
(Name)

_____
(Title)

_____
(Date)

END OF SECTION

SECTION 00480

LIST OF SUBCONTRACTORS

In compliance with the provisions of Sections 4100-4113 of the Public Contract Code of the State of California, and any amendments thereto, the undersigned bidder sets forth the following:

a. The name and location of the place of business of each subcontractor who will perform work or labor, or render service to the undersigned Prime Contractor in or about the construction of the work or improvement, or a subcontractor licensed by the State of California who, under subcontract to the Prime Contractor, specially fabricates and installs a portion of the work or improvement according to detailed drawings contained in the plans and specifications, in an amount in excess of one-half of one percent of the undersigned Prime Contractor's total bid or in the case of bids for the construction of streets and highways, including bridges, in excess of one-half of one percent or ten thousand dollars ($10,000), whichever is greater.*

b. The portion of the work which will be done by each such subcontractor. Only one subcontractor shall be listed for each such portion.

*When there is a failure to list a subcontractor, as required, the law provides that the Contractor agrees to do the work with his or her own forces. In such case, bidder must be authorized to perform said work. Any bid not complying with the provisions hereof may be rejected.

Work to be Performed	License Number	Percent of Total Contract	Subcontractor's Name and Address
1.			
2.			
3.			
4.			
5.			
6.			
7.			

Work to be Performed	License Number	Percent of Total Contract	Subcontractor's Name and Address
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			

(ATTACH ADDITIONAL NUMBERED PAGES IF NEEDED)

_____

(Name of Bidder)

_____

(Signature)

_____

(Date)

END OF SECTION

SECTION 00485

BIIDDERS LIST

In compliance with the provisions of 40 CFR 33, the undersigned bidder sets forth that the following lists all subcontractors, subconsultants, and suppliers who supplied bids or quoted on the Project.

Name, Address, Contact Name & Phone Number of Firm	Description of Work Items	Approximate $ amount	DBE	MBE	WBE
1.			☐	☐	☐
2.			☐	☐	☐
3.			☐	☐	☐
4.			☐	☐	☐
5.			☐	☐	☐
6.			☐	☐	☐
7.			☐	☐	☐
8.			☐	☐	☐
9.			☐	☐	☐

Name, Address, & Phone Number of Firm	Description of Work Items	Approximate $ amount	DBE	MBE	WBE
10.			☐	☐	☐
11.			☐	☐	☐
12.			☐	☐	☐
13.			☐	☐	☐
14.			☐	☐	☐
15.			☐	☐	☐
16.			☐	☐	☐
17.			☐	☐	☐
18.			☐	☐	☐
19.			☐	☐	☐
20.			☐	☐	☐

Name, Address, & Phone Number of Firm	Description of Work Items	Approximate $ amount	DBE	MBE	WBE
21.			☐	☐	☐
22.			☐	☐	☐
23.			☐	☐	☐
24.			☐	☐	☐
25.			☐	☐	☐
26.			☐	☐	☐
27.			☐	☐	☐

(ATTACH ADDITIONAL NUMBERED PAGES IF NEEDED)

_____

(Name of Bidder)

_____

(Signature)

_____

(Date)

END OF SECTION

SECTION 00490

GOOD FAITH EFFORT DOCUMENTATION SUMMARY FORM

In compliance with the provisions of 40 CFR 33, the undersigned Bidder sets forth the following as documentation that a Good Faith Effort was made to assure that Disadvantaged Business Enterprise businesses were used when possible as sources of supplies, equipment, construction, and services (refer to Paragraph 18.06 of the General Conditions):

1. List the names of each publication in which a request for DBE participation for this Project was placed (attach copies of advertisements or proofs of publication):

_____

_____

_____

_____

_____

2. List the names of DBEs that Contractor sent written notices soliciting bids for this Project (attach copies of solicitations, telephone records, fax confirmations, etc.):

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

3. Did Bidder establish delivery schedules, when economically feasible, in a way that encourages and facilitates participation by DBEs in the competitive process?

☐ Yes ☐ No

Provide explanation below:

4. Did Bidder divide the Work, when economically feasible, into small tasks or quantities to permit maximum participation of DBEs?

☐ Yes ☐ No

List of the items of Work made available to DBE firms, including any breaking down of the Bid items into economically feasible units to facilitate DBE participation.

6. Brief description of services or assistance utilized by Contractor from the Small Business Administration and the Minority Business Development Agency?

_____

_____

_____

_____

_____

7. Did Bidder include provisions in advertisements and solicitations requiring each Subcontractor to employ the good faith efforts described in 40 CFR 33.301?

☐ Yes ☐ No

If no, provide explanation below:

_____

_____

_____

_____

_____

All information supporting the Good Faith Effort must be submitted with the Bid.

_____
(Name of Bidder)

_____
(Signature)

_____
(Date)

END OF SECTION

SECTION 00495

DISADVANTAGED BUSINESS ENTERPRISE
CONTRACTOR SUBCONTRACTOR CERTIFICATION

Firm Name:	Phone:
Address:	
Principal Service or Product:	Bid Amount $

PLEASE INDICATE PERCENTAGE OF OWNERSHIP BELOW

☐ DBE _____% Ownership	
☐ Prime Contractor	☐ Supplier of Material/Service
☐ Subcontractor	
☐ Sole Ownership	☐ Corporation
☐ Partnership	☐ Joint Venture
Certified by:	Title:

(Original signature and date required)

Name:	Date:

NOTE: Contractors can no longer self-certify. They must be certified by EPA, Small Business Administration (SBA), Department of Transportation (DOT) or by State, Local, Tribal or private entities whose certification criteria match EPA's.

Proof of Certification must be provided. A copy of the contractor certification must be submitted with the Bid.

END OF SECTION

SECTION 00500

AGREEMENT

AGREEMENT
BETWEEN OWNER AND CONTRACTOR
FOR CONSTRUCTION CONTRACT (STIPULATED PRICE)

THIS AGREEMENT is by and between the County of San Luis Obispo ("Owner") and

_____ ("Contractor").

Owner and Contractor hereby agree as follows:

ARTICLE 1 – WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

The Los Osos Wastewater Project, Collection System Pump Stations includes, but is not limited to, the following:

1. Nine sewage lift stations equipped with submersible solids-handling pumps.
2. Twelve 'pocket pumps stations' equipped with submersible grinder-type sewage pumps.
3. Each of the sewage lift stations will be equipped with back-up generators, associated system controls, valves, and accessories. The pocket pumps stations will have associated system controls, valves, and accessories.

ARTICLE 2 – THE PROJECT

2.01 The Project for which the Work under the Contract Documents may be the whole or only a part is generally described as follows:

LOS OSOS WASTEWATER PROJECT
COLLECTION SYSTEM PUMP STATIONS
LOS OSOS, CA
CONTRACT NO. 300448.08.01.PS

ARTICLE 3 – DESIGNER AND ENGINEER

3.01 The Project has been designed by CDM Smith (Designer).

3.02 The Owner has entered into a separate agreement for construction management services with HDR Engineering, Inc. (Engineer), which is to act as Owner's representative, assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

ARTICLE 4 – CONTRACT TIMES

4.01 *Time of the Essence*

A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

4.02 *Deadlines for Substantial Completion and Final Completion*

A. The Work will be substantially completed within 860 days after the date when the Contract Times commence to run as provided in Paragraph 2.03 of the General Conditions, and completed and ready for final payment in accordance with Paragraph 14.07 of the General Conditions within 920 days after the date when the Contract Times commence to run.

4.03 *Liquidated Damages*

A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial loss if the Work is not completed within the times specified in Paragraph 4.02.A above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty), Contractor shall pay Owner $1000.00 for each day that expires after the time specified in Paragraph 4.02.A above for Substantial Completion until the Work is substantially complete. After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Time or any proper extension thereof granted by Owner, Contractor shall pay Owner $500.00 for each day that expires after the time specified in Paragraph 4.02.A above for completion and readiness for final payment until the Work is completed and ready for final payment.

B. Nothing in this Paragraph 4.03 diminishes or affects Contractor's liability to Owner and any other contractor under direct contract to Owner for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's failure to satisfy any of the time deadlines set forth above.

ARTICLE 5 – CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents an amount in current funds equal to the sum of the amounts determined pursuant to Paragraphs 5.01.A below:

A. For all Work, at the prices stated in Contractor's Bid, as set forth below:

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	BID UNIT PRICE	BID PRICE
1	MOBILIZATION	1	LUMP SUM	LUMP SUM	
2	SHEETING, SHORING, AND BRACING	1	LUMP SUM	LUMP SUM	
3	DEWATERING	1	LUMP SUM	LUMP SUM	
4	SITE PREPARATION	1	LUMP SUM	LUMP SUM	
5	HOT MIX ASPHALT PAVEMENT	403	TON		
6	AGGREGATE BASE	498	CUBIC YARD		
7	TRAFFIC CONTROL	1	LUMP SUM	LUMP SUM	
8	POCKET PUMP STATIONS	12	EACH		
9	DUPLEX PUMP STATION	7	EACH		
10	TRIPLEX PUMP STATION	2	EACH		
11	STANDBY POWER BUILDINGS	8	EACH		
12	INSTALL NATIVE VEGETATION	31,635	SQUARE FOOT		
				TOTAL	

The Bid prices for Unit Price Work set forth as of the Effective Date of the Agreement are based on estimated quantities. As provided in Paragraph 11.03 of the General Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by Engineer as provided in Paragraph 9.07 of the General Conditions.

All other Work required by the Contract Documents shall be considered incidental to the Work and considered as included in the Contract Price.

ARTICLE 6 – PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

A. Contractor shall submit Applications for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 *Progress Payments; Retainage*

A. Within thirty (30) days of Engineer's receipt of a proper Application for Payment under Article 14 of the General Conditions, Owner shall make progress payments on account of the Contract Price on the basis of Contractor's Applications for Payment as provided in Paragraph 6.02.A.1 below. All such payments will be measured by the schedule of values established as provided in Paragraph 2.07.A of the General Conditions (and in the case of

Unit Price Work based on the number of units completed) or, in the event there is no schedule of values, as provided in the General Requirements.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Engineer may determine or Owner may withhold, including but not limited to liquidated damages, in accordance with Paragraph 14.02 of the General Conditions.

    a. 95 percent of Work completed (with the balance being retainage); and

    b. 95 percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

B. Within 60 days of Substantial Completion of all Work under the Contract Documents, Owner shall pay to Contractor an amount sufficient to reduce the retainage withheld on Work properly completed to zero percent of the Work completed, less such amounts as Engineer shall determine in accordance with Paragraph 14.02.B.5 of the General Conditions and less 150 percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the tentative list of items to be completed or corrected attached to the certificate of Substantial Completion. In the event of any disputes between the Owner and Contractor, the Owner may also withhold an additional amount not to exceed 150 percent of the disputed amount. Nothing in this paragraph shall require the Owner to pay any amounts which the Owner refuses to pay pursuant to Paragraph 14.02.D. of the General Conditions (or any other provision in the Contract Documents authorizing the withholding or reduction of any payment to the Contractor).

6.03 *Final Payment*

A. Upon final completion and acceptance of the Work in accordance with Paragraph 14.07 of the General Conditions, Owner shall pay the remainder of the Contract Price as provided in said Paragraph 14.07.

ARTICLE 7 – INTEREST

7.01 All moneys not paid when due as provided in Article 14 of the General Conditions shall bear interest, if applicable, as provided in the Contract Documents.

ARTICLE 8 – CONTRACTOR'S REPRESENTATIONS

8.01 In order to induce Owner to enter into this Agreement, Contractor makes the following representations:

A. Contractor has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents.

B. Contractor has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. Contractor is familiar with and is satisfied as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work.

D. Contractor has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site, if any, and all drawings of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities), if any, that have been identified in Paragraph 4.02 of the General Conditions as containing reliable "technical data," and (2) reports and drawings of Hazardous Environmental Conditions, if any, at the Site that have been identified in Paragraph 4.06 of the General Conditions as containing reliable "technical data."

E. Contractor has considered the information known to Contractor; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Site-related reports and drawings identified in the Contract Documents, if any, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, including any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Contract Documents; and (3) Contractor's safety precautions and programs.

F. Based on the information and observations referred to in Paragraph 8.01.E above, Contractor does not consider that further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract Documents.

G. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.

H. Contractor has given Owner written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and the written resolution thereof by Owner is acceptable to Contractor.

I. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

ARTICLE 9 – CONTRACT DOCUMENTS

9.01 *Contents*

A. The Contract Documents consist of the following:

1. This Agreement.

2. General Conditions.

3. Specifications as listed in the table of contents of the Project Manual.

4. Drawings as listed in the table of contents of the Project Manual

5. Addenda (numbers _____ to _____, inclusive).

6. Exhibits to this Agreement (enumerated as follows):

   a. List of Subcontractors;

   b. Compliance Statement;

   c. Certification Regarding Debarment;

   d. Contractor's Certification Regarding Worker's Compensation Insurance;

   e. Certification for Contracts, Grants, and Loans;

   f. *Good Faith Effort Documentation Summary Form;*

   g. Disadvantaged Business Enterprise Contactor - Subcontractor Certification

7. The following which may be delivered or issued on or after the Effective Date of the Agreement and are not attached hereto:

   a. Notice to Proceed.

   b. Work Change Directives.

   c. Change Orders.

B. The documents listed in Paragraph 9.01.A are attached to this Agreement (except as expressly noted otherwise above).

C. There are no Contract Documents other than those listed above in this Article 9.

D. The Contract Documents may only be amended, modified, or supplemented as provided in Paragraph 3.04 of the General Conditions.

E. Contractor agrees that the Payment Bond and Performance Bond attached to this Agreement are for reference purposes only, and shall not be considered a part of this Agreement or any other Contract Document. Contractor further agrees that said bonds are separate obligations of the Contractor and its surety, and that any attorney's fee provision contained in any payment bond or performance bond shall not apply to any legal action between Contractor and Owner to enforce any provision of the Contract Documents.

ARTICLE 10 – MISCELLANEOUS

10.01 *Terms*

A. Terms used in this Agreement will have the meanings stated in the General Conditions.

10.02 *Assignment of Contract*

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

10.03 *Successors and Assigns*

A. Owner and Contractor each binds itself, its partners, successors, assigns, and legal representatives to the other party hereto, its partners, successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

10.04 *Severability*

A. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Owner and Contractor, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

10.05 *Contractor's Certifications*

A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 10.05:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process or in the Contract execution;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

10.06 *Attorneys Fees*

A. No provisions of the Contract Documents provide either the Contractor or the Owner the right to be awarded any attorney's fees and/or costs under Civil Code section 1717 in any legal action brought by either party to enforce any provision of the Contract Documents against the other party. The parties agree that any references to attorney's fees in language describing indemnification obligations do not constitute a contractual provision that would provide either the Contractor or the Owner the right to be awarded any attorney's fees and/or costs under Civil Code section 1717 in any legal action brought by either party to enforce any provision of the Contract Documents against the other party. Any other language in the Contract Documents providing for a recovery of attorney's fees shall be strictly construed as not including the recovery of any attorney's fees incurred by either Contractor or Owner in any legal action brought by either party to enforce any provision of the Contract Documents against the other party.

B. The parties agree that the Contract Documents contain no provisions that would allow either the Contractor or the Owner to be awarded attorney's fees and/or costs under Civil Code section 1717. Nothing in this Paragraph 10.06. affects any right by Contractor or Owner to recover attorney's fees or costs by operation of any law other than Civil Code section 1717.

C. In the event of any conflict between language in this Paragraph 10.06 and any other language in the Contract Documents, the language in Paragraph 10.06 shall prevail.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement. Counterparts have been delivered to Owner and Contractor. All portions of the Contract Documents have been signed or have been identified by Owner and Contractor or on their behalf.

This Agreement will be effective on _____ (which is the Effective Date of the Agreement).

OWNER:

County of San Luis Obispo

By: _____

Title: Chairperson of the Board of Supervisors

Attest: _____

Title: Clerk of the Board of Supervisors

Address for giving notices:

_____

_____

_____

APPROVAL RECOMMENDED

PAAVO OGREN

By: _____

Director of Public Works

Date: 5/3/2012

APPROVED AS TO FORM AND

LEGAL EFFECT:

WARREN R. JENSEN

County Counsel

By: _____

Date: 5/3/12

CONTRACTOR

_____

By: _____

Title: _____

(If Contractor is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest: _____

Title: _____

Address for giving notices:

_____

_____

_____

License No.: _____

(Where applicable)

NOTE TO USER: Use in those states or other jurisdictions where applicable or required.

Agent for service of process:

_____

ATTACHMENT TO AGREEMENT
BETWEEN OWNER AND CONTRACTOR
FOR CONSTRUCTION CONTRACT (STIPULATED PRICE)

This attachment is to the Agreement made and entered into on _____, by and between the County of San Luis Obispo hereinafter "Owner", and _____ hereinafter called "Contractor." This Contract is for that Work described in the Contract Documents entitled:

LOS OSOS WASTEWATER PROJECT
COLLECTION SYSTEM PUMP STATIONS
LOS OSOS, CA
CONTRACT NO. 300448.08.01.PS

This Contract shall not be effective unless and until approved by a delegated representative of USDA Rural Development.

CONSTRUCTION LENDER

USDA Rural Development
430 G Street, Agency 4169
Davis, CA 95616-4169

As lender or insurer of funds to defray the costs of this Contract, and without liability for any payments thereunder, the Agency hereby concurs in the form, content, and execution of this Agreement.

U.S. Department of Agriculture
RURAL DEVELOPMENT:

BY:_____

TITLE:_____

DATE:_____

END OF SECTION

SECTION 00510

NOTICE OF AWARD

Date: _____

Project: Los Osos Wastewater Project	
Owner: County of San Luis Obispo	Contract No.: 300448.08.01.PS
Contract: Collection System Pump Stations	
Bidder:	
Bidder's Address: *[send Notice of Award Certified Mail, Return Receipt Requested]*	

You are notified that your Bid dated _____ for the above Contract has been considered. You are the Successful Bidder and are awarded a Contract for _____.

The Contract Price of your Contract is _____ Dollars ($_____).

6 copies of the proposed Contract Documents (except Drawings) accompany this Notice of Award.

___ sets of the Drawings will be delivered separately or otherwise made available to you immediately.

You must comply with the following conditions precedent within [15] days of the date you receive this Notice of Award:

1. Deliver to the Owner 6 fully executed counterparts of the Contract Documents.
2. Deliver with the executed Contract Documents the Contract security [Bonds] and certificates of insurance as specified in the Instructions to Bidders (Article 20), and General Conditions (Paragraph 5.01).
3. Other conditions precedent:

   _____

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

Within ten days after you comply with the above conditions, Owner will return to you one fully executed counterpart of the Contract Documents.

County of San Luis Obispo
Owner

By: _____
Authorized Signature

_____
Title

Copy: File & Engineer

END OF SECTION

SECTION 00550

NOTICE TO PROCEED

Date: _____

Project: Los Osos Wastewater Project	
Owner: County of San Luis Obispo	Owner's Contract No.: 300448.08.01.PS
Contract: Collection System Pump Stations	
Contractor:	
Contractor's Address: *[send Certified Mail, Return Receipt Requested]*	

You are notified that the Contract Times under the above Contract will commence to run on_____. On or before that date, you are to start performing your obligations under the Contract Documents. In accordance with Article 4 of the Agreement, the number of days to achieve Substantial Completion is _____, and the number of days to achieve readiness for final payment is _____.

Also, before you may start any Work at the Site, you must:

_____ *[add other requirements]*.

_____ County of San Luis Obispo
Owner

_____ Given by:

_____
Authorized Signature

_____ _____
Title

_____ _____
Date

Copy to Engineer & File

END OF SECTION

SECTION 00600

ADDITIONAL INSURED ENDORSEMENT

POLICY NUMBER(S): _____

NAMED INSURED: _____

THIS ENDORSEMENT CHANGES THE POLICY. READ IT CAREFULLY.

This endorsement modifies insurance provided under this policy:

In consideration of the premium charged and notwithstanding any inconsistent statement in the policy to which this endorsement is attached or in any endorsement which now or later attaches to the policy, the Company agrees as follows:

SCHEDULE OF ADDITIONAL INSUREDS:

County of San Luis Obispo, its officials, board members, departments, agencies, directors, agents, employees, volunteers and representatives

Camp Dresser & McKee, Inc., and its officers, directors, members, partners, employees, agents, consultants, and subcontractors

HDR Engineering, Inc., and its officers, directors, members, partners, employees, agents, consultants, and subcontractors

WHO IS AN INSURED: Section is amended to include as an insured the persons or organizations shown in the Schedule of additional insureds above, but only with respect to liability arising out of "your work" for that insured by or for you.

The Insurance afforded by this policy shall be primary insurance as respects any claim, loss or liability arising out of the Named Insured's operations. Any other insurance maintained by the Additional Insured(s) shall be excess and non-contributory with the insurance provided hereunder. The insurer hereby waives any rights of subrogation against any Additional Insured. Any deductible or self-insured retention due under this policy may be paid or satisfied by any Additional Insured should the Named Insured fail to do so.

By my signature on this endorsement, I warrant that I have authority to bind the insurance company and do so bind the company to this endorsement:

Insurance Company Authorized Representative: Name, Title and Signature:	Date Signed:

END OF SECTION

SECTION 00610

PERFORMANCE BOND

Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

CONTRACTOR (*Name and Address*): SURETY (*Name, and Address of Principal Place of Business*):

OWNER (*Name and Address*):
County of San Luis Obispo
1055 Monterey Street
San Luis Obispo, CA 93408

CONTRACT
Effective Date of Agreement:
Amount:
Description (*Name and Location*):

BOND
Bond Number:
Premium $
Date (*Not earlier than Effective Date of Agreement*):
Penal Amount:

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL	**SURETY**
_____ (Seal)	_____ (Seal)
Contractor's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	By: _____
Signature	Signature (Attach Power of Attorney)
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	Attest: _____
Signature	Signature
_____	_____
Title	Title

Note: Provide execution by additional parties, such as joint venturers, if necessary.

Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to Owner for the performance of the Contract, which is incorporated herein by reference.

1. If Contractor performs the Contract, Surety and Contractor have no obligation under this Bond, except to participate in conferences as provided in Paragraph 2.1.

2. Surety's obligation under this Bond shall arise after:
   2.1 Owner has notified Contractor and Surety, at the addresses described in Paragraph 9 below, that Owner is considering declaring a Contractor Default and has requested and attempted to arrange a conference with Contractor and Surety to be held not later than 15 days after receipt of such notice to discuss methods of performing the Contract. If Owner, Contractor, and Surety agree, Contractor shall be allowed a reasonable time to perform the Contract, but such an agreement shall not waive Owner's right, if any, subsequently to declare a Contractor Default; and
   2.2 Owner has declared a Contractor Default and formally terminated Contractor's right to complete the Contract. Such Contractor Default shall not be declared earlier than 20 days after Contractor and Surety have received notice as provided in Paragraph 2.1; and
   2.3 Owner has agreed to pay the Balance of the Contract Price to:
      1. Surety in accordance with the terms of the Contract; or
      2. Another contractor selected pursuant to Paragraph 3.3 to perform the Contract.

3. When Owner has satisfied the conditions of Paragraph 2, Surety shall promptly, and at Surety's expense, take one of the following actions:
   3.1 Arrange for Contractor, with consent of Owner, to perform and complete the Contract; or
   3.2 Undertake to perform and complete the Contract itself, through its agents or through independent contractors; or
   3.3 Obtain bids or negotiated proposals from qualified contractors acceptable to Owner for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by Owner and contractor selected with Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Contract, and pay to Owner the amount of damages as described in Paragraph 5 in excess of the Balance of the Contract Price incurred by Owner resulting from Contractor Default; or
   3.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:
      1. After investigation, determine the amount for which it may be liable to Owner and, as soon as practicable after the amount is determined, tender payment therefor to Owner; or
      2. Deny liability in whole or in part and notify Owner citing reasons therefor.

4. If Surety does not proceed as provided in Paragraph 3 with reasonable promptness, Surety shall be deemed to be in default on this Bond 15 days after receipt of an additional written notice from Owner to Surety demanding that Surety perform its obligations under this Bond, and Owner shall be entitled to enforce any remedy available to Owner. If Surety proceeds as provided in Paragraph 3.4, and Owner refuses the payment tendered or Surety has denied liability, in whole or in part, without further notice Owner shall be entitled to enforce any remedy available to Owner.

5. After Owner has terminated Contractor's right to complete the Contract, and if Surety elects to act under Paragraph 3.1, 3.2, or 3.3 above, then the responsibilities of Surety to Owner shall not be greater than those of Contractor under the Contract, and the responsibilities of Owner to Surety shall not be greater than those of Owner under the Contract. To the limit of the amount of this Bond, but subject to commitment by Owner of the Balance of the Contract Price to mitigation of costs and damages on the Contract, Surety is obligated without duplication for:
   5.1 The responsibilities of Contractor for correction of defective Work and completion of the Contract;

5.2 Additional legal, design professional, and delay costs resulting from Contractor's Default, and resulting from the actions of or failure to act of Surety under Paragraph 3; and

5.3 Liquidated damages, or if no liquidated damages are specified in the Contract, actual damages caused by delayed performance or non-performance of Contractor.

6. Surety shall not be liable to Owner or others for obligations of Contractor that are unrelated to the Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than Owner or its heirs, executors, administrators, or successors.

7. Surety hereby waives notice of any change, including changes of time, to Contract or to related subcontracts, purchase orders, and other obligations.

8. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the Work or part of the Work is located, and shall be instituted within four years after Surety refuses or fails to perform its obligations under this Bond. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

9. Notice to Surety, Owner, or Contractor shall be mailed or delivered to the address shown on the signature page.

10. When this Bond has been furnished to comply with a statutory requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory requirement shall be deemed deleted herefrom and provisions conforming to such statutory requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

11. If an action is brought to enforce the liability on the Bond, the Surety will pay reasonable attorney's fees, to be fixed by the court.

12. Definitions.

12.1 Balance of the Contract Price: The total amount payable by Owner to Contractor under the Contract after all proper adjustments have been made, including allowance to Contractor of any amounts received or to be received by Owner in settlement of insurance or other Claims for damages to which Contractor is entitled, reduced by all valid and proper payments made to or on behalf of Contractor under the Contract.

12.2 Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.

12.3 Contractor Default: Failure of Contractor, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Contract.

FOR INFORMATION ONLY – (*Name, Address and Telephone*) Surety Agency or Broker: Owner's Representative (*Engineer or other party*):

END OF SECTION

SECTION 00615

PAYMENT BOND

Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

CONTRACTOR (*Name and Address*):

SURETY (*Name, and Address of Principal Place of Business*):

OWNER (*Name and Address*):
County of San Luis Obispo
1055 Monterey Street, San Luis Obispo, CA 93408

CONTRACT
Effective Date of Agreement:
Amount:
Description *(Name and Location)*:

BOND
Bond Number:
Premium: $
Date (*Not earlier than Effective Date of Agreement*):
Penal Amount:

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL	**SURETY**
_____ (Seal)	_____ (Seal)
Contractor's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	By: _____
Signature	Signature (Attach Power of Attorney)
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	Attest: _____
Signature	Signature
_____	_____
Title	Title

Note: Provide execution by additional parties, such as joint venturers, if necessary.

13. Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to Owner to pay for labor, materials, and equipment furnished by Claimants for use in the performance of the Contract, which is incorporated herein by reference.

14. With respect to Owner, this obligation shall be null and void if Contractor:

14.1 Promptly makes payment, directly or indirectly, for all sums due Claimants, and

14.2 Defends, indemnifies, and holds harmless Owner from all claims, demands, liens, or suits alleging non-payment by Contractor by any person or entity who furnished labor, materials, or equipment for use in the performance of the Contract, provided Owner has promptly notified Contractor and Surety (at the addresses described in Paragraph 12) of any claims, demands, liens, or suits and tendered defense of such claims, demands, liens, or suits to Contractor and Surety

15. With respect to Claimants, this obligation shall be null and void if Contractor promptly makes payment, directly or indirectly, for all sums due.

16. Surety shall have no obligation to Claimants under this Bond until:

The Contractor or a subcontractor fails to pay any of the following:

(1) A person authorized under Civil Code Section 3181 (Civil Code Section 9100 effective July 1. 2012) to assert a claim against a payment bond.

(2) Amounts due under the Unemployment Insurance Code with respect to work or labor performed pursuant to the public works contract.

(3) Amounts required to be deducted, withheld, and paid over to the Employment Development Department from the wages of employees of the contractor and subcontractors under Section 13020 of the Unemployment Insurance Code with respect to the work and labor.

17. Not used

18. Reserved.

19. Surety's total obligation shall not exceed the penal amount of this Bond, and the amount of this Bond shall be credited for any payments made in good faith by Surety.

20. Amounts owed by Owner to Contractor under the Contract shall be used for the performance of the Contract and to satisfy claims, if any, under any performance bond. By Contractor furnishing and Owner accepting this Bond, they agree that all funds earned by Contractor in the performance of the Contract are dedicated to satisfy obligations of Contractor and Surety under this Bond, subject to Owner's priority to use the funds for the completion of the Work.

21. Surety shall not be liable to Owner, Claimants, or others for obligations of Contractor that are unrelated to the Contract. Owner shall not be liable for payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligations to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.

22. Surety hereby waives notice of any change, including changes of time, to the Contract or to related subcontracts, purchase orders, and other obligations.

23. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the location in which the Work or part of the Work is located or after the expiration of periods of limitation established by applicable provisions of the California Civil Code. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

24. Notice to Surety, Owner, or Contractor shall be mailed or delivered to the addresses shown on the signature page. Actual receipt of notice by Surety, Owner, or Contractor, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.

25. When this Bond has been furnished to comply with a statutory requirement in the location where the

Contract was to be performed, any provision in this Bond conflicting with said statutory requirement shall be deemed deleted herefrom and provisions conforming to such statutory requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory Bond and not as a common law bond.

26. Upon request of any person or entity appearing to be a potential beneficiary of this Bond, Contractor shall promptly furnish a copy of this Bond or shall permit a copy to be made.

27. The Bond shall be conditioned for the payment in full of the claims of all claimants and shall inure to the benefit of any person authorized under Civil Code Section 3181 (Civil Code Section 9100 effective July 1. 2012) to assert a claim against a payment bond so as to give a right of action to that person or that person's assigns in an action to enforce the liability on the bond.

28. If an action is brought to enforce the liability on the Bond, the Surety will pay a reasonable attorney's fee, to be fixed by the court.

29. Definitions

29.1 Claimant: An individual or entity identified in California a Civil Code Sections 3110, 3111 or 3112 (Civil Code Section 9100 effective July 1. 2012) or in Section 4107.7 of the Public Contract Code.

29.2 Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.

FOR INFORMATION ONLY – (*Name, Address, and Telephone*) Surety Agency or Broker: Owner's Representative (*Engineer or other*):

END OF SECTION

SECTION 00625

CERTIFICATE OF SUBSTANTIAL COMPLETION

Project: Los Osos Wastewater Project	
Owner: County of San Luis Obispo	Owner's Contract No.: 300448.08.01.PS
Contract: Collection System Pump Stations	

This [tentative] [definitive] Certificate of Substantial Completion applies to:

All Work under the Contract Documents: The following specified portions of the Work:

_____

_____

_____

_____

_____
Date of Substantial Completion

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Project or portion thereof designated above is hereby declared and is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below.

A [tentative] [definitive] list of items to be completed or corrected is attached hereto. This list may not be all-inclusive, and the failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance and warranties shall be as provided in the Contract Documents except as amended as follows:

Amended Responsibilities Not Amended

Owner's Amended Responsibilities:

_____

_____

_____

Contractor's Amended Responsibilities:

The following documents are attached to and made part of this Certificate:

This Certificate does not constitute an acceptance of Work not in accordance with the Contract Documents nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract Documents.

Executed by Engineer	Date
Accepted by Contractor	Date
Accepted by Owner	Date

END OF SECTION

SECTION 700

STANDARD GENERAL CONDITIONS

SECTION 700

STANDARD GENERAL CONDITIONS

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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters or in all capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters or in all capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms. The use of the term "Paragraph" with initial capital letters is used to connote a sub-article of one of the 21 articles herein, and includes all of the paragraphs falling under that sub-article (including sub-articles that are subsidiary to that sub-article).

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agency*— The Project is financed in part by USDA Rural Utilities Service pursuant to the Consolidated Farm and Rural Development Act (7 USC Section 19212 et seq.). The Rural Utilities Service programs are administered through the USDA Rural Development offices, therefore, the Agency for these documents is USDA Rural Development. The Agency is USDA Rural Development.

3. *Agreement*—The written instrument which is evidence of the agreement between Owner and Contractor covering the Work.

4. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

   The Application for Payment form to be used on this Project is found in Section 00820. The Agency must approve all Applications for Payment before payment is made.

5. *Asbestos*—Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.

6. *Bid*—The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

7. *Bidder*—The individual or entity who submits a Bid directly to Owner.

8. *Bidding Documents*—The Bidding Requirements and the proposed Contract Documents (including all Addenda).

9. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid security of acceptable form, if any, and the Bid Form with any supplements.

10. *Bilateral Change Order*—A document recommended by Engineer which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.

    The Change Order form to be used for a Bilateral Change Order is found in Section 00830. Agency approval is required before Change Orders are effective.

11. *Change Order*—A document in the form of either a Bilateral Change Order or Unilateral Change Order that authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.

    The Change Order form to be used for this Project is found in Section 00830. Agency approval is required before Change Orders are effective.

12. *Claim*—A demand or assertion by Contractor seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim. A condition precedent to Contractor's right to make a Claim is Contractor's strict compliance with the requirements set forth in Paragraph 10.05.

13. *Contract*—The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

14. *Contract Documents*—Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.

15. *Contract Price*—The moneys payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of Paragraph 11.02 in the case of Allowances and Paragraph 11.03 in the case of Unit Price Work).

16. *Contract Times*—The number of days or the dates stated in the Agreement to: (i) achieve Milestones, if any; (ii) achieve Substantial Completion; and (iii) complete the Work so that it is ready for final payment as evidenced by Engineer's written recommendation of final payment.

17. *Contractor*—The individual or entity with whom Owner has entered into the Agreement.

18. *Cost of the Work*—See Paragraph 11.01 for definition.

19. *Designer*— The individual or entity named as such in the Agreement.

20. *Drawings*—That part of the Contract Documents prepared or approved by Designer which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.

21. *Effective Date of the Agreement*—The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

22. *Engineer*—The individual or entity named as such in the Agreement.

23. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.

24. *General Requirements*—Sections of Division 1 of the Specifications.

25. *Hazardous Environmental Condition*—The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, military munitions (including unexploded ordnance), or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto.

26. *Hazardous Waste*—The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.

27. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction, or purporting to have jurisdiction, including but not limited to the Law and Regulations listed in Appendix G.

28. *Liens*—Charges, security interests, stop notices, or encumbrances upon Project funds, real property, or personal property.

29. *Milestone*—A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

30. *Notice of Award*—The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Owner will sign and deliver the Agreement to the successful Bidder, if Owner decides to proceed with the Work. The Notice of Award alone shall not create remedies for any Work performed under the Agreement or Contract Documents. Until Contractor receives a Notice to Proceed from Owner, Contractor shall not proceed with the Work and has no remedy against Owner for performing any Work related to the Project before receiving that notice.

31. *Notice to Proceed*—A written notice given by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.

32. *Owner*—The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.

    The Owner is the County of San Luis Obispo.

33. *PCBs*—Polychlorinated biphenyls.

34. *Petroleum*—Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.

35. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.

36. *Project*—The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.

37. *Project Manual*—The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.

38. *Radioactive Material*—Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.

39. *Resident Project Representative*—The authorized representative of Engineer who may be assigned to the Site or any part thereof.

40. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.

41. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.

42. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

43. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.

44. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.

45. *Specifications*—That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.

46. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.

47. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer: (1) the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended ; (2) a temporary certificate of occupancy or equivalent inspector sign-off has been issued by the governing authority (3) all systems included in the Work are operational, as designed, installed and tested; and (4) Contractor has submitted a written certification that all remaining Work shall be completed within a specified number of days approved by the Engineer following the Date of Substantial Completion. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

48. *Successful Bidder*—The Bidder submitting a responsive Bid to whom Owner makes an award.

49. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or Subcontractor.

50. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

51. *Unilateral Change Order*—A document signed by the Owner that authorizes an adjustment to the Contract Price and/or Contract Times. Whenever an adjustment in Contract Price and/or Contract Times is warranted under the Contract Documents, but the Owner and Contractor cannot agree to the amount of adjustment, if any, that should be allowed to the Contract Price and/or Contract Times the Owner may issue a Unilateral Change Order stating the adjustment, if any, that is being made to the Contract Price and/or Contract Times. If any unilateral adjustment to the Contract Price and/or Contract Times is not acceptable to Contractor for any reason,

including any argument that an adjustment to the Contract Price and/or Contract Times was not warranted by the Contract Documents, the Contractor's exclusive remedy is to follow the Claim process set forth in Paragraph 10.05. A Unilateral Change Order may be jointly signed by the Engineer, but the Engineer's signature is not required.

The Change Order form to be used for a Unilateral Change Order is found in Section 00830. Notwithstanding anything to the contrary set forth in Section 00830, neither the approval nor signature of the Contractor is required in order for a Unilateral Change Order to be effective. Agency approval is required before Change Orders are effective.

52. *Unit Price Work*—Work to be paid for on the basis of unit prices.

53. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

54. *Work Change Directive*—A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by Owner and recommended by Engineer ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

1.02 *Terminology*

A. The words and terms discussed in Paragraph 1.02.B through F are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives:*

1. The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority

to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Paragraph 9.09 or any other provision of the Contract Documents.

C. *Day:*

1. The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective:*

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

   a. does not conform to the Contract Documents; or

   b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

   c. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.04 or 14.05).

E. *Furnish, Install, Perform, Provide:*

1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

4. When "furnish," "install," "perform," or "provide" is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, "provide" is implied.

F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

G. *Employ:*

1. The word "employ" when used in the context of Contractor's hiring or use of a Subcontractor is not intended to suggest that the relationship between Contractor and Subcontractor is an employer-employee relationship.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

A. When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds and certificates of insurance as Contractor may be required to furnish.

B. *Blank*

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor up to 4 printed or hard copies of the Drawings and Project Manual. Additional copies will be furnished upon request at the cost of reproduction.

2.03 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence as set forth in the Notice to Proceed. In no event will Contractor have any remedies for Work performed on the Project until the Notice to Proceed is given to Contractor.

2.04 *Starting the Work*

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to the date on which the Contract Times commence to run.

2.05 *Before Starting Construction*

A. *Preliminary Schedules:* Within 14 days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents. The Progress Schedule, using Primavera P6 software, shall (1) provide a graphic representation of all activities and events that will occur during the performance of the Work; (2) identify each phase of construction and occupancy; and (3) set forth milestone dates that are significant to ensure the timely and orderly completion of the Work in accordance with the requirements of the Contract Documents.;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

4. a preliminary Staking Request Schedule for the initial thirty (30) days of Work.

B. *Recycling Plan*: Within 10 days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), Contractor shall submit Recycling Plan to Owner for timely review, as specified in the Contact Documents.

2.06 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, Designer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.05.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit instructions, receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

1. Generally, Contractor shall communicate with Engineer, or Engineer's designated representative under Paragraph 9.03, as Engineer shall specify, concerning matters affecting Engineer or Owner. In the event that Contractor believes he/she cannot physically locate or deliver necessary communications to Engineer, or Engineer's designated representative, as specific circumstances require those communications to be received by Engineer, Contractor may transmit those communications to Owner with a copy to Engineer, or Engineer's designated representative, and shall include in the communication an explanation why Contractor is sending the communication to Owner as well as Engineer, or Engineer's representatives.

2.07 *Initial Acceptance of Schedules*

A. Contractor shall be responsible for arranging a meeting to be held at least 5 days before submission of the first Application for Payment, where Contractor, Engineer, Owner, and others as appropriate, shall review for acceptability to Engineer and Owner the schedules submitted in accordance with Paragraph 2.05.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until Contractor submits schedules that are accepted by Engineer and Owner in writing. Such acceptance shall only mean that the schedule satisfies the acceptability standard set forth below, and shall not constitute any type of approval or ratification by Engineer or Owner as to any means or methods of Work chosen by Contractor (which Contractor shall be solely responsible for).

1. The Progress Schedule will be acceptable to Engineer and Owner if it provides an orderly progression of the Work to completion within the Contract Times, in compliance with the requirements of Paragraph 2.05.A.1. If not accepted, the Progress Schedule shall be promptly revised by Contractor in accordance with the recommendations of Owner and Engineer and resubmitted for acceptance. Upon review and acceptance by Owner and Engineer, the Progress Schedule shall be

deemed to be part of the Contract Documents and attached to the Agreement. Such acceptance must be in a writing signed by Owner and Engineer that expressly states that the Progress Schedule is deemed part of the Contract Documents and an attachment to the Agreement. Such acceptance will not impose on Engineer or Owner any responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer and Owner if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer and Owner as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

4. Contractor's Staking Request Schedule will be acceptable to Engineer and Owner if it correlates with the Progress Schedule.

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that reasonably may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result will be provided whether or not specifically called for, at no additional cost to Owner.

Contractor shall be responsible for verifying at the Site the accuracy of all grades, elevations, dimensions, locations and field measurements in any Drawings, Specifications, or any other Contract Documents. In all cases of the interconnection of its Work with existing or other Work, Contractor shall verify at the site all dimensions relating to such existing or other Work. Any additional work caused by Contractor's failure to verify all such grades, elevations, dimensions, locations, or field measurements shall be promptly rectified by Contractor without any increase in Contract Price or Contract Times. Nothing in this paragraph is intended to require the Contractor to assume responsibility for the completeness and accuracy of any Drawings, Specifications, or other Contract Documents. This paragraph simply sets forth Contractor's obligation to verify data before incurring costs or delays that could have been mitigated by such verification.

C. Clarifications and interpretations of the Contract Documents shall be issued by Engineer.

D. Contractor shall keep at the Work site a copy of the Plans and Specifications to which Engineer shall have access at all times.

3.02 *Reference Standards*

A. Standards, Specifications, Codes, Laws, and Regulations

1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids, except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard, specification, manual, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, Designer, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the Contract Documents. No such provision or instruction shall be effective to assign to Owner, Designer, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies:*

1. *Contractor's Review of Contract Documents Before Starting Work*: Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy which Contractor discovers, or has actual knowledge of, and shall obtain a written interpretation or clarification from Engineer before proceeding with any Work affected thereby.

2. *Contractor's Review of Contract Documents During Performance of Work*: If, either before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation , (b) any standard, specification, manual, or code, or (c) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.04.

3. Contractor shall not be liable to Owner or Engineer for Contractor's failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof, or should have had such knowledge if it had acted in accordance with the provisions of the Contract Documents.

B. Resolving Discrepancies:

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:

   a. the provisions of any standard, specification, manual, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference in the Contract Documents); or

   b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

C. *Order of Precedence of Contract Documents:*

1. In the event of conflict between any of the Contract Documents, the provision placing a more stringent requirement on the Contractor shall prevail. The Contractor shall provide the better quality or greater quantity of Work and/or materials unless otherwise directed by Owner in writing. In the event none of the Contract Documents place a more stringent requirement or greater burden on the Contractor, the controlling provision shall be that which is found in the document with higher precedence. Nothing herein shall relieve the Contractor of its obligation to notify the Owner of any inconsistencies in the documents.

2. In the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following order of precedence:

   a. Change Orders and Work Change Directives issued after execution of the Agreement in reverse chronological order (i.e. most recent first);

   b. The Owner-Contractor Agreement, including all attachments and Addenda with later Addenda having priority over earlier Addenda;

   c. General Conditions

   d. Specifications

   e. Drawings (Figures govern over scaled dimensions, Detail drawings govern over general drawings, Addenda/Change Order drawings govern over Contract Documents, Contract Drawings govern over Standard Plans);

   f. Bidding Requirements;

   g. Reference Specifications; and

3.04 *Amending and Supplementing Contract Documents*

A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by either a Change

Order or a Work Change Directive. Any amendment to adjust either the Contract Times or the Contract Price shall be effective only if and when it is in writing and executed as a written Change Order.

Any amendment to adjust either the Contract Times or the Contract Price shall be effective only if and when it is in writing and executed as a written Change Order.

B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways:

1. A Field Order;

2. Engineer's approval of a Shop Drawing or Sample (subject to the provisions of Paragraph 6.17.D.3); or

3. Engineer's written interpretation or clarification.

No supplementation, variations, or deviations in the Work arising from any of the methods set forth in Paragraph 3.04.B shall, per se, adjust the Contract Price or Contract Times.

3.05 *Reuse of Documents*

A. Contractor and any Subcontractor or Supplier shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Designer or its consultants; or

2. reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Designer and specific written verification or adaptation by Designer.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

3.06 *Electronic Data*

A. Unless otherwise stated in the Specifications, the data furnished by Owner or Engineer to Contractor, or by Contractor to Owner or Engineer, that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.

B. *Blank*

C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

ARTICLE 4 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS

4.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work. Owner will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If Contractor believes it is entitled to an adjustment in Contract Price and/or Contract Time, or any other relief, as a result of any delay in Owner's furnishing the Site or a part thereof, Contractor's exclusive remedy is set forth in Paragraph 10.05.

B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.02 *Subsurface and Physical Conditions*

A. *Reports and Drawings*

1. In the preparation of Drawings and Specifications, Designer relied upon the following reports of exploration and tests of subsurface conditions at the Site:

   a. Geotechnical Report, Los Osos Wastewater Project; Los Osos Community Services District; San Luis Obispo County, California; March 9, 2004

   b. Addendum and Update to Geotechnical Report, Los Osos Wastewater Project; San Luis Obispo County, California; October 24, 2011

   c. Shallow Groundwater Water Quality Sampling and Analysis, Los Osos, California; February 2, 2012

   The reports itemized in this Paragraph 4.02.A are not part of the Contract Documents, but may be examined at the Department of Public Works and Transportation at 1050 Monterey Street, Room 207, County Government Center, San Luis Obispo, CA 93408, during regular business hours. Other than the limited reliance on "technical data" as provided in Paragraphs 4.02.B and 4.02.C below,

Contractor is not entitled to rely upon any information in said reports, or any other information or data utilized by Designer in the preparation of the Drawings and Specifications. The use of the term "technical data" refers only to the limited factual data included in the "Appendices" and "Attachments" that are attached to the end of the reports listed above in Paragraph 4.02.A.

Such reports shall not excuse Contractor from the duty to independently evaluate and satisfy themselves as to the Site conditions and limitations under which the Work is to be performed, including, without limitation, (1) the location, condition, layout, and nature of the Site and surrounding areas; (2) generally prevailing climatic conditions; (3) anticipated labor, supply, and costs; (4) availability and cost of materials, tools, equipment; and (5) other similar issues. Further, Owner assumes no responsibility or liability for the physical condition or safety of the Site or any improvement located on the Site. Except as set forth in Article 4, Contractor shall be solely responsible for providing a safe place for the performance of the Work. Owner shall not be required to make adjustments in either the Contract Price or Contract Times arising from a failure by Contractor or any Subcontractor to make a proper independent evaluation as to any Site conditions or limitations required in this Contract.

Any additional subsurface exploration shall be done by Contractor at its own expense.

2. No drawings of physical conditions in or relating to existing surface and subsurface structures (except Underground Facilities) which are at or contiguous to the Site are known to Owner.

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely on the "technical data" contained in such reports, but such reliance shall be limited to the accuracy of such data as of the date each respective soil boring identified in the report was made. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner, Designer, or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions, and information contained in such reports; or

3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

C. *Variability of Groundwater Levels:* No data relating to groundwater levels is intended to provide an indication as to what the groundwater levels will be at the Site when any Work is being performed. Any such data relating to any groundwater level is simply that which existed on the date when soil boring data was determined. No groundwater level data can be relied upon as an indication of what the level will be at any Site at

any time the Work would be performed under the Contract. It is commonly understood that groundwater levels are affected by a wide array of factors, including but not limited to, rainfall amounts, storm water runoff, the weather, irrigation schedules, the amount of groundwater being pumped by groundwater users, tidal influence, and many other factors. Since these factors vary over time, it is Contractor's responsibility to determine and allow for the groundwater level that exists on the date(s) the Contractor is performing any Work related thereto. Contractor shall be responsible for furnishing all labor, materials, equipment and incidentals required to remove and dispose of all surface water and groundwater entering any excavations. For purposes of this paragraph, the word "data" is intended to include "technical data", and any other type of data.

4.03 *Differing Subsurface or Physical Conditions*

A. *Notice:* If Contractor discovers, or could reasonably have discovered, that any subsurface or physical condition that is uncovered or revealed either:

1. is of such a nature as to establish that any "technical data" on which Contractor is entitled to rely as provided in Paragraph 4.02 is materially inaccurate; or

2. is of such a nature as to require a change in the Contract Documents; or

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall immediately, and in any event not more than 24 hours thereafter, and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

B. *Engineer's Review*: After receipt of written notice as required by Paragraph 4.03.A, Engineer will promptly review the pertinent condition, determine the necessity of Owner's obtaining additional exploration or tests with respect thereto, and advise Owner in writing (with a copy to Contractor) of Engineer's findings and conclusions.

C. *Possible Price and Times Adjustments:*

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. such condition must meet any one or more of the categories described in Paragraph 4.03.A; and

b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.07 and 11.03.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if:

a. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or

b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such final commitment; or

c. Contractor failed to give the written notice as required by Paragraph 4.03.A.

3. If Contractor believes it is entitled to an adjustment in Contract Price and/or Contract Time, or any other relief, Contractor's exclusive remedy is set forth in Paragraph 10.05. However, neither Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

4.04 *Underground Facilities*

A. *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to Owner or Designer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Specifications:

1. Neither Owner nor Engineer nor Designer shall be responsible for the accuracy or completeness of any such information or data provided by others; and

2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:

a. reviewing and checking all such information and data;

b. locating all Underground Facilities shown or indicated in the Contract Documents;

c. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction; and

d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. *Not Shown or Indicated:*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, immediately, or as soon as feasible, after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer. Engineer will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

2. If Engineer concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment may be made to the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that Contractor did not know of and could not reasonably have discovered, or have been expected to be aware of or to have anticipated. If Contractor believes it is entitled to an adjustment in Contract Price and/or Contract Time, or any other relief, Contractor's exclusive remedy is set forth in Paragraph 10.05.

3. Notwithstanding the foregoing, nothing in this Contract requires Owner to show or indicate in the Contract Documents any Underground Facility that constitutes a service lateral or related appurtenance whenever the presence of such Underground Facility at the Site can be reasonably inferred from the presence of other visible facilities, such as buildings, meter and/or junction boxes, on or adjacent to the Site. Contractor is deemed to be aware of, and to have anticipated, any such Underground Facility.

4. The location of existing service lateral or related appurtenance are not shown on the Drawings. Where underground main distribution conduits such as water, gas, sewer, electric power, telephone, or cable television are shown on the Drawings, Contractor shall assume that every property parcel will be served by a service lateral or related appurtenance for each type of utility.

4.05 *Lines and Grades*

A. Stakes or marks will be set by Engineer in accordance with the “Construction Staking Guidelines,” set forth in Appendix H of these Contract Documents. The Contractor is responsible for assuring that all Work complies with the Contract Documents, and nothing in this Paragraph 4.05 or Appendix H diminishes or effects the Contractor’s

responsibility for providing Work that is in full compliance with the Contract Documents.

B. When Contractor requires stakes or marks to be set, Contractor shall notify Engineer of the requirements in writing no less than 5 days in advance of starting operations that require their use. In the event that a staking operation is estimated to take more than 1 day to complete, add 1 day to the minimum 5 days advance notice.

C. If any vegetation needs to be cleared or grubbed, as determined by Engineer, before stakes or marks can be set, then Contractor shall clear the obstructing vegetation for the proper placement of stakes or marks prior to submittal of a staking request. Engineer and Contractor shall agree on the extent of vegetation removal necessary to prepare the Site for the setting of stakes or marks. Vegetation removal for the preparation of the Site for the setting of stakes or marks shall be considered as included in the various items of work involved and no additional compensation will be allowed therefor. Contractor will not be entitled to any compensation for any perceived delay, nor entitled to an extension of time for any perceived delay without due cause for the period between when the Site is deemed cleared by Engineer and when the stakes or marks are set for use by Contractor.

D. Stakes and marks set by Engineer shall be carefully preserved by Contractor. If the stakes or marks are destroyed or damaged, the stakes and marks will be replaced or restored at Engineer's earliest convenience. Contractor will be charged for each stake or mark replaced or restored which in the judgment of Engineer had been carelessly or willfully destroyed or damaged by Contractor's operations. As indicated in the "Construction Staking Guidelines," restaking charges will be based on the current costs of survey personnel plus overhead. This charge will be deducted from any moneys due or to become due Contractor.

E. Pursuant to Section 8771(b) of the California Business and Professions Code, existing survey monuments that control the location of subdivisions, tracts, boundaries, roads, streets, or highways, or provide survey control that are within or adjacent to Contractor's operations, shall be located and referenced by or under the direction of a California Professional Land Surveyor or California Registered Civil Engineer authorized to practice land surveying prior to the time when any streets, highways, other rights-of-way, or easements are improved, constructed, reconstructed, maintained, resurfaced, or relocated. It is the Contractor's responsibility to arrange and pay for a diligent and thorough search for survey monuments within the Site. Such work shall be performed by or under the direction of a California Professional Land Surveyor or a California Registered Civil Engineer authorized to practice land surveying prior to the beginning of any Work that could disturb or destroy a survey monument. Contractor shall provide Engineer a list of all such monuments and reference documents. In the event that any existing survey monuments are disturbed in any way by Contractor's operations, the Contractor shall be responsible for resetting monuments in accordance with Section 8771(b) of the California Business and Professions Code, and a corner record or record of survey shall be prepared and filed with the County Surveyor prior to filing of the Notice of Completion for the Project. Full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in locating existing survey monuments by or under the direction of a California

Professional Land Surveyor or California Registered Civil Engineer authorized to practice land surveying, resetting any disturbed survey monument and preparing and filing a corner record or record of survey, shall be considered as included in the Contract Price and no additional compensation will be allowed therefor.

4.06 *Hazardous Environmental Condition at Site*

A. No reports or drawings related to Hazardous Environmental Conditions at the Site are known to Owner.

Absence of such reports and drawings shall not excuse Contractor from the duty to independently evaluate and satisfy themselves as to the Site conditions and limitations under which the Work is to be performed, including the existence of Hazardous Environmental Conditions that a reasonable contractor would have discovered either from a reasonable evaluation of external Site conditions, or upon the further investigation a reasonable contractor would have performed based upon information obtained from such external Site evaluation or other sources.

B. *Blank*

C. Contractor must act reasonably and shall not be excused for carelessly failing to discover and locate any Hazardous Environmental Condition(s) at the Site that may present a substantial danger to persons or property exposed thereto in connection with the Work at the Site. Contractor is liable for any damages caused by any Hazardous Environmental Condition(s) that Contractor knew of, or by the exercise of reasonable efforts should have known of. Within 24 hours of the time when Contractor discovers any such Hazardous Environmental Condition(s), Contractor shall follow the procedures set forth in Paragraph 4.06.D.

D. If Contractor encounters a Hazardous Environmental Condition or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, Contractor shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 6.16.A); and (iii) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor written notice regarding any special instructions or conditions on how to proceed with the Work in the affected area.

E. *Blank*

F. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If Contractor believes it is entitled to an adjustment in Contract Price and/or Contract Time, or any other relief, Contractor's exclusive remedy is set forth in Paragraph 10.05. Owner may have such

deleted portion of the Work performed by Owner's own forces or others in accordance with Article 7.

G. *Blank*

H. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.H shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

I. The provisions of Paragraphs 4.02, 4.03, and 4.04 do not apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

4.07 *Public Contract Code Section 7104*

The provisions of Article 4 shall be interpreted and implemented in a manner consistent with Public Contract Code section 7104. Pursuant to Public Contract Code section 7104:

A. Contractor shall promptly, and in any event not more than 24 hours thereafter, and before the following conditions are disturbed, notify Owner and Engineer in writing of any:

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

2. Subsurface or latent physical conditions at the Site differing from those indicated by information about the Site made available to Bidders prior to the deadline for submitting Bids.

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

B. Upon receiving Contractor's notification, Engineer, as Owner's authorized representative, shall promptly investigate the conditions on behalf of Owner and report the results of its investigation to Owner. If Owner finds that the conditions do materially differ, or do involve hazardous waste, and that the conditions cause an adjustment in Contract Price and/or Contract Time for performance of any part of the Work under the terms of the Contract, a Change Order shall be processed under the procedures described in the Contract.

C. In the event that a dispute arises between Owner and Contractor whether the conditions materially differ, or involve hazardous waste, or cause a decrease or increase in Contractor's cost of, or time required for, performance of any part of the Work under the terms of the Contract, Contractor shall not be excused from any scheduled completion date provided for by the Contract, but shall proceed with all Work to be performed under the Contract. In such event, Contractor retains the right to submit a Claim therefor pursuant to the provisions of Article 10.

D. The provisions of this Paragraph 4.07 are not intended to override or replace any other language of this Contract, including other language in Article 4, but simply supplements such other language. All of the other provisions of this Contract (including Article 4) remain in full force and effect, including those provisions relating to the same topics covered in this Paragraph 4.6.J., so long as each such provision does not violate Public Contract Code section 7104. If any court finds any provision(s) of this Contract to be in violation of section 7104, such provision(s) are hereby deemed severed and removed from this Contract without affecting the validity of any of the remaining provisions of this Contract.

ARTICLE 5 – BONDS AND INSURANCE

5.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish performance and payment bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all of Contractor’s obligations under the Contract Documents. All performance bonds shall remain in effect until Contractor performs all obligations under the Contract Documents including, but not limited to, insurance, indemnity and warranty obligations, which survive completion of the Work. Contractor shall also furnish such other bonds as are required by the Contract Documents.

B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations. All bonds shall be executed by a California “admitted surety insurer,” as defined in California Code of Civil Procedure Section 995.120 and listed by the California Insurance Commissioner pursuant to Insurance Code Section 12070. Bonds issued by a California admitted surety listed in the latest versions of the U.S. Department of Treasury Circular 570 shall be deemed to be accepted unless specifically rejected by Owner. Bonds from a California admitted surety insurer not listed in Treasury Circular 570 must be accompanied by all of the documents enumerated in California Code of Civil Procedure Section 995.660(a). The attorney-in-fact who executes the required bonds on behalf of the surety shall affix thereto a certified and current copy of the power of attorney. The signatures shall be acknowledged by a Notary Public.

C. If the surety on any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 5.01.B, Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of Paragraphs 5.01.B and 5.02. No further payments shall

be deemed due or will be made under the Contract until a new surety(ies) qualifies and is accepted by Owner.

D. If the Contractor or a Subcontractor disputes the correctness or validity or enforceability of any stop notice either may file with Owner a bond, on a form provided or approved by Owner executed by one or more California admitted surety insurers, in an amount equal to one hundred and twenty-five percent (125%) of the claim stated in the stop notice conditioned for the payment of any sum which the stop notice claimant may recover on the claim together with its costs of suit in the action. Upon Engineer's acceptance of such bond, Owner shall not withhold money from the Contractor on account of the stop notice. The surety(ies) upon the stop notice release bond shall be different than, and jointly and severally liable to the stop notice claimant with, the payment bond surety(ies).

5.02 *Licensed Sureties and Insurers*

A. All bonds and insurance required by the Contract Documents to be purchased and maintained by Owner or Contractor shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in Contract Documents.

B. Insurance shall be placed with insurers with an A.M. Best Guide, or similar rating service guide, rating of no less than **A-: XV.**

5.03 *Certificates of Insurance*

A. Contractor shall deliver to Owner, with copies to each additional insured and loss payee, certificates of insurance (and other evidence of insurance requested by Owner or any other additional insured) which Contractor is required to purchase and maintain. Upon Owner's request, Contractor shall provide complete copies of Contractor's and Subcontractors' insurance policies (including, but not limited to, the declarations page, form list and riders), endorsements or certificates required under the Contractor Documents and invoices for premiums.

B. *Blank*

C. Failure of Owner to demand such certificates or other evidence of Contractor's full compliance with these insurance requirements or failure of Owner to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.

D. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor.

E. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner in the Contract Documents.

F. Each certificate and endorsement is to be signed by a person authorized by that insurer to bind coverage on its behalf. The certificate(s) and endorsement(s) must be in a form approved by Owner. All deductibles and self-insured retentions must be identified in the certificates. Any deductible or self-insured retention in excess of **$25,000** must be declared to and approved in writing by Owner prior to execution of the Agreement. The deductibles and retentions shall be considered a form of self-insurance.

5.04 *Contractor's Insurance*

A. Contractor shall purchase and maintain such insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:

1. claims under workers' compensation, disability benefits, and other similar employee benefit acts;

2. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;

3. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;

4. claims for damages insured by reasonably available personal injury liability coverage which are sustained:

   a. by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or

   b. by any other person for any other reason;

5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and

6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

7. Claims for bodily injury or property damage arising out of completed operations under the Contract, whether such operations are by the Contractor, its Subcontractors, or anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable; and

8. Claims for third party liability and remediation costs stemming from pollution incidents that result from the operations of Contractor, its Subcontractors, Sub-subcontractors and suppliers.

B. The policies of insurance required by this Paragraph 5.04 shall:

1. with respect to insurance required by Paragraphs 5.04.A.3 through 5.04.A.6 inclusive, be written on an occurrence basis, include as additional insureds (subject to any customary exclusion regarding professional liability) Owner, Designer, and Engineer, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;

2. include at least the specific coverages and be written for not less than the limits of liability provided in these General Conditions or required by Laws or Regulations, whichever is greater;

3. include contractual liability insurance covering Contractor's indemnity obligations under Paragraphs 6.11 and 6.20;

4. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured (and the certificates of insurance furnished by the Contractor pursuant to Paragraph 5.03 will so provide);

5. remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work in accordance with Paragraph 13.07; and

6. include completed operations coverage:

    a. Such insurance shall remain in effect for ten (10) years after final payment.

    b. Contractor shall furnish Owner and each other additional insured evidence satisfactory to Owner and any such additional insured of continuation of such insurance as a condition to final payment and thereafter upon the annual renewal of such coverage until the time within which such coverage must be maintained expires.

C. Contractor shall provide insurance in the types, and limits set forth below, with companies lawfully licensed and authorized to do business in the State of California, or otherwise under such forms and limits and with such companies approved by Owner, following Owner's examination of the company's financial, reinsurance, claims procedures and other data requested by the Owner. The Contractor's liability insurance required by Paragraph 5.04 of the General Conditions shall provide coverage with scope and limits not less than the following or greater when required by Laws and Regulations:

1. *Minimum Scope of Coverages*

   a. *Workers' Compensation and related coverages under Paragraphs 5.04.A.1 and A.2 of the General Conditions:* Contractor shall comply with the applicable sections of the California Labor Code concerning workers' compensation for injuries on the job. Compliance is accomplished in one of the following manners:

      i) Provide copy of permissive self-insurance certificate approved by the State of California; or

      ii) Secure and maintain in force a policy of workers' compensation insurance with State and applicable Federal statutory limits (e.g. Longshoremen's, if applicable) and Employer's Liability Insurance with a minimal limit of **$1,000,000** per accident; or

      iii) Provide a "waiver" form certifying that no employees subject to the California Labor Code's Workers' Compensation provision will be used in performance of this Contract.

      In addition, all Worker's Compensation policies shall contain a waiver of subrogation in favor of the County of San Luis Obispo, its officials, board members, departments, agencies, directors, agents, employees, volunteers and representatives.

   b. *Commercial General Liability under Paragraphs 5.04.A.3 through A.5 of the General Conditions:* Coverage shall be written on an Insurance Services Office (ISO) Commercial General Liability "occurrence" form CG 00 01 (10/01 or later edition) or equivalent form approved by Owner for coverage on an occurrence basis. The insurance shall cover liability, including, but not limited to, that arising from premises operations, stop gap liability, independent contractors, product liability and completed operations, personal injury, advertising injury, and liability assumed under an insured contract, and shall eliminate the exclusion with respect to property under the care, custody and control of Contractor. The policy shall be endorsed to provide the Aggregate per Project Endorsement ISO form CG 25 03 (11/85). Coverage shall contain no contractors' limitation or other endorsement limiting the scope of coverage for liability arising from pollution, explosion, collapse, or underground (x, c, u) property damage. Contractor shall maintain and provide Products/Completed Operations coverage to be maintained continuously for a minimum of ten (10) years after final payment. The policy shall be scheduled as underlying insurance to the Umbrella or Excess Policy required herein.

   c. *Business Automobile Liability under Paragraph 5.04.A.6 of the General Conditions*. Coverage shall include owned, hired, leased and non-owned vehicles, whether scheduled or not, written on Insurance Services Office (ISO) form CA 00 01 (12/93 or later edition) or a substitute form providing equivalent coverage. If necessary, the policy shall be endorsed to provide contractual

liability coverage. The policy shall be scheduled as underlying insurance to the Umbrella or Excess Policy required herein.

d. *Excess or Umbrella Liability Insurance:* Coverage shall be at least as broad as any underlying coverage and shall be "following form" to the underlying coverage. Coverage shall be provided on a "pay on behalf" basis, with defense costs payable in addition to policy limits. There shall be no cross liability exclusion and no contractor's limitation endorsement. The policy shall have starting and ending dates concurrent with the underlying coverages. The Named Insured may determine the layering of primary and excess liability insurance provided that if such layering differs from that described here, the actual coverage program meets the minimum total required limits and complies with all other requirements listed in Paragraph 5.04. Contractor's excess or umbrella liability coverage shall be maintained continuously for a minimum of ten (10) years after final payment.

e. *Contractor's Pollution Liability Insurance:* Coverage shall be provided on a form acceptable to Owner for liability caused by pollution conditions arising out of the operations of Contractor. Coverage shall apply to bodily injury, property damage (including loss of use of damaged property or of property that has not been physically injured), cleanup costs, and defense (including costs and expenses incurred in the investigation, defense, or settlement of claims). All activities contemplated in this Contract shall be specifically scheduled on the policy as "covered operations." The policy shall provide coverage for the hauling of waste from the Project Site to the final disposal location, including non-owned disposal sites. Coverage shall be included on behalf of the insured for covered claims arising out of the actions of independent contractors. If the insured is using Subcontractors, the policy must include work performed "by or on behalf" of the insured. The policy shall specifically provide for a duty to defend on the part of the insurer. Such insurance shall include coverage for all operations, including completed operations and professional services. Such insurance shall not contain any exclusion for asbestos or lead. Contractor's pollution liability coverage shall be maintained continuously for a minimum of three (3) years after final payment.

2. *Minimum Limits of Insurance.* The limits of liability for the insurance required by Paragraph 5.04 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:

a. Workers' Compensation, and related coverages under Paragraphs 5.04.A.1 and A.2 of the General Conditions:

i.	State:	Statutory
ii.	Applicable Federal (e.g., Longshoreman's):	Statutory
iii.	Employer's Liability:	**$1,000,000** per accident for bodily injury or disease and **$1,000,000** per employee for bodily injury or disease**.**

b. Contractor's General Liability under Paragraphs 5.04.A.3 through 5.04.A.6 of the General Conditions which shall include completed operations and product liability coverages and eliminate the exclusion with respect to property under the care, custody and control of Contractor:

i.	General Aggregate:	**$2,000.000**
ii.	Products – Completed Operations Aggregate:	**$2,000,000**
iii.	Personal and Advertising Injury:	**$2,000,000**
iv.	Each Occurrence (Bodily Injury and Property Damage):	**$2,000,000**
v.	Property Damage liability insurance will provide Explosion, Collapse, and Under-ground coverages where applicable:	**$2,000,000**
vi.	Excess or Umbrella Liability:	
	• General Aggregate:	**$4,000,000**
	• Each Occurrence:	**$4,000,000**

c. Automobile Liability under Paragraph 5.04.A.6 of the General Conditions:

i.	Bodily Injury:	
	• Each Person:	**$1,000,000**
	• Each Accident:	**$1,000,000**
ii.	Property Damage:	
	• Each Accident	**$1,000,000**
	[or]	
i.	Combined Single Limit	**$1,000,000**

d. The Contractual Liability coverage required by Paragraph 5.04.B.3 of the General Conditions shall provide coverage for not less than the following amounts:

i. Bodily Injury:

- Each Person: **$2,000,000**
- Each Accident: **$2,000,000**

ii. Property Damage:

- Each Accident: **$2,000,000**
- Annual Aggregate: **$4,000,000**

e. Contractor's Pollution Liability Insurance:

i. Each Occurrence: **$2,000,000**

ii. General Aggregate: **$4,000,000**

3. *Additional Insured Endorsements*. The Contractor shall cause the insurance required by the Contract Documents (except professional liability and worker's compensation) to include the County of San Luis Obispo, its officials, board members, departments, agencies, directors, agents, employees, volunteers and representatives as additional insureds. The Engineer and Designer and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each shall also be included as additional insureds.

None of the insurance coverage required by Article 5 shall contain any special limitations on the scope of protection afforded to any additional insureds. All policies shall contain a waiver of subrogation in favor of the additional insureds. Coverage for such additional insureds does not extend to liability to the extent prohibited by Insurance Code Section 11580.4. All additional insured endorsements shall be on the form of endorsement found in Section 00600 **and** shall state:

"The Insurance afforded by this policy shall be primary insurance as respects any claim, loss or liability arising out of the Named Insured's operations. Any other insurance maintained by the Additional Insured(s) shall be excess and non-contributory with the insurance provided hereunder. The insurer hereby waives any rights of subrogation against any Additional Insured. Any deductible or self-insured retention due under this policy may be paid or satisfied by any Additional Insured should the Named Insured fail to do so."

D. *Deductibles and Self-Insured Retention*. Contractor and its Subcontractors shall pay all deductibles or self-insured retentions under each policy of insurance they are required to maintain under the Contract Documents. Their policies shall not contain a provision that requires that only the named insured may pay the deductible or self-insured retention. The additional insureds under each policy shall have the right, but not the obligation, to pay any deductible or self-insured retention should the Contractor or any

Subcontractor fail to do so. In the event the Owner pays any deductible or self-insured retention, Owner shall be entitled to reimbursement by Contractor.

E. *Acceptance of Coverage.* All insurance policies, certificates, endorsements and binders shall be subject to the approval of Owner as to form and content. The insurance requirements are subject to amendment or waiver only if approved in writing by Owner.

F. *Contractor's Failure to Provide Required Insurance.* Failure to maintain required insurance at all times shall constitute a default and material breach. In such event, Contractor shall immediately notify Owner and cease all performance under this Contract until further directed by the Owner. In the absence of satisfactory insurance coverage, Owner may, at its discretion and sole option: (a) procure insurance with collection rights for premiums and costs against Contractor by way of set-off or recoupment from sums due Contractor; (b) immediately terminate or suspend Contractor's performance of the Contract; (c) pay Contractor's premiums for renewal of Contractor's coverage; or (d) self-insure the risk, with all damages and costs incurred, by judgment, settlement or otherwise, including attorney's fees and costs, being collectible from Contractor, by way of set-off or recoupment from any sums due Contractor. Upon demand, Contractor shall repay Owner for all sums that Owner paid to obtain, renew, reinstate or replace the insurance, or Owner may offset the cost against any monies that the Owner may owe Contractor.

G. *Reassessment of Contractor's Insurance Requirements.* At any time during the duration of this Contract, the Owner may require that Contractor obtain, pay for, and maintain more or less insurance depending on the Owner's assessment of any one or more of the following factors: (1) the Owner's risk of liability or exposure arising out of, or in any way connected with, Contractor's services under this Contract; (2) the nature or number of accidents, claims, or lawsuits arising out of, or in any way connected with, Contractor's services under this Contract; or (3) the availability, or affordability, or both, of increased liability insurance coverage. The Owner reserves the right to utilize a wrap insurance program for the Work of the Project. In the event the Owner implements a wrap program, Owner shall be entitled to reduce/credit the Contract Price in an amount equal to the premium for Contractor's insurance and its Subcontractors' insurance. Contractor agrees and will require its Subcontractors to cooperate with Owner in determining the amount of the credit due Owner and will provide Owner with true and correct copies of all existing and recent insurance policies and invoices for premiums.

5.05 *Blank*

5.06 *Blank*

5.07 *Blank*

5.08 *Blank*

5.09 *Acceptance of Bonds and Insurance; Option to Replace*

A. If Owner has any objection to the coverage afforded by or other provisions of the bonds or insurance required to be purchased and maintained by Contractor in accordance with

Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within 10 days after receipt of the certificates (or other evidence requested) required by Paragraph 2.01.A. Contractor shall each provide to the Owner such additional information in respect of insurance provided as the Owner may reasonably request. If Contractor does not purchase or maintain all of the bonds and insurance required of Contractor by the Contract Documents, Contractor shall notify the Owner in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the Owner may elect to obtain equivalent bonds or insurance to protect the Owner's interests at the expense of the Contractor, and a Change Order shall be issued to adjust the Contract Price accordingly.

5.10 *Blank*

ARTICLE 6 – CONTRACTOR'S RESPONSIBILITIES

6.01 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Contractor shall not be responsible for the negligence of Owner, Designer, or Engineer in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents. Contractor shall be responsible for making sure that the completed Work complies accurately with the Contract Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent, who shall be the individual designated by Contractor under Paragraph 2.06.B, and who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

   The resident superintendent shall be present at the Site of the Work at all times while Work is actually in progress on the Contract. When Work is not in progress and during periods when Work is suspended, arrangements acceptable to Engineer shall be made for any work which may be required under the Contract Documents.

C. Whenever the resident superintendent is not present on any particular part of the work where it may be desired to give direction, orders will be given by Engineer which shall be received and obeyed by the superintendent or foreman who may have charge of the particular work in reference to which the orders are given.

   Any order given by Engineer, not otherwise required by the Contract Documents to be in writing, will on request of Contractor, be given or confirmed by the Engineer in writing.

D. Contractor shall be skilled in the type of work required by the Contract Documents and shall be licensed in accordance with applicable law. Contractor shall perform at least 50 percent of the dollar value of the Work using personnel on its own payroll.

6.02 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.

Contractor shall remove any person performing Work upon written request by Engineer if the Engineer has reason to believe that such worker has behaved in a manner that demonstrates incompetence or other unsuitable behavior. Notwithstanding the forgoing, nothing in the Contract Documents imposes any obligation, responsibilities, or liabilities on Engineer and/or Owner for any incompetence or unsuitable behavior of any persons employed by Contractor (or any Subcontractor or Supplier), or any other persons allowed on the Site by a Contractor, Subcontractor or Supplier.

B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours. Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without Engineer's written consent (which will not be unreasonably withheld) given after prior written notice to Engineer. Eight hours labor constitutes a legal day's work in the state of California under California Labor Code section 1810.

C. This is a federally financed public works project subject to all applicable Federal and State Laws and Regulations governing public works projects, including but not limiting to any and all labor Laws and Regulations requiring the payment of prevailing wages. Contractor shall comply with all applicable Federal and State labor and prevailing wage Laws and Regulations, and shall comply with all labor and wage requirements referenced in sections 00200 and 00300 of the Contract Documents. Contractor shall also comply with the labor standard provisions set forth in Article 21.

6.03 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.

B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

D. All warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. Contractor is responsible for making sure that all such warranties and guaranties are transferable to, and enforceable by, Owner. Contractor agrees to assign to Owner at the time of final completion of the Work any and all manufacturer's warranties and guarantees relating to materials and labor used in the Work and Contractor further agrees to perform the Work in such a manner as to preserve any and all manufacturer's warranties and guarantees.

6.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.07 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.07) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times. Such adjustments will comply with any provisions of the General Requirements applicable thereto.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 12. Adjustments in Contract Times may only be made by a Change Order.

3. If Contractor desires to make a major change in the method of operations after commencing construction, or if the schedule fails to reflect the actual progress, Contractor shall submit to Engineer a revised Progress Schedule as soon as possible and prior to beginning revised operations.

4. Contractor shall submit to Engineer an updated Progress Schedule within 5 days of the Engineer's written request.

6.05 *Substitutes and "Or-Equals"*

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or-equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to Engineer for review under the circumstances described below.

1. *"Or-Equal" Items:* If in Engineer's sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Engineer as an "or-equal" item, in which case review and approval of the proposed item may, in Engineer's sole discretion, be accomplished without compliance with

some or all of the requirements for approval of proposed substitute items. For the purposes of this Paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that:

1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole; and

3) it has a proven record of performance and availability of responsive service.

b. Contractor certifies that, if approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

2. *Substitute Items:*

a. If in Engineer's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item under Paragraph 6.05.A.1, it will be considered a proposed substitute item.

b. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by Engineer from anyone other than Contractor.

c. The requirements for review by Engineer will be as set forth in Paragraph 6.05.A.2.d, as supplemented by the General Requirements, and as Engineer may decide is appropriate under the circumstances.

d. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:

1) shall certify that the proposed substitute item will:

a) perform adequately the functions and achieve the results called for by the general design,

b) be similar in substance to that specified, and

c) be suited to the same use as that specified;

2) will state:

a) the extent, if any, to which the use of the proposed substitute item will prejudice Contractor's achievement of Substantial Completion on time,

b) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and

c) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;

3) will identify:

a) all variations of the proposed substitute item from that specified, and

b) available engineering, sales, maintenance, repair, and replacement services; and

4) shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change.

B. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Engineer. Contractor shall submit sufficient information to allow Engineer, in Engineer's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The requirements for review by Engineer will be similar to those provided in Paragraph 6.05.A.2.

C. *Engineer's Evaluation*

1. *During Bidding.* The Contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents, or "or-equal" materials and equipment as defined in paragraph 6.05 of the General Conditions, or those substitute or materials and equipment approved by the Owner and identified by Addendum. The materials and equipment described in the Bidding Documents establish a standard of required type, function, and quality to be met by any proposed substitute or "or-equal" item. Request for Owner's clarification of materials and equipment considered "or-equal" prior to the Effective Date of the Agreement must be received by the Owner at least 10 days prior to the date for receipt of Bids. No item of material or equipment will be considered by Owner as a substitute unless written request for approval has been submitted by Bidder and has been received by Owner at least 15 days prior to the date for receipt of Bids. Each request shall conform to the requirements of Paragraph 6.05 of the General Conditions. The burden of proof of the merit of the proposed item is upon the

Bidder. Owner's decision of approval or disapproval of a proposed item will be final. If Owner approves any proposed substitute item, such approval will be set forth in an Addendum issued to all prospective Bidders. Bidders shall not rely upon approvals made in any other manner.

2. *After Effective Date of Agreement.* Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraphs 6.05.A and 6.05.B. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No "or equal" or substitute will be ordered, installed or utilized until Engineer's review is complete, which will be evidenced by a Change Order in the case of a substitute and an approved Shop Drawing for an "or equal." Engineer will advise Contractor in writing of any negative determination.

D. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

E. *Engineer's Cost Reimbursement*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor pursuant to Paragraphs 6.05.A.2 and 6.05.B. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

F. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute or "or-equal" at Contractor's expense.

6.06 *Concerning Subcontractors, Suppliers, and Others*

A. No later than 14 days after the Effective Date of the Agreement by Contractor and Owner, Contractor shall furnish Owner and Engineer, in writing, with the names of all persons or entities proposed as manufacturers of the products identified in the Specifications (including those who are to furnish materials or equipment fabricated to a special design) and, where applicable, the name of the installing Subcontractor. Contractor shall not employ any Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, against whom Owner may have reasonable objection. Contractor shall not be required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom Contractor has reasonable objection.

Contractor is solely responsible for which Subcontractor, Supplier, or any other individual or entity it uses to furnish or perform any of the Work, and Owner's failure to object to any such Subcontractor, Supplier, or other individual or entity does not in any way relieve Contractor of this responsibility. No act or omission by Owner or Engineer shall be construed as an acceptance or approval of any such Subcontractor, Supplier, or individual or entity. No act or omission by Owner or Engineer shall be construed as a waiver of any right of Owner or Engineer to reject defective Work.

Every Subcontractor shall be skilled in the type of work required by the Contract Documents and shall be licensed in accordance with applicable law.

B. Contractor shall comply with the Subcontractor Listing Laws set forth in California Public Contract Code sections 4100-4114. If Owner consents to Contractors request for substitution of a Subcontractor pursuant to Public Contract Code section 4107, such consent shall not be deemed an approval or acceptance of a Subcontractor, but merely Owner's determination that such consent is authorized under the statute.

Pursuant to Public Contract Code section 4114, Owner's functions under Public Contract Code sections 4107 and 4110 are delegated to the County's Director of Public Works (or his designee). Contractor shall provide all data in support of any Subcontractor substitution request. Owner will be allowed a reasonable time within which to evaluate such request, and may require Contractor to furnish additional data regarding the requested substitution. All data provided by Contractor regarding the requested substitution shall be at Contractor's sole expense. Whether or not Owner approves the requested substitution proposed by Contractor, Contractor shall reimburse Owner for the reasonable charges of Owner for Owner's time and expense in evaluating the requested substitution. Regardless of whether or not Owner approves a requested substitution, Contractor shall not be entitled to any additional Contract Time or any increase in Contract Price for any time delays relating to a resolution of a Subcontractor substitution request so long as Owner did not unreasonably delay the processing of the request.

If Owner's decision on a Subcontractor substitution request is challenged in court, under no circumstances shall Contractor be entitled to any additional Contract Time or any increase in Contract Price if Owner's decision was to consent to a Subcontractor substitution requested by Contractor. Furthermore, Contractor shall indemnify Owner from all claims and/or court actions challenging the Owner's approval of any Subcontractor substitution requested by Contractor, regardless of whether the claim or action seeks legal or equitable relief, so that any and all costs or damages incurred by Owner relating to said claims and/or actions shall be paid by Contractor. If an Owner's decision to deny a Subcontractor substitution requested by Contractor is overruled by a court, Contractor shall not be entitled to any additional Contract Time or any increase in Contract Price for any associated time delays unless the court expressly finds that (1) Owner acted in an arbitrary and capricious manner and (2) Owner's conduct caused an unnecessary delay.

C. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents:

1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier or other individual or entity; nor

2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

D. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.

E. Contractor shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with Engineer through Contractor.

F. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

G. *Blank*

H. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor on account of Work performed for Contractor by a particular Subcontractor or Supplier.

I. Contractor shall not award work valued at more than fifty (50%) of the Contract Price to Subcontractor(s).

J. All subcontracts shall be in writing and shall specifically provide that Owner is an intended third-party beneficiary of said subcontract.

K. All Work performed for Contractor by a Subcontractor or Supplier will be pursuant to a signed written agreement between Contractor and Subcontractor or Supplier which specifically binds Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer. Each and every agreement between Contractor and any Subcontractor or Supplier shall provide for Contractor's assignment of the agreement to Owner, at Owner's option, in the event of a termination by Owner under Paragraphs 15.02 or 15.03. By executing the Agreement that is part of these Contract Documents, Contractor hereby assigns to Owner each agreement entered into by Contractor and any Subcontractor or Supplier, subject to the following two conditions subsequent: (1) Owner exercises its right to terminate Contractor’s services pursuant to Paragraphs 15.02 or 15.03; and (2) Owner notifies in writing the Contractor and the Subcontractor/Supplier of the particular agreement that (a) Owner is exercising its right under this paragraph to accept an assignment of that particular agreement, and (b) the date upon which the assignment is being accepted by Owner. Under this paragraph, Owner has the right to only accept those assignments which Owner believes is in its best interest. Only those particular agreements expressly and specifically accepted by Owner pursuant to this paragraph shall be deemed assigned to Owner.

L. Upon the request of Owner or Engineer, Contractor shall provide Engineer a copy of any requested subcontract within five (5) days of the request.

6.07 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner, Designer, or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.

B. *Blank*

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner, Designer, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

D. Neither the approval of any material or equipment proposed by Contractor under Paragraph 6.05.A, nor the approval of any substitute means, method, technique, sequence, or procedure of construction approved under Paragraph 6.05.B. shall constitute an "invention, design, process, product, or device specified in the Contract Documents" under this Paragraph 6.07. Contractor shall pay all license fees and royalties and assume all costs incident to the use of any such material, equipment, means, method, technique, sequence, or procedure of construction approved under Paragraph 6.05.A. or 6.05.B. which is the subject of any patent rights or copyrights held by others.

6.08 *Permits*

A. Unless otherwise provided in the Specifications, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. Contractor shall pay all charges of utility owners for connections to the Work, and Owner shall pay all charges of such utility owners for costs related to providing post construction service to the Work. All such payment of fee, charges, permits, and licenses by Contractor under this Paragraph 6.08 shall be considered as included in the prices paid for the various Contract items of Work and no additional payment will be made therefor.

6.09 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work. Contractor shall indemnify and hold harmless Owner, Engineer, Designer, the State Water Resources Control Board, and the California Infrastructure and Economic Development Bank and each of their respective trustees, officers, directors, members, partners, employees, agents, and consultants from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any agency or body against Owner relating to such Work performed by Contractor contrary to Laws and Regulations (including, without limitation, the Federal Comprehensive Environmental Response, Compensation and Liability Act, the Resource Conservation and Recovery Act, the California Hazardous Substance Account Act, the Federal Water Pollution Control Act, the Clean Air Act, the California Hazardous Waste Control Law and California Water Code Section 13304). The duty to defend shall apply notwithstanding any alleged or actual concurrent negligence (active or passive) or partial fault on the part of any person or entity indemnified hereunder.

C. Any new Laws or Regulations adopted after the time of opening of Bids that cause an effect on the cost or time of performance of the Work shall be the subject of an adjustment in Contract Price or Contract Times. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of any such adjustment, Contractor may submit a Claim as provided in Paragraph 10.05. Similarly, if Contractor disagrees with a unilateral adjustment in Contract Price or Contract Times made by Owner, Contractor may submit a Claim as provided in Paragraph 10.05.

D. The date upon which a new Law or Regulation is adopted shall be determined by the date it was formally adopted by the governing body or officer authorized to adopt the Law or Regulation, and not by its effective date. (For example, California Senate Bill 189 (SB189, Stats 2010, c. 697), which was approved by the Governor of September 30, 2010, but contains provisions which are not effective until July 1, 2012, would not be considered a new Law or Regulation, even if the opening of Bids is before July 1, 2012.) Contractor shall not be entitled to any adjustment in Contract Price or Contract Time when the new Law or Regulation is an Order specifically directed towards Contractor that relates to Contractor's past or present conduct, or other circumstances within Contractor's control or responsibility.

6.10 *Taxes*

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

6.11 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas:*

1. Contractor shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.

2. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.

3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner, Engineer, Designer, the State Water Resources Control Board, the California Infrastructure and Economic Development Bank, and each of their respective trustees, officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work. The duty to defend shall apply notwithstanding any alleged or actual concurrent negligence (active or passive) or partial fault on the part of any person or entity indemnified hereunder.

B. *Removal of Debris During Performance of the Work:* During the progress of the Work Contractor shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

C. *Cleaning:* Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading Structures:* Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.12 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, and written interpretations and clarifications in good order and annotated to show changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to Engineer for reference. Upon completion of the Work, these record documents, Samples, and Shop Drawings shall be delivered by Contractor to Engineer for Owner.

6.13 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. This requirement shall apply continuously, including days when Work is suspended, and shall not be limited to normal working hours. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

1. all persons on the Site or who may be affected by the Work, including but not limited to members of the public using any adjoining road or right of way;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, fences, wall, signs, buildings, all highway facilities and Underground Facilities, and any other improvements or facilities within or adjacent to the Work not designated for removal, relocation, or replacement in the course of construction.

B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.

1. Contractor shall maintain at its office or other well-known place at the Project Site, the appropriate items for giving first aid to the injured, and shall establish the procedure for the immediate removal to a hospital or a doctor's care of persons (including employees) who may be injured on the Project Site.

2. No review or inspections by Owner or Engineer shall relieve Contractor of its responsibilities under this Paragraph 6.13.

3. If death or serious injuries or serious damages are caused, the accident shall be reported immediately by telephone or messenger to Engineer and Owner. In addition, Contractor must promptly report in writing to Engineer all accidents whatsoever arising out of, or in connection with, the performance of the Work whether on, or adjacent to the Site, giving full details and statements of witnesses. Nothing in this paragraph shall excuse Contractor from reporting any accident, damage, injuries, or fatalities to any other person, entity, or agency as may be required by Laws or Regulations.

4. For all excavations in excess of five (5) feet, Contractor shall, pursuant to Labor Code Section 6705, submit in advance of any excavation hereunder a detailed plan showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection from caving ground. No such excavation shall be made until said detailed plan is submitted by Contractor and accepted by Engineer. If such plan varies from the shoring system standards, the plan shall be prepared by a registered civil or structural engineer. Nothing in this paragraph shall be deemed to allow the use of a shoring, sloping, or protective system less effective than that required by the Construction Safety Orders of the California Division of Occupational Safety and Health. Nothing in this paragraph shall be construed as imposing any liability upon Owner or Engineer.

5. Contractor shall comply with applicable occupational safety and health standards, rules, regulations, and orders. The Occupational Safety and Health Standards Board is the only agency authorized in the State to adopt and enforce occupational safety and health standards (Labor Code § 142 et seq.). Contractor is the controlling employer and must ensure hazardous conditions are corrected (Labor Code § 6400).

6. Contractor shall submit to Engineer copies of its Injury and Illness Prevention Program and permits required by Cal/OSHA.

C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Specifications identify any Owner's safety programs that are applicable to the Work.

D. Contractor shall notify Owner and Engineer in writing of the specific requirements of Contractor's safety program and Owner's and Engineer's employees and representatives shall comply therewith while at the Site, so long as said requirements do not unreasonably interfere with Owner's and Engineer's functions at the Site.

E. All damage, injury, or loss to any property referred to in Paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be the responsibility of Contractor and shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or Designer or anyone employed by any of them, or

anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

F. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

G. Full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the Work involved in protecting person or property or repairing property, as specified in the Contract Documents shall be considered as included in the prices paid for the various contract items of Work and no additional compensation will be allowed therefor.

6.14 *Safety Representative*

A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

6.15 *Hazard Communication Programs*

A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with all applicable Laws or Regulations.

6.16 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall immediately notify Engineer of emergency. Contractor shall also provide Engineer written notice as soon as feasible, and in no instance later than the end of the next business day after the day on which the alleged emergency occurred, if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

6.17 *Shop Drawings and Samples*

A. Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals (as required by Paragraph 2.07). Each submittal will be identified as Engineer may require.

1. *Shop Drawings:*

    a. Submit 5 copies.

    b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 6.17.D.

2. *Samples:*

    a. Submit number of Samples specified in the Specifications.

    b. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 6.17.D.

B. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Submittal Procedures:*

1. Before submitting each Shop Drawing or Sample, Contractor shall have:

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

    b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

    c. determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

    d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.

3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the

Contract Documents. This notice shall be both a written communication separate from the Shop Drawings or Sample submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.

4. The practice of submitting incomplete or unchecked Shop Drawings for Engineer to correct or finish will not be acceptable; and Shop Drawings which, in the opinion of Engineer, clearly indicate that they have not been checked by Contractor will be considered as not complying with the intent of the Contract Documents and will be returned to Contractor for resubmission in the proper form.

D. *Engineer's Review:*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

3. Engineer's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.17.C.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C.1.

4. After the Shop Drawings have been reviewed by Engineer, two sets of submittals will be returned to Contractor appropriately stamped. If major changes or corrections are necessary, the Shop Drawings may be rejected and one set will be returned to Contractor with such changes or corrections indicated.

E. *Resubmittal Procedures:*

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

   If Contractor makes any changes to resubmitted Shop Drawings other than those changes indicated by Engineer, Contractor shall provide Engineer written notice of

such changes. This notice shall be both a written communication separate from the Shop Drawings; and, in addition, by a specific notation made on each Shop Drawing submitted to Engineer for review and approval of each such variation.

F. Contractor shall furnish required submittals with sufficient information and accuracy in order to obtain required approval of an item with no more than three submittals. Engineer will record Engineer's time for reviewing subsequent submittals of Shop Drawings, samples, or other items requiring approval and Contractor shall reimburse Owner for Engineer's charges for such time.

G. In the event that Contractor requests a change of a previously approved item, Contractor shall reimburse Owner for Engineer's charges for its review time unless the need for such change is beyond the control of Contractor.

6.18 *Continuing the Work*

A. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Engineer and/or Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements.

6.19 *Contractor's General Warranty and Correction Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be performed and installed in accordance and conformance with the Contract Documents, will be of good quality and new, and will not be defective. Owner and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on the Contractor's warranty and guarantee made hereunder or in any separate warranties by Contractor, its Subcontractors and Suppliers.

B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, modification, improper maintenance, or improper operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

This warranty is not limited by the provisions of Paragraph 13.07 herein, relating to Contractor's correction period. The provisions of this Paragraph 6.19 shall survive Contractor's completion of the Work or termination of the Contractor's performance of the Work. Contractor's surety shall be liable for breaches of this warranty and the correction obligations described in this Paragraph 6.19 and in Paragraph 13.07.

C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

1. observations by Engineer;

2. recommendation by Engineer or payment by Owner of any progress or final payment;

3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. use or occupancy of the Work or any part thereof by Owner;

5. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer;

6. any inspection, lack of inspection, test, or approval by Engineer or others; or

7. any correction of defective Work by Owner.

D. In addition to the Contractor's general warranty provided in Paragraphs 6.19.A and 6.19.B, Contractor hereby agrees to make, at its own expense, all repairs or replacements necessitated by defective Work, including defects in material or workmanship, supplied under terms of this Contract, which become evident within one year after the date of final acceptance of the Work, or such longer period of time as may be prescribed by the terms of any applicable special guarantee or warranty periods specified in the Contract Documents. After being deemed substantially complete by Engineer and Owner, Contractor shall also warranty its work against trench settlement for a period of three years after the date of final acceptance by Owner, or such longer period of time as may be prescribed by the terms of any applicable special guarantee or warranty periods specified in the Contract Documents.

E. Contractor shall make all repairs and replacements promptly upon receipt of written notice for same from Owner. If Contractor fails to make the repairs and replacements in a timely manner, Owner may do the work, and Contractor and its surety shall be liable for the cost thereof.

6.20 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, Contractor shall defend, indemnify and hold harmless Owner, Designer, Engineer, the State Water Resources Control Board, and the California Infrastructure and Economic Development Bank, and each of their respective trustees, officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property, including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable. The duty to defend shall apply notwithstanding any alleged or actual concurrent negligence (active or passive) or partial fault on the part of any person or entity indemnified hereunder.

B. In any and all claims against Owner, Designer, Engineer, the State Water Resources Control Board, or the California Infrastructure and Economic Development Bank, or any of their trustees, officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

C. The indemnification obligations of Contractor under Paragraph 6.20.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of any of the following acts or omissions of Engineer or Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors:

1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or

2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

D. The indemnification obligations of Contractor under Paragraph 6.20.A shall not extend to the liability of Designer and Designer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of any of the following acts or omissions of Designer or Designer's officers, directors, members, partners, employees, agents, consultants and subcontractors:

1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or

2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

6.21 *Delegation of Professional Design Services*

A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.

B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other

submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.

C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.

D. Pursuant to this Paragraph 6.21, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.D.1.

E. Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

6.22 *Daily Reports*

A. Contractor shall complete a daily report on forms provided by Engineer (and approved by Owner) that sets forth the daily progress and status of the Work. The daily report is due at the conclusion of each work day, and shall be signed and submitted by Contractor to Engineer no later than the close of the next working day. Failure to submit the completed daily report by the close of the next working day shall constitute a breach of this Contract. Reports by Subcontractors or others shall be submitted through Contractor.

B. Acceptance of the daily report by the Engineer does not constitute any agreement or acquiescence by Engineer or Owner that the information contained therein is accurate or complete. If the Engineer requests the Contractor to resubmit the daily report with more complete or accurate information, the Contractor shall respond to such requests within 24 hours by resubmitting a revised daily report. The daily report shall set forth the daily progress and status for each component of the Work requested by the Engineer, and shall inform the Engineer of any events, issues or circumstances which Contractor believes may lead Contractor to seek an adjustment in Contract Price or Contract Time. The daily report shall also include applicable delivery tickets, listing all labor, materials, and equipment involved for that day, and other services and expenditures when authorized. In addition to any other information requested by the Engineer on the form, the report shall also:

1. Show names of workers, classifications, and hours worked.

2. Describe and list quantities of materials used.

3. Show type of equipment, size, identification number, and hours of operation, including loading and transportation, if applicable (and noting periods of time when said equipment is out of service, if applicable).

4. Describe other services and expenditures in such detail as the Engineer or Owner may require.

6.23 *Payroll Record of Wages Paid*

A. Contractor shall submit, weekly, a copy of certified payroll records, including those of Subcontractors. Payroll records shall include:

1. each employees showing the full name; address; social security number; work classification; straight time and overtime hours worked each day and week; actual per diem wages paid to each journeyman, apprentice, worker, or other employee employed in connection with the Work; pay rate; itemized deductions made; check number issued; and

2. apprentices and the apprentice-to-journeyman ratio.

B. Each certified payroll shall be accompanied by a statement of compliance, on a form acceptable to the Engineer, signed by the employer or the employer's agent indicating that the payrolls are correct and complete and that the wage rates contained therein are not less than those required by the Contract.

C. The payroll records shall be available for inspection at all reasonable hours at Contractor's principal office upon the basis set forth in Section 1776 of the Labor Code, and Contractor shall comply fully with all of the provisions thereof and of any rules adopted pursuant thereto.

D. In the event of noncompliance with the requirements of such section after 10 days written notice specifying in what respects compliance is required Contractor shall forfeit as a penalty to Owner, $25.00 for each calendar day, or portion thereof, for each worker, until strict compliance is effectuated. Upon the request of the Division of Apprenticeship Standards or the Division of Labor Standards Enforcement, such penalties shall be withheld from progress payments then due.

E. Contractor and each Subcontractor shall preserve their payroll records for a period of 3 years from the date of final payment.

6.24 *Disadvantaged Business Enterprises Utilization Report*

A. Contractor shall submit, with each progress payment request, a DBE Utilization Report on a form furnished by the Engineer (and approved by Owner).

ARTICLE 7 – OTHER WORK AT THE SITE

7.01 *Related Work at Site*

A. Owner may perform other work related to the Project at the Site with Owner's employees, or through other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:

1. written notice thereof will be given to Contractor prior to starting any such other work; and

2. if Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in Paragraph 10.05.

B. Contractor shall afford each other contractor who is a party to such a direct contract, each utility owner, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work, and properly coordinate the Work with theirs. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected. The duties and responsibilities of Contractor under this Paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of Contractor in said direct contracts between Owner and such utility owners and other contractors.

C. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 7, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

7.02 *Coordination*

A. Unless otherwise provided in the Contract Documents, Contractor shall be responsible for coordinating the performance of its Work with the performance of other work on the Project at the Site.

7.03 *Legal Relationships*

A. Paragraphs 7.01.A and 7.02 are not applicable for utilities not under the control of Owner.

B. Each other direct contract of Owner under Paragraph 7.01.A shall provide that the other contractor is liable to Owner and Contractor for the reasonable direct delay and disruption costs incurred by Contractor as a result of the other contractor's wrongful actions or inactions.

Only those contracts between Owner and an independent contractor hired by Owner to perform specific work pursuant to Owner's specifications shall constitute a "direct contract" of Owner under Paragraph 7.01.A. Any contract relating to any facilities

owned by a utility, regardless of whether Owner is contracting with the utility company or some other individual or entity authorized to perform work relating to said facilities, does not constitute a "direct contract" of Owner under Paragraph 7.01.A.

C. Contractor shall be liable to Owner and any other contractor under direct contract to Owner for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's wrongful action or inactions.

7.04 *Claims Between Contractors*

A. Should Contractor cause damage to the work or property of any other contractor at the Site, or should any claim arising out of Contractor's performance of the Work at the Site be made by any other contractor against Contractor, Owner, or Engineer, then Contractor shall (at no cost to Owner or Engineer) either (1) remedy the damage, (2) agree to compensate the other contractor for remedy of the damage, or (3) remedy the damage and attempt to settle with such other contractor by agreement, or otherwise resolve the dispute by arbitration or at law.

B. Contractor shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer and the officers, directors, partners, employees, agents and other consultants and subcontractors of each and any of them from and against all claims, costs, losses and damages (including, but not limited to, fees and charges of engineers, architects, attorneys, and other professionals and court and arbitration costs) arising directly, indirectly or consequentially out of any action, legal or equitable, brought by any other contractor against Owner or Engineer to the extent said claim is based on or arises out of Contractor's performance of the Work. Should another contractor cause damage to the Work or property of Contractor or should the performance of work by any other contractor at the Site give rise to any Claim, Contractor shall not institute any action, legal or equitable, against Owner or Engineer or permit any action against any of them to be maintained and continued in its name or for its benefit in any court or before any arbiter which seeks to impose liability on or to recover damages from Owner or Engineer on account of any such damage or Claim.

C. If Contractor is delayed at any time in performing or furnishing the Work by any act or neglect of another contractor, and Owner and Contractor are unable to agree as to the extent of any adjustment in Contract Times attributable thereto, Contractor may make a Claim for an extension of times in accordance with Paragraph 10.05. An extension of the Contract Times shall be Contractor's exclusive remedy with respect to Owner and Engineer for any delay, disruption, interference, or hindrance caused by any other contractor.

ARTICLE 8 – OWNER'S RESPONSIBILITIES

8.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

8.02 *Replacement of Engineer*

A. In case of termination of the employment of Engineer, Owner shall appoint an engineer whose status under the Contract Documents shall be that of the former Engineer.

8.03 *Furnish Data*

A. Owner shall furnish the data required of Owner under the Contract Documents in a timely manner.

8.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in Paragraphs 14.02.C and 14.07.C.

8.05 *Lands and Easements; Reports and Tests*

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 4.01. Paragraph 4.02 refers to Owner's identifying and making available to Contractor copies of certain reports of explorations and tests of subsurface conditions at or contiguous to the Site, if any, and drawings of physical conditions relating to existing surface or subsurface structures (other than Underground Facilities)at the Site.

8.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 5.

8.07 *Change Orders*

A. Owner is obligated to execute Change Orders as indicated in Paragraph 10.03.

8.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 13.03.B.

8.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

8.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 4.06.

8.11 *Blank*

8.12 *Compliance with Safety Program*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed pursuant to Paragraph 6.13.D.

ARTICLE 9 – ENGINEER'S STATUS DURING CONSTRUCTION

9.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract Documents.

9.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 9.09. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

9.03 *Project Representative*

A. An employee of Engineer shall act as a Resident Project Representative to assist Engineer in providing more extensive observation of the Work. The authority and responsibilities of any such Resident Project Representative and assistants shall include the authority to transmit instructions, receive information, and perform other acts Engineer is authorized to perform under the Contract Documents. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Specifications.

Other duties, responsibilities, and limitations of authority of the Resident Project Representative are located in the written agreement between Engineer and Owner for this specific Project (which agreement may be amended by Engineer and Owner from time to time).

9.04 *Authorized Variations in Work*

A. Engineer may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on Owner and also on Contractor, who shall perform the Work involved promptly If Contractor believes that a Field Order should instead have been issued as a Change Order because that Field Order justifies an adjustment in the Contract Price or Contract Times, or both, and the parties are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, Contractor's exclusive remedy is set forth in Paragraph 10.05. A notice stating the general nature of such a Claim for adjustment to the Contract Times or Contract Price, as a result of the issuance of a Field Order, shall be submitted by Contractor, under Paragraph 10.05.B, before Contractor performs any portion of the Field Order work for which Contractor believes an adjustment to the Contract Time or Contract Price should be made, unless an emergency comparable to conditions under Paragraph 6.16 requires the performance of the Field Order before such a notice can be submitted by Contractor.

B. Contractor shall acknowledge in writing the receipt of all Field Orders. Contractor’s acknowledgement of receipt does not preclude Contractor from submitting a Claim pursuant to Paragraphs 9.04 and 10.05. The lack of any such acknowledgement does not affect Contractor’s obligation to comply with the Field Order.

9.05 *Rejecting Defective Work*

A. Engineer will have authority to reject Work which Engineer believes to be defective, or that Engineer believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Engineer will also have authority to require special inspection or testing of the Work as provided in Paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

9.06 *Shop Drawings, Change Orders and Payments*

A. In connection with Engineer’s authority, and limitations thereof, as to Shop Drawings and Samples, see Paragraph 6.17.

B. In connection with Engineer’s authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21.

C. In connection with Engineer’s authority as to Change Orders, see Articles 10, 11, and 12.

D. In connection with Engineer's authority as to Applications for Payment, see Article 14.

9.07 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Contractor, subject to the provisions of Paragraph 10.05.

9.08 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. Any questions by Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to Engineer in writing within 7 days of the event giving rise to the question.

B. Engineer will, with reasonable promptness, render a written decision on any such questions referred by Contractor. If Contractor believes that any such decision entitles it to an adjustment in the Contract Price or Contract Times or both, Contractor's exclusive remedy is set forth in Paragraph 10.05. The date of Engineer's decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B. If no written decision is issued by Engineer within 30 days of Contractor's written question(s), a written decision shall be deemed to have been issued on said 30th day by Engineer that resolves every such question raised by Contractor in a manner that would be the most unfavorable to Contractor's position, such that the decision would not entitle Contractor to any adjustment in Contract Price and/or Contract Time.

C. Engineer's written decision on any questions referred by Contractor will be final and binding on Contractor, subject to the provisions of Paragraph 10.05.

9.09 *Limitations on Engineer's Authority and Responsibilities*

A. *Blank*

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 14.07.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with, the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 9.09 shall also apply to the Resident Project Representative, if any, and assistants, if any.

9.10 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Engineer has been informed pursuant to Paragraph 6.13.D.

9.11 *Lines and Grades*

A. Engineer's duties with respect to providing stakes and marks are set forth in Paragraph 4.05.

ARTICLE 10 – CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided in the Change Order or Work Change Directive).

B. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made by Contractor as provided in Paragraph 10.05.

C. If, after issuance of a Work Change Directive, the Owner and Contractor do not agree on the appropriate adjustment in Contract Price and/or Contract Times, if any, that should be allowed as a result of the Work Change Directive, the Owner may issue a Unilateral Change Order stating the adjustment, if any, that is being made to the Contract Price and/or Contract Times as a result of the Work Change Directive. If Contractor believes it is entitled to any further adjustment in Contract Price and/or Contract Time, or any other relief, as a result of the Work Change Directive, Contractor's exclusive remedy is set forth in Paragraph 10.05.

10.02 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in Paragraph 3.04, except in the case of an emergency as provided in Paragraph 6.16 or in the case of uncovering Work as provided in Paragraph 13.04.D.

10.03 *Execution of Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders recommended by Engineer covering:

1. changes in the Work which are: (i) ordered by Owner pursuant to Paragraph 10.01.A, (ii) required because of acceptance of defective Work under Paragraph 13.08.A or Owner's correction of defective Work under Paragraph 13.09, or (iii) agreed to by the parties;

2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and

B. A Change Order that adjusts the Contract Price, or the Contract Time, or both, shall be accomplished only by a written and executed Change Order. Accordingly, no course of conduct or dealings between the parties, no expressed or implied acceptance of alterations or additions to the Work, and no assertion that Owner has been unjustly enriched by any alterations or additions to the Work shall be the basis for an increase in any amount due under the Contract Documents or in any time period provided for in the Contract Documents, unless executed as a Change Order under this Paragraph 10.03. A Bilateral Change Order shall constitute a final settlement of all matters relating to the change in the Work that is the subject of the Change Order, including, but no limited to, all direct and indirect costs associated with such change and any and all adjustments to the Contract Price and the Contract Times.

C. Whenever an adjustment in Contract Price and/or Contract Times is warranted under the Contract Documents, but the Owner and Contractor cannot agree to the amount of adjustment, if any, that should be allowed to the Contract Price and/or Contract Times, the Owner may issue a Unilateral Change Order stating the adjustment, if any, that is being made to the Contract Price and/or Contract Times. If any unilateral adjustment to the Contract Price and/or Contract Times is not acceptable to Contractor for any reason, including any argument that an adjustment to the Contract Price and/or Contract Times was not warranted by the Contract Documents, the Contractor's exclusive remedy is to follow the Claim process set forth in Paragraph 10.05. A Unilateral Change Order may be jointly signed by the Engineer, but the Engineer's signature is not required. Unless otherwise obligated under applicable law, the Owner is not obligated to issue a Unilateral Change Order.

D. In the event a Change Order increases the Contract Price, Contractor shall include the Work covered by such Change Order in applications for payments as if such Work were originally part of the Agreement.

10.04 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), and such notice has not been consented to in advance by the surety, the giving of any such notice will be Contractor's responsibility. It shall be Contractor's responsibility to ensure that the amount of each applicable bond is adjusted to reflect the effect of any such change.

10.05 *Claims*

A. *Mandatory Procedure and Condition Precedent.*

1. Any demand or assertion by Contractor seeking an adjustment of Contract Price and/or Contract Times, or other relief, for any reason whatsoever, must be in strict compliance with the requirements of this Paragraph 10.05. For purposes of this Paragraph 10.05, any and all work relating to any such demand or assertion shall be referred to as "Disputed Work", regardless of whether the basis of the demand or assertion arises from an interpretation of the Contract Documents, an action or inaction of Contractor, Engineer or Owner, or any other event, issue, or circumstance. In order for any such demand or assertion to qualify as a "Claim", it must strictly comply with the provisions of this Paragraph 10.05. Contractor shall bear all costs incurred in complying with the provisions of this Paragraph 10.05.

2. The requirements set forth in this Paragraph 10.05 are mandatory, and Contractor shall strictly comply with these requirements. Strict compliance with these requirements is a condition precedent to Contractor's ability to exercise any rights or remedies that may otherwise be available to Contractor under the Contract Documents or any applicable Laws or Regulations relating to the Claim. No action or inaction by Contractor, Owner, and/or Engineer to try to resolve any Claim(s) through agreement (including Change Order), mediation, settlement, or any other means shall excuse Contractor from strictly complying with the requirements of this Paragraph 10.05. Notwithstanding any other language in the Contract Documents that permits Contractor to submit a Claim under Paragraph 10.05 in the event Contractor, Engineer, and/or Owner are unable to reach an agreement on any particular issue, Contractor shall strictly comply with requirements of this Paragraph 10.05, and shall not delay compliance with any requirements herein on the grounds that Contractor, Engineer, and/or Owner were trying to reach an agreement on any issue relating to the Claim.

3. Contractor's strict compliance with the requirements of this Paragraph 10.05 serves the important purpose of facilitating the Owner's management of its budget for not only this Contract, but also for other contracts relating to the sewer collection system. This Contract is but one of numerous prime contracts for the construction of the sewer collection system, and Contractor's strict compliance with this Paragraph 10.05 provides the Owner with the prompt notice of potential and actual Claims needed for budget management purposes. This Paragraph 10.05 also serves the important public purpose of providing the Owner a means of verifying the basis for the expenditure and/or reduction of the public funds or resources sought by a Claim.

Another purpose of the requirements in this Paragraph 10.05 is to promptly provide Engineer and Owner with information that may enable Owner and Contractor to resolve Contractor's Claim through a Bilateral Change Order.

4. Contractor's compliance with the provisions of this Paragraph 10.05 shall not excuse Contractor's failure to comply with any other provisions of the Contract Documents, including but not limited to, any provisions relating to Contractor's obligation to provide any notice, documentation, inspections, Site access, or any other requirements relating to any event, issue, or circumstance (including, but not limited to, any documentation required by Paragraph 11.01.D). Contractor's compliance with the provisions of this Paragraph 10.05 shall not excuse Contractor's failure to provide notice of any event, issue, or circumstance, or to perform any other duties expressed or implied in Contract Documents, at the time Contractor reasonably should have been aware of the event, issue, or circumstance. Nothing in this Paragraph 10.05 shall extend any time deadlines provided in any other provisions in the Contract Documents.

5. Pursuant to the Claim requirements set forth in this Paragraph 10.05, the Contractor's submittal of an Initial Notice of Potential Claim, Supplemental Notice of Potential Claim, and updated Supplemental Notices of Potential Claim will provide the Contractor and Engineer multiple opportunities to meet and confer regarding a potential Claim before it becomes a final Claim. In addition to the important public purpose of providing a means of verifying the basis for the expenditure and/or reduction of public resources sought by a Claim, the notice and reporting requirements imposed upon Contractor under this Paragraph 10.05 promote regular, periodic communications of updated information regarding a potential claim before it becomes a final claim so that final claims can be processed more efficiently. Such communication may also help facilitate resolution of the potential Claim. If Contractor or Engineer request an informal conference to discuss a potential Claim, such a conference may be held at a mutually convenient time. Once a Notice of Final Claim is filed, Paragraph 10.05.E. shall govern the scheduling of any informal conference to meet and confer for settlement of the Claim. No action or inaction by Contractor, Engineer, and/or Owner relating to any conference to discuss a potential or final Claim shall excuse Contractor from strictly complying with the requirements of this Paragraph 10.05.

6. For Claims less than or equal to $375,000, Paragraphs 10.05 and 10.06 shall be interpreted in a manner consistent with Public Contract Code sections 20104 and 20104.2. The substance of Public Contract Code sections 20104 and 20104.2 have been incorporated into Paragraphs 10.05 and 10.06 in a manner that is consistent with the notice requirements provided in the Contract Documents.

B. Initial Notice of Potential Claim.

Promptly upon becoming aware of any event, issue, or circumstance which Contractor believes provides a basis for an adjustment of Contract Price and/or Contract Times, or other relief, Contractor shall provide a signed written Initial Notice of Potential Claim to Engineer and Owner. The Initial Notice of Potential Claim shall be submitted before

commencing any Disputed Work, or within 7 days of the event, issue, or circumstance from which the Claim arises, whichever is earlier.

The Initial Notice of Potential Claim shall clearly state the Contractor's grounds for seeking an adjustment in Contract Price and/or Contract Times or other relief, the nature and circumstances of the Disputed Work, the relief or adjustment sought by Contractor, and a cost proposal for the Disputed Work. The Initial Notice of Potential Claim shall be submitted on a form furnished by the Engineer (and approved by Owner) and shall be certified under penalty of perjury with reference to the California False Claims Act, Government Code Sections 12650-12655. Contractor shall assign an exclusive identification number for each potential Claim, determined by chronological sequencing, based on the date of the potential Claim. The nature and circumstances involved in the dispute shall remain consistent throughout the processing of the Claim.

The exclusive identification number for each Claim shall be used on the following corresponding documents:

1. Initial Notice of Potential Claim.

2. Supplemental Notice of Potential Claim.

3. Notice of Final Claim.

4. Contractor's written statement of Claims under Paragraph 14.07.A.2.

After reviewing Contractor's initial notice, Engineer may provide a written response thereto or may decide to delay providing a response until Contractor provides further information regarding the potential Claim pursuant to the provisions of this Paragraph 10.05. No response by Engineer that could be interpreted as suggesting that Contractor is entitled to an increase Contract Price or Contract Time is binding upon Owner unless Owner has co-signed the response.

C. *Supplemental Notice of Potential Claim:* Within 15 days of submitting the Initial Notice of Potential Claim, Contractor shall provide a signed Supplemental Notice of Potential Claim to Engineer and Owner that provides the following information:

1. The complete nature and circumstances of the dispute which caused the potential Claim.

2. The contract provisions that provide the basis of the potential Claim.

3. The requested adjustment of Contract Price, if any, and the estimated cost of the potential Claim, including an itemized breakdown of individual costs and how each estimate was determined.

4. The requested adjustment of Contract Time, if any, and a time impact analysis of the Progress Schedule that illustrates the effect on the scheduled completion date due to schedule changes or disruptions.

The information provided by Contractor shall provide Contractor's complete reasoning for additional compensation or adjustments and shall be as complete as reasonably possible.

The Supplemental Notice of Potential Claim shall be submitted on a form furnished by Engineer (and approved by Owner) and shall be certified under penalty of perjury with reference to the California False Claims Act, Government Code Sections 12650-12655. If at any time the estimated cost of the potential Claim or effect on the Progress Schedule changes, Contractor shall update information in items 3 and 4 above as soon as the change is recognized and submit this information to Engineer.

If the Disputed Work is not completed within 30 days, then Contractor shall, every 30 days until the Disputed Work ceases, submit to Engineer and Owner an updated Supplemental Notice of Potential Claim that shall update and quantify all of the information required in the Supplemental Notice of Potential Claim. Contractor's failure to so quantify costs and schedule impacts every 30 days shall result in a waiver of the Claim for that 30-day period. Any supplemental notice or updated notice that states that the requested adjustment of Contract Price and/or Contract Time will be provided or determined at a later date, or that any damages, costs, schedule impacts, and/or any other analysis will be provided or determined at a later date, shall be deemed to be not in compliance with this Paragraph 10.05, and shall result in Contractor waiving its Claim.

After reviewing the Contractor's Supplemental Notice of Potential Claim or updated Supplemental Notice of Potential Claim, Engineer may provide a written response thereto or may decide to delay providing a response until Contractor provides further information regarding the potential Claim pursuant to the provisions of this Paragraph 10.05. No response by Engineer that could be interpreted as suggesting that Contractor is entitled to an increase Contract Price or Contract Time is binding upon the Owner unless Owner has co-signed the response.

D. Notice of Final Claim.

As soon as reasonably practical upon completion of the Disputed Work, and no later than 30 days after completion of the Disputed Work, Contractor shall provide to Engineer and Owner a Notice of Final Claim containing a full and final documentation of the Claim that provides the following information:

1. A detailed factual narration of events fully describing the nature and circumstances that caused the dispute, including, but not limited to, necessary dates, locations, and items of Work affected by the dispute.

2. The specific provisions of the Contract that support the Claim and a statement of the reasons these provisions support and provide a basis for entitlement of the Claim.

3. When additional monetary compensation is requested, the exact amount requested calculated in conformance with the Contract Documents and shall include an

itemized breakdown of individual costs. These costs shall be segregated into the following cost categories:

a. Labor – A listing of individuals, classifications, regular hours and overtime hours worked, dates worked, hourly labor rates, and other pertinent information related to the requested reimbursement of labor costs.

b. Materials – Invoices, purchase orders, location of materials either stored or incorporated into the work, dates materials were transported to the project or incorporated into the work, and other pertinent information related to the requested reimbursement of material costs.

c. Equipment – Listing of detailed description (make, model, and serial number), hours of use, dates of use, and equipment rates. Equipment rates shall be at the applicable State rental rate as listed in the Department of Transportation publication entitled "Labor Surcharge and Equipment Rental Rates," in effect when the Disputed Work was performed.

d. Other categories as specified by Contractor or Engineer.

4. When an adjustment of Contract Time is requested the following information shall be provided:

   a. The chronology of the specific dates for which Contract Time is being requested.

   b. The specific reasons for entitlement to a Contract Time adjustment.

   c. The specific provisions of the Contract that provide the basis for the requested Contract Time adjustment.

   d. A detailed time impact analysis of the Progress Schedule. The time impact analysis shall show the effect of changes or disruptions on the scheduled completion date to demonstrate entitlement to a Contract Time adjustment.

5. The listing, identification, and production of copies of all documents Contractor believes support its Claim and the date, time, circumstances, details and substance of any oral communications that Contractor believes support the Claim.

   The Notice of Final Claim shall be submitted on a form furnished by Engineer (and approved by Owner) and shall be certified under penalty of perjury with reference to the California False Claims Act, Government Code Sections 12650-12655.

   Contractor shall include all pertinent information, references, arguments, and data supporting its Claim in the Notice of Final Claim. Information submitted subsequent to the Notice of Final Claim will not be considered. No Notice of Final Claim will be considered that does not have the same nature and circumstances, and basis of Claim as those specified on the Initial and Supplemental Notices of Potential Claim.

E. *Response to Notice of Final Claim.*

1. *Engineer's Authority to Respond to Claim*. Engineer will evaluate the information and documentation presented in the Notice of Final Claim and provide a written response to Contractor. Engineer may issue a written response denying the Claim, but Owner's signature is required on any response granting any part of the Claim.

   A Claim may be granted in whole or in part only by a written response that contains a signature of an authorized officer or employee of Owner acknowledging Owner's approval of the response. A response unsigned by Owner that grants in whole or in part any part of a Claim is invalid and not binding on the Owner. In the event a valid written decision is not provided to Contractor within the time prescribed in this Paragraph 10.05, the Claim shall be deemed denied on the last day a written response was due. The date upon which the Claim is approved or denied pursuant to the provisions of this Paragraph 10.05, shall constitute the date of the final decision on the Claim under the provisions of this Paragraph 10.05. The date of the final decision on a Claim can only be changed by a subsequent writing signed by Engineer and Owner that expressly states that the date of the final decision on the Claim has been changed to a new specific date.

2. *For Claims of less than $50,000*. For Claims of less than fifty thousand dollars ($50,000), the Engineer shall respond in writing to the Notice of Final Claim within 45 days of receipt thereof, or may request, in writing, within 30 days of said receipt, any additional documentation relating to the Claim or any defenses to the Claim the Owner may have against the Contractor. Contractor shall comply with the request within the reasonable time deadlines provided by Engineer in the request. If additional information is thereafter required, it shall be requested and provided upon mutual agreement of the Owner and the Contractor. The written response to the Notice of Final Claim shall be submitted to the Contractor within 15 days after receipt of the further documentation or within a period of time no greater than that taken by the Contractor in producing the additional information, whichever is greater.

3. *For Claims Over $50,000 and Less Than or Equal to $375,000*. For Claims of over fifty thousand dollars ($50,000) and less than or equal to three hundred seventy-five thousand dollars ($375,000), the Engineer shall respond in writing to the Notice of Final Claim within 60 days of receipt thereof, or may request, in writing, within 30 days of said receipt, any additional documentation relating to the Claim or any defenses to the Claim the Owner may have against the Contractor. Contractor shall comply with the request within the reasonable time deadlines provided by Engineer in the request. If additional information is thereafter required, it shall be requested and provided upon mutual agreement of the Owner and the Contractor. The written response to the Notice of Final Claim shall be submitted to the Contractor within 30 days after receipt of the further documentation, or within a period of time no greater than that taken by the Contractor in producing the additional information or requested documentation, whichever is greater.

4. *For Claims Less Than or Equal to $375,000*. For Claims less than or equal to $375,000, if the Contractor disputes the written response to the Claim, or if a written response is not submitted within the time prescribed above, the Contractor may so notify the Engineer and Owner, in writing, either within 15 days of receipt of the written response or within 15 days of the Engineer's failure to respond within the time prescribed, respectively, and demand an informal conference to meet and confer for settlement of the issues in dispute. Upon such a timely demand by Contractor, the Engineer and Owner shall schedule a meet and confer conference within 30 days for settlement of the dispute. Within 30 days after such conference, a final written response to the Claim shall be issued which will serve as the new final decision on the Claim. Pursuant to Public Contract Code section 20104.6, the Owner shall not fail to pay money as to any portion of a Claim which is undisputed, except as otherwise provided in the Contract Documents.

5. *For Claims Greater Than $375,000*. For Claims over three hundred seventy-five thousand dollars ($375,000), the Engineer shall respond in writing to the Notice of Final Claim within 60 days of receipt thereof Claim, or may request, in writing, within 45 days of said receipt, any additional information or documentation relating to the Claim or any defenses to the Claim the Owner may have against the Contractor. Contractor shall comply with the request within the reasonable time deadline provided by Engineer in the request. If any additional information is thereafter requested by Engineer, it shall likewise be provided by Contractor within the reasonable time deadline provided by Engineer in such follow-up request. The written response to the Notice of Final Claim shall be submitted to the Contractor within 30 days after receipt of such further information and documentation, or within a period of time no greater than that taken by the Contractor in producing the additional information or documentation, whichever is greater. Contractor may request an informal conference to meet and confer for settlement of the issues in dispute, but Contractor shall have no right to demand such a conference. Neither the requesting of any such conference by Contractor, Engineer or Owner, nor the holding of such conference shall affect the date of the final decision on the Claim. No written communications of Engineer and/or Owner sent to Contractor after any such conference will change the date of the final decision on the Claim unless the writing expressly states that the date of the final decision is being changed to a new specific date.

F. *Contractor's Continuing Obligations.*

1. At all times during the processing of Contractor's potential or final Claim, Contractor shall diligently proceed with the performance of the Disputed Work and other Work, unless otherwise specified or directed by Engineer.

2. Contractor shall provide Owner and Engineer the opportunity to examine the Site of the Disputed Work as soon as reasonably possible, and in no event later than 5 days from the date of the Initial Notice of Potential Claim. Throughout the processing of Contractor's potential or final Claim, Contractor shall provide Owner and Engineer a reasonable opportunity to examine the Site of the Disputed Work within 5 days of the date of Owner's or Engineer's written request therefor.

3. Contractor shall promptly respond to any requests for further information or documentation regarding Contractor's potential or final Claim. If Contractor fails to provide an adequate written response to Engineer or Owner within 15 days of Engineer's or Owner's written request for such further documentation or information, Contractor shall be deemed to have waived its Claim. If the further documentation or information requested by Owner or Engineer would, in the opinion of the Engineer, reasonably take the Contractor more than 15 days to comply with, the written request shall provide the Contractor a specific response deadline that is commensurate to a reasonable response time.

4. Throughout the performance of the Disputed Work, Contractor shall maintain records that provide a clear distinction between the incurred direct costs of Disputed Work and other Work. Contractor shall allow Owner and Engineer access to Contractor's Project records deemed necessary by Owner or Engineer to evaluate the potential or final Claim within 15 days of the date of Owner or Engineer's written request. Contractor's failure to comply with the provision of this Paragraph 10.05 shall constitute a waiver of the Contractor's Claim.

5. All Subcontractor and Supplier claims of any type shall be brought only through Contractor pursuant to the provisions of this Paragraph 10.05. Under no circumstances shall any Subcontractor or Supplier make any direct claim against Owner.

6. Except where provided by law, or elsewhere in these Contract Documents (if applicable), OWNER SHALL NOT BE LIABLE FOR SPECIAL OR CONSEQUENTIAL DAMAGES, AND CONTRACTOR SHALL NOT INCLUDE THEM IN ITS CLAIMS. Contractor shall be limited in its recovery on any Claim(s) to the adjustments allowed in Articles 11 and 12 of the Contract Documents.

7. During each step in the processing of Contractor's Claim, each notice shall be accompanied by Contractor's written statement that the adjustment or relief claimed is the entire adjustment or relief to which the claimant believes it is entitled as a result of the event, issue, or circumstance giving rise to the Claim.

8. Contractor shall be responsible for providing written evidence of the date any of the notices referenced in paragraphs 10.05.B through 10.05.C above were provided to Engineer and Owner, and shall provide Engineer and Owner a copy of such written evidence within 5 days of a request thereof. Such evidence shall be either a written receipt of actual delivery from U.S. Postal Service or other reputable delivery service, or by the recipient's written acknowledgement of receipt.

9. The rights of Owner and Engineer to request further records, documents, or information from Contractor regarding a Claim are for the sole benefit of Owner and Engineer, and may be exercised at their sole discretion. Any failure by Owner and/or Engineer to exercise their rights does not provide the Contractor any excuse for not providing all of the records, documents, and other information it is requested

to provide under Paragraph 10.05 or any other provision of the Contract Documents.

10. Under no circumstances may Contractor submit an Initial Notice of Potential Claim, Supplemental Notice of Potential Claim, or Final Notice of Potential Claim after the date of final payment.

G. *Exclusive Remedy.*

1. The administration of a Claim as provided in this Paragraph 10.05, including Contractor's performance of its duties and obligations specified in this Paragraph 10.05 is Contractor's sole and exclusive remedy for disputes of all types pertaining to the payment of money, extension of time, the adjustment or interpretation of the Contract Documents terms or other contractual or tort relief arising from Contract Documents. This exclusive remedy and the limitation of liability (expressed herein and elsewhere throughout the Contract Documents) apply notwithstanding the completion, termination, suspension, cancellation, breach, or rescission of the Work or Contract Documents, the negligence or strict liability of Owner, its representatives, consultants, or agents, or the transfer of Work or the Project to Owner for any reason whatsoever.

2. Contractor waives and covenants not to raise any claims of waiver, estoppel, release, bar, or any other type of excuse for non-compliance with these Paragraph 10.05 requirements. Compliance with the procedures described in this Paragraph 10.05 is a condition precedent to the right to file a Government Code Claim, commence litigation, or commence any other legal action. Claim(s) or issue(s) not raised in a timely Claim submitted under this Paragraph 10.05 may not be asserted in any subsequent Government Code Claim, litigation, or legal action. Owner shall not be deemed to waive any provision under this Paragraph 10.05, if at Owner's sole discretion, a claim is administered in a manner not in accordance with this Paragraph 10.05.

10.06 *Other Requirements Relating to Claims*

A. *Government Code Claim Requirements:*

For all Claims not resolved as a result of the Paragraph 10.05 procedures, Contractor must submit each Claim in a Government Code Section 910 form of claim for final investigation and consideration of its settlement prior to initiation of any litigation on any such Claim, as required by Government Code Section 945.4. Pursuant to Government Code Section 930.2, the one-year period in Government Code Section 911.2 is hereby reduced to 150 days. This time deadline is measured from the accrual date of each separate cause of action.

B. *Tolling.*

1. For each unresolved Claim properly processed by Contractor in accordance with Paragraph 10.05, the running of the period of time within which a Government Code claim must be submitted shall be tolled during the time the Contractor is

processing the Claim in compliance with Paragraph 10.05. Under no circumstances shall the time for submitting a Government Code Claim be extended beyond 150 days of the date of the final decision on the Claim under Paragraph 10.05. Contractor waives the right to pursue or submit any Claims not processed in accordance with Paragraph 10.05.

2. Other than as expressly provided in Paragraph 10.06.B.1., the time deadline for filing a Government Code claim shall not be tolled by any action or inaction by Contractor, Engineer or Owner, including but not limited to any action or inaction to try to resolve the Claim through negotiation, mediation, settlement, agreement (including Change Order), or by any other means, other than by a separate written tolling agreement expressly approved as to form (on the face of the agreement) by the County Counsel's Office of Owner.

ARTICLE 11 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

11.01 *Cost of the Work*

A. *Costs Included:* The term Cost of the Work means the sum of all costs, except those excluded in Paragraph 11.01.B, necessarily incurred and paid by Contractor in the proper performance of the extra work. When the value of any extra work covered by a Change Order is determined on the basis of Cost of the Work, or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 11.01.B, and shall include only the following items:

1. The cost of labor for the workers, under schedules of job classifications agreed upon by Owner and Contractor (including foreman when authorized in writing by Engineer), used in the actual and direct performance of the extra work. The cost of labor, whether the employer is Contractor, Subcontractor, or other forces, will be the sum of the following:

   a. The actual wages paid (including basic hourly wage, health and welfare, pension, vacation, training, and other State and Federal recognized fringe benefit payments)

   b. The employer labor surcharge, as set forth in the Department of Transportation publication entitled Labor Surcharge and Equipment Rental Rates which is in effect on the date upon which the extra work is accomplished and which is part of this Contract, constituting full compensation for worker's compensation insurance, social security contributions, Medicare, federal unemployment insurance, state unemployment insurance, and state training taxes; and

   c. Subsistence and travel allowances paid to the workers.

2. Cost of all materials necessarily furnished and incorporated in the extra work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.

   The cost of materials will be the cost to the purchaser, whether Contractor, Subcontractor, or other forces, from the supplier thereof, except as the following are applicable:

   a. If materials are procured by the purchaser by any method which is not a direct purchase from and a direct billing by the actual supplier to the purchaser, the cost of those materials shall be deemed to be the price paid to the actual supplier plus the actual costs, if any, incurred in the handling of the materials.

   b. If the materials are obtained from a supply or source owned wholly or in part by the purchaser, the cost of those materials shall not exceed the price paid by the purchaser for similar materials furnished from that source on contract items or the current wholesale price for those materials delivered to the Project Site, whichever price is lower.

   c. If the cost of the materials is, in the opinion of Engineer, excessive, then the cost of the material shall be deemed to be the lowest current wholesale price at which the materials were available in the quantities concerned delivered to the Project Site, less any discounts as provided in this paragraph.

   d. If Contractor does not furnish satisfactory evidence of the cost of the materials from the actual supplier thereof within 60 days after the date of delivery of the material or within 15 days after acceptance of the Contract, whichever occurs first, the Owner reserves the right to establish the cost of the materials at the lowest current wholesale prices at which the materials were available in the quantities concerned delivered to the location of the Work, less any discounts as provided in this paragraph.

   e. The Owner reserves the right to furnish materials for the extra work and no request for Change Order or Claim will be allowed by Contractor for costs and profit on such materials.

3. Costs of special work or services are defined as that work characterized by extraordinary complexity, sophistication, innovation, or a combination of the foregoing attributes which are unique to the construction industry. When Engineer and Contractor, by agreement, determine that a special service on an item of extra work cannot be performed by Contractor's forces or those of any of its Subcontractors, that service or extra work item may be performed by a specialist. Payment for special services work will be subject to the following:

   a. Invoices for the service or item of extra work on the basis of the current market price thereof may be accepted without complete itemization of labor, material,

and equipment rental costs when it is impracticable and not in accordance with the established practice of the special service industry to provide a complete itemization;

b. In those instances wherein Contractor is required to perform extra work necessitating a fabrication or machining process in a fabrication or machine shop facility away from the Project Site, the charges for that portion of the extra work performed in the facility may, by agreement, be accepted as a special service and accordingly, the invoices for the work may be accepted without detailed itemization; and

c. All invoices for special services will be adjusted by deducting all cash or trade discounts offered or available, whether or not the discount may have been taken. An allowance 15 percent will be added to invoices for special services, in lieu of the percentages provided in Paragraph 12.01.C.

4. Equipment: Cost of equipment necessarily used in the performance of the extra work will be paid at the rental rates listed for that equipment in the Department of Transportation publication entitled Labor Surcharge And Equipment Rental Rates, which is in effect on the date upon which the work is accomplished and which is a part of this Contract, regardless of ownership and any rental or other agreement, if they may exist, for the use of that equipment entered into by Contractor, except that for those pieces of equipment with a rental rate of $10.00 per hour or less as listed in the Labor Surcharge And Equipment Rental Rates publication and which are rented from a local equipment agency, other than Contractor owned, Contractor will be paid at the hourly rate shown on the rental agency invoice or agreement for the time used on the extra work as provided in this paragraph. If a minimum equipment rental amount is required by the local equipment rental agency, the actual amount charged will be paid to Contractor. If it is deemed necessary by Engineer to use equipment not listed in the Labor Surcharge And Equipment Rental Rates publication, a suitable rental rate for that equipment will be established by Contractor. If the rental rate established by Contractor is $10.00 per hour or less, the provisions above concerning rental of equipment from a local equipment agency shall apply. Payment for equipment shall be subject to the following:

   a. The rental rates shall include the cost of fuel, oil, lubrication, supplies, small tools, necessary attachments, repairs and maintenance of any kind, depreciation, storage, insurance and all incidentals.

   b. Operators of rented equipment will be paid for as provided in Paragraph 11.01.A.1.

   c. All equipment shall, in the opinion of Engineer, be in good working condition and suitable for the purpose for which the equipment is to be used.

   d. Unless otherwise specified, manufacturer's ratings and manufacturer approved modifications shall be used to classify equipment for the determination of applicable rental rates. Equipment which has no direct power unit shall be

powered by a unit of at least the minimum rating recommended by the manufacturer.

e. Individual pieces of equipment or tools not listed in the Labor Surcharge and Equipment Rental Rate publication and having a replacement value of $500 or less, whether or not consumed by use, shall be considered to be small tools and no payment will be made therefor.

f. Rental time will not be allowed while equipment is inoperative due to breakdowns.

5. Equipment at the Work Site: The rental time to be paid for equipment on the Site at the time required to perform the extra work will be the time the equipment is in productive operation on the extra work being performed and, in addition, will include the time required to move the equipment to the location of the extra work and return it to the original location (or to another location requiring no more time than that required to return it to its original location); except that moving time will not be paid if the equipment is used at the site of the extra work on other than the extra work. Loading and transporting cost will be allowed, in lieu of moving time, when the equipment is moved by means other than its own power, except that no payment will be made for loading and transporting costs when the equipment is used at the site of the extra work on other than extra work. The rental time of equipment on the Site operated to perform the extra work will be computed subject to the following:

a. Hourly rates are paid in 1/2-hour increments

b. Daily rates are paid in 1/2-day increments.

c. Payment for the equipment will be made in accordance with the provisions in Paragraph 11.01.A.4;

B. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.01.A.1 or specifically covered by Paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the Contractor's fee.

2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraphs 11.01.A.

6. Cost of premiums for all Bonds and for all insurance whether or not Contractor is required by the Contract Documents to purchase and maintain the same (except for the cost of premiums covered by Paragraph 11.01.C.

7. Costs associated with the preparation or submittal of any requests for Change Orders (whether or not ultimately authorized), cost estimates, Claims.

8. Contractor's expenses associated with anticipated lost profits or lost revenue, lost income or earnings, lost interest or earnings or unpaid retention.

9. Costs of special consultants or attorneys, whether or not in the direct employ of Contractor, employed for services specifically related to the submittal or resolution of a Claim, dispute, or other matter relating to the acceptability of the Work.

C. *Contractor's Fee:* When all the Work is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 12.01.C.

D. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to Paragraphs 11.01.A and 11.01.B, Contractor shall submit to Engineer a daily extra work report, on a form acceptable to Engineer, which provides an itemized cost breakdown together with supporting data, at the end of the week.

11.02 *Allowances*

A. Any allowances provided for in the Contract Documents are for the sole use of Owner to cover the costs of certain types of extra work that may need to be performed as part of the Project. The allowance may be used in whole, in part, or not at all as determined by Owner and Engineer. No portion of any sum of money designated as an allowance shall become due or payable to the Contractor unless there is a Change Order specifically allocating a portion of an allowance to the work described in the Change Order. All such work will be considered extra work that was not included in the original Contract, but which has been provided for as an allowance.

B. Notwithstanding 11.02.A. above, the allowance for the HMA Price Index Fluctuation Adjustment shall not be limited to only extra work. (See Par. 1.28 of Section 01025 "Measurement and Payment".)

C. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer, and approved by Owner, to reflect actual amounts due Contractor on account

of Work covered by allowances, and the Contract Price shall be correspondingly adjusted. Contractor shall make no Claim nor receive any compensation for anticipated profits, loss of profit, damages, or any extra payment due to the difference between the amount of Work actually completed and the original amount allocated for the allowance.

11.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Engineer subject to the provisions of Paragraph 9.07.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Contractor may make a Claim for an adjustment in the Contract Price in accordance with Paragraph 10.05 for Unit Price Work only when the following conditions are satisfied:

1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement, and if the change increases or decreases the actual unit cost of the changed item as compared to the estimated actual unit cost of performing the Work; and

2. there is no corresponding adjustment with respect to any other item of Work; and

3. If Contractor has incurred additional expense justifying an increase in Contract Price for the Unit Price Work, Contractor's exclusive remedy is set forth in Paragraph 10.05.

11.04 *Extra Work*

A. "Extra work" consists of work, desired or performed, not included in the original Contract, which the Engineer determines is not covered by any of the various items for which there is a Bid price or by combinations of those items. In the event portions of this work are determined by the Engineer to be covered by some of the various items for which there is a Bid price or combinations of those items, the remaining portion of the work will be classed as extra work. Extra work also includes work specifically designated as "extra work" in the Specifications.

B. The Contractor shall do the extra work and furnish labor, material and equipment therefor upon receipt of a Change Order or Work Change Directive from the Engineer,

and in the absence of such Change Order or Work Change Directive, the Contractor shall not be entitled to payment for the extra work.

ARTICLE 12 – CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

12.01 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by Contractor in accordance with the provisions of Paragraph 10.05.

B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents and the total pay quantity varies from the estimated quantity of such item indicated in the Agreement by 25% or less, by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.03); or

2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 12.01.C.2); or

3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under Paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in Paragraph 11.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 12.01.C); or

4. where the Work involved is covered by unit prices contained in the Contract Documents and the total pay quantity of any item of Work required under the Contract exceeds the total pay quantity of the item indicated in the Agreement therefor by more than 25 percent, the Work in excess of 125 percent and not covered by an executed Change Order specifying the compensation to be paid therefor will be paid for by adjusting the Contract unit price, as hereinafter provided, or at the option of Engineer, payment for the Work involved in the excess will be paid for as extra work as provided in Paragraph 11.01.

   The adjustment of the unit price for said Work in excess of 125 percent will be the difference between the Contract unit price and the actual unit cost which will be determined as hereinafter provided, of the total pay quantity of the item. If the costs applicable to the item of work include fixed costs, the fixed costs will be deemed to have been recovered by Contractor by the payments made for 125 percent of the estimated quantity of such item indicated in the Agreement, and in computing the actual unit cost, the fixed costs will be excluded. Subject to the above provisions, the actual unit cost will be determined by Engineer in the same manner as if the work were to be paid for as extra work as provided in Paragraph 11.01; or the adjustment will be as agreed to by Contractor and Engineer.

When the compensation payable for the number of units of an item of work performed in excess of 125 percent of the total pay quantity of the item indicated in the Agreement is less than $5,000 at the applicable Contract unit price, Engineer reserves the right to make no adjustment in the Contract unit price if Engineer so elects, except that an adjustment will be made if requested in writing by Contractor; or

5. where the Work involved is covered by unit prices contained in the Contract Documents and the total pay quantity of any item of Work required under the Contract is less than 75 percent of the total pay quantity of the item indicated in the Agreement therefor, an adjustment in compensation pursuant to this paragraph will not be made unless Contractor submits a written request to Engineer. If Contractor so requests, the quantity of the item performed, unless covered by an executed Contract Change Order specifying the compensation payable therefor, will be paid for by adjusting the Contract unit price as hereinafter provided, or at the option of Engineer, payment for the quantity of the work of the item performed will be paid for as extra work as provided in Paragraph 11.01, provided however, that in no case shall the payment for that Work be less than that which would be made at the Contract unit price.

   The adjustment of the Contract unit price will be the difference between the Contract unit price and the actual unit cost, which will be determined as hereinafter provided, of the total pay quantity of the item, including fixed costs. The actual unit cost will be determined by Engineer in the same manner as if the Work were to be paid for as extra work as provided in Paragraph 11.01; or the adjustment will be as agreed to by Contractor and Engineer.

   The payment for the total pay quantity of the item of work will in no case exceed the payment which would be made for the performance of 75 percent of the of the total pay quantity of the item indicated in the Agreement of the quantity for the item at the original contract unit price.

C. *Contractor's Fee:* The Contractor's fee for overhead and profit shall be determined as follows:

   1. a mutually acceptable fixed fee; or

   2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

      a. for costs incurred under Paragraphs 11.01.A.1 and 11.01.A.2, the Contractor's fee shall be 10 percent;

      b. for costs incurred under Paragraph 11.01.A.3, the Contractor's fee shall be five percent;

      c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 12.01.C.2.a and 12.01.C.2.b is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 10 percent of the costs incurred by such

Subcontractor under Paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor, provided, however, that on any subcontracted work the total maximum fee to be paid by Owner under this subparagraph shall be no greater than 27 percent of the costs incurred by the Subcontractor who actually performs the work;

d. no fee shall be payable on the basis of costs itemized under Paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;

e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and

f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

12.02 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Claim for an adjustment in the Contract Times shall be based on written notice submitted by Contractor in accordance with the provisions of Paragraph 10.05.

B. Any adjustment of the Contract Times covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

C. All time limits stated in the Contract Documents are of the essence of the Agreement. Contractor acknowledges and understands that Owner has a need for the completed Work, shortly after the date set forth in the Agreement.

12.03 *Delays*

A. If Contractor believes it has been prevented from completing any part of the Work with the Contract Times due to delay beyond the control of Contractor, Contractor's exclusive remedy is set forth in Paragraph 10.05.

B. If Owner delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

1. Owner shall not be liable, as damages for delays under Paragraph 12.03.B, for any consequential damages, lost opportunity costs, impact damages, or other similar remuneration. Owner's exercise of any of its rights or remedies under the Contract Documents (including, without limitation, ordering changes in the Work, directing suspension, rescheduling, or correction of the Work, or terminating this Agreement

for its convenience), regardless of the extent or frequency of Owner's exercise of such rights or remedies, shall not be construed as active interference with Contractor's performance of the Work. If Contractor submits a Progress Schedule or any other schedule indicating, or otherwise expressing, an intention to achieve completion of the Work prior to any completion date required by the Contract Documents, or expiration of the Contract Times, Owner shall have no liability to Contractor for any failure of Contractor to so complete the Work according to such schedule.

C. If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the control of Owner, or other causes not the fault of and beyond control of Owner and Contractor, then Contractor shall be entitled to an equitable adjustment in Contract Times, if such adjustment is essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays described in this Paragraph 12.03.C.

D. Owner, Engineer, and their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

E. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delays within the control of Contractor. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

F. In no event shall Owner or Engineer be liable to Contractor, any Subcontractor, any Supplier, or any other person or organization, or to any surety for or employee or agent of any of them, for damages arising out of or resulting from:

1. any delays caused by or within the control of Contractor, its Subcontractors, Suppliers, agents and representatives; or

2. any delays beyond the control of Owner including but not limited to fires, floods, epidemics, abnormal weather conditions, acts of God, or acts or neglect by utility owners or other contractors performing other work as contemplated by Article 7.

ARTICLE 13 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.01 *Notice of Defects*

A. Reasonable notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor. Defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, the State Water Resources Control Board, the Governor of the State, the United States Environmental Protection Agency, the Office of Inspector General, any member of Congress, the President of the United States, or any authorized representative of the foregoing, and governmental agencies with jurisdictional interests will have access to the Site and the Work at all times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

13.03 *Tests and Inspections*

A. Contractor shall give Engineer timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests. Inspection of the Work shall not relieve Contractor of the obligation to fulfill all conditions of the Contact.

B. Owner shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:

1. for inspections, tests, or approvals covered by Paragraphs 13.03.C and 13.03.D below;

2. that costs incurred in connection with tests or inspections conducted pursuant to Paragraph 13.04.B shall be paid as provided in Paragraph 13.04.C; and

3. as otherwise specifically provided in the Contract Documents.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to Owner and Engineer.

E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation.

F. Uncovering Work as provided in Paragraph 13.03.E shall be at Contractor's expense unless Contractor has given Engineer sufficient advanced written notice of Contractor's intention to cover the same and Engineer has not acted in the time set forth in

Contractor's notice, or by the end of the next business day after Engineer receives Contractor's notice, whichever is later, in response to such notice.

13.04 *Uncovering Work*

A. If any Work is covered contrary to the written request of Engineer, it must, if requested by Engineer, be uncovered for Engineer's observation and replaced at Contractor's expense.

B. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment.

C. If it is found that the uncovered Work is defective, Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and Owner shall be entitled to an appropriate decrease in the Contract Price.

D. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction, unless Contractor failed to provide the written notice required in Paragraph 13.03.F. If Contractor believes it is entitled to an adjustment in Contract Price and/or Contract Time, or any other relief, Contractor's exclusive remedy is set forth in Paragraph 10.05.

13.05 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

13.06 *Correction or Removal of Defective Work*

A. Promptly after receipt of written notice, Contractor shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Engineer, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction

or removal (including but not limited to all costs of repair or replacement of work of others).

B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

13.07 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee or warranty specified or required by the Contract Documents), any Work is found to be defective, or if the repair of any damages to the land or areas made available for Contractor's use by Owner or permitted by Laws and Regulations as contemplated in Paragraph 6.11.A is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. repair such defective land or areas;

2. correct such defective Work;

3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom.

B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.

C. In special circumstances where a particular item of equipment is placed in continuous service for the benefit of Owner before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed, or for such additional period as specified in the Contract Documents.

E. Contractor's obligations under this Paragraph 13.07 are in addition to Contractor's general warranty and guarantee under Paragraph 6.19 and any other obligation or warranty required by the Contract Documents. The provisions of this Paragraph 13.07

and Paragraph 6.19 shall not be construed as a substitute for, or a waiver of, or limitation upon the provisions of any applicable statute of limitation or repose. Establishment of the one-year correction period relates only to the specific obligation of the Contractor to correct defective Work, and has no relationship to the time within which the Contractor's obligation to comply with the Contract Documents may be enforced.

13.08 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to Engineer's recommendation of final payment, Engineer) prefers to accept it, Owner may do so. Contractor shall pay Owner all of the following sums (hereafter "Paragraph 13.08 Costs"): (1) all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, and other professionals and all court or arbitration or other dispute resolution costs) attributable to Owner's evaluation of and determination to accept such defective Work; (such costs to be approved by Engineer as to reasonableness) (2) and for the diminished value of the Work to the extent not otherwise paid by Contractor pursuant to this sentence. If any such acceptance occurs prior to Engineer's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and Owner shall be entitled to an appropriate decrease in the Contract Price in the sum of the Paragraph 13.08 Costs. If the parties are unable to agree as to the amount thereof, Owner may withhold the sum of the Paragraph 13.08 Costs from any payments otherwise due Contractor, and Contractor may make a Claim therefor as provided in Paragraph 10.05. If the acceptance occurs after such recommendation or if the amount of the payment(s) otherwise due the Contractor are less than the Paragraph 13.08 Costs, Contractor shall pay Owner the appropriate amount to fully compensate the Owner for all Paragraph 13.08 Costs.

13.09 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer in accordance with Paragraph 13.06.A, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven days written notice to Contractor, correct, or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 13.09, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this Paragraph.

C. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 13.09 (hereafter, collectively "Paragraph 13.09 Costs") will be charged against Contractor, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price in the sum of the Paragraph 13.09 Costs. If the parties are unable to agree as to the amount of the adjustment, Owner may withhold the sum of the Paragraph 13.09 Costs from any payments otherwise due Contractor, and Contractor may make a Claim therefor as provided in Paragraph 10.05. If the amount of the payment(s) otherwise due Contractor are less than the Paragraph 13.09 Costs, Contractor shall pay Owner the appropriate amount to fully compensate Owner for all Paragraph 13.09 Costs. Paragraph 13.09 Costs include, but are not limited to, all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 13.09.

ARTICLE 14 – PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 *Schedule of Values*

A. The Schedule of Values established as provided in Paragraph 2.07.A will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed.

14.02 *Progress Payments*

A. *Applications for Payments:*

1. On the first business day of the month, Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents including, but not limited to, a Schedule of Values reflecting current status; an updated Project Schedule; and affidavits signed by all Subcontractor performing the Work to date, stating that each of them has been paid, less earned retainage, as their interest appeared in the last preceding Application for Payment. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement. No payments will be made that would deplete the retainage, place in escrow any funds that are required for retainage, or invest the retainage for the benefit of Contractor.

4. The Application for Payment Form to be used on this Project is located in Section 00820. The Agency must approve all Applications for Payment before payment is made.

B. *Review of Applications:*

1. Engineer will, within 7 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to Owner or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application. Engineer will be acting as Owner's authorized representative in reviewing each Application for Payment, and Engineer shall perform such review in compliance with Public Contract Code section 20104.50. If Engineer determines that an Application for Payment is not proper, Engineer shall return said application to Contractor as soon as practicable, but not later than 7 days after Engineer's receipt of said application, and shall set forth in writing to Contractor the reasons why the payment request is not proper. If Engineer exceeds the 7-day return requirement set forth in this paragraph, the number of days available to Owner to make a payment without incurring interest shall be correspondingly reduced as set forth in Paragraph 14.02.C.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

   a. the Work has progressed to the point indicated;

   b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 9.07, and any other qualifications stated in the recommendation); and

c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

   a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents; or

   b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

   a. to supervise, direct, or control the Work, or

   b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or

   c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or

   d. to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or

   e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Contractor shall also comply with the following specific requirements:

   a. The aggregate cost of materials stored off site shall not exceed $10,000.00 at any time without written approval of Owner.

   b. Title to such materials shall be vested in Owner, as evidenced by documentation satisfactory in form and substance to Owner, including, without limitation, recorded financing statements, UCC filings, and UCC searches.

   c. With each Application for Payment, Contractor shall submit to Engineer a written list identifying each location where materials are stored off the Project Site and the value of materials at each location. Contractor shall procure insurance satisfactory to Owner for materials stored off the Project Site in an amount not less than the total value thereof.

d. The consent of any surety shall be obtained, to the extent required by the surety, or Owner prior to payment for any materials stored off the Project Site.

e. Engineer and Owner shall have the right to make inspections of the storage areas for any materials stored off the Project Site at any time.

f. Such materials shall be (1) protected from diversion, destruction, theft, and damage to the satisfaction of the Engineer and/or Owner; (2) specifically marked for use on the Project; and (3) segregated from other materials at the storage facility.

6. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 14.02.B.2. Engineer may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Engineer's opinion to protect Owner from loss because:

   a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;

   b. the Contract Price has been reduced by Change Orders;

   c. Owner has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or

   d. Engineer has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A.

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

   f. Contractor's failure to make payments properly to subcontractors or suppliers for labor, materials or equipment;

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

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

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

   j. Work that required submittals was performed prior to obtaining in writing from the Engineer any required acceptance, approval or other response required under the Contract Documents for said submittals;

l. Contractor's persistent failure to carry out the Work in accordance with the Contract Documents;

m. Contractor's failure to submit a construction schedule or to update the construction schedule in accordance with the Contract Documents;

n. Contractor's failure to timely provide or update any record documents, Shop Drawings, or Samples as required of Contractor under the Contract Documents (including, but not limited to, Paragraph 6.12);

o. Contractor's failure to reinstate required insurance that has been allowed to lapse;

p. Contractor's failure to pay money owed to Owner under the Contract Documents; or

q. Contractor's failure to provide Engineer copies of any contracts with Subcontractors or Suppliers requested by Engineer.

6. Engineer will help coordinate and attend any Site visit(s) or other meetings requested by Agency or Owner to help facilitate Agency and/or Owner approval of a recommended payment. If so directed by Owner, Engineer shall simultaneously send to the Agency any payment recommendations it sends to Owner.

C. *Payment Becomes Due:*

1. Pursuant to Public Contract Code section 20104.50, Owner shall make a progress payment (subject to the provisions of Paragraph 14.02.D.) within 30 days of Engineer's receipt of an undisputed and properly submitted Application for Payment. If Owner fails to make a progress payment on an undisputed and properly submitted Application for Payment within said 30 day period, Owner shall pay interest to Contractor equivalent to the legal rate set forth in subdivision (a) of section 685.010 of the Code of Civil Procedure. The number of days available to Owner to make a payment without incurring interest pursuant to Public Contract Code section 20104.50 shall be reduced by the number of days by which Engineer exceeds the 7 day return requirement set forth in Paragraph 14.02.B.1.

D. *Reduction in Payment:*

1. Owner may refuse to make payment of the full amount recommended by Engineer because:

a. claims have been made against Owner on account of Contractor's performance or furnishing of the Work;

b. Liens, stop notices or third-party claims for non-payment have been filed in connection with the Work, except where Contractor has delivered a specific release bond satisfactory to Owner to secure the satisfaction and discharge of such Liens and stop notices;

c. there are other items entitling Owner to a set-off against the amount recommended; or

d. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02.B.5.a through 14.02.D.5.q or Paragraph 15.02.A.

e. Contractor's failure to submit or obtain acceptance of a progress schedule, schedule of values, and any updated schedules;

f. Defective or non-conforming Work;

g. Costs incurred by Owner to correct, repair or replace Defective or nonconforming Work, or to complete the Work;

h. A reasonable doubt that the Work can be completed for the balance then unpaid;

i. A reasonable concern by Owner that the materials, equipment or component parts are not in proper operating condition;

j. Assessment of Liquidated Damages;

k. Contractor's failure to perform in accordance with the Agreement;

l. A reasonable concern that cost or liability that may occur to Owner as the result of Contractor’s, Subcontractor’s or Supplier’s improper acts, omissions, fault, or negligence will cause Owner to incur cost, expense or liability (even if Owner is indemnified for such cost, expense or liability under Paragraph 6.15);

m. Reduction in contract Work;

n. Failure of Contractor to repair damaged materials, equipment, property, or Work;

o. Contractor's failure to provide or obtain review of submittals;

p. Contractor's failure to pay Subcontractors or Suppliers;

q. Contractor's failure to keep record documents up to date;

r. Contractor's failure to comply with all applicable federal, state, and local laws, statutes, regulations, codes, licenses, easements, and permits;

s. Contractor's failure to obtain and maintain applicable permits, insurance, and bonds;

t. Contractor's failure to provide certified payroll records

u. Contractor's failure to comply with the contract safety requirements; and

v. Contractor's failure to pay money owed to Owner under the Contract Documents.

2. If Owner refuses to make payment of the full amount recommended by Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor remedies the reasons for such action.

14.03 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner no later than the time of payment free and clear of all Liens.

1. Contractor further expressly undertakes to defend Owner and Engineer, at Contractor's sole expense, against any actions, lawsuits, or proceedings brought against Owner, Engineer, or any third party as a result of liens filed against the Work, the site of any of the Work, the Project Site and any improvements thereon, payments due Contractor, or any portion of the property of Owner, Engineer, or third party. Contractor hereby agrees to indemnify and hold Owner, Engineer, and third parties harmless against any such liens or claims of lien and agrees to pay any judgment or lien resulting from any such action, lawsuit, or proceeding.

14.04 *Substantial Completion*

A. When Contractor considers the entire Work is properly completed in conformance with the Contract Documents and ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete (except for minor items which do not materially affect the intended use of the Project and which are specifically listed in writing by Contractor as incomplete) and request that Engineer issue a certificate of Substantial Completion. Failure to include an item on such list does not alter the responsibility of Contractor to complete all Work in accordance with the Contract Documents. Such written notification in writing by Contractor is a prerequisite to any assertion or claim by Contractor that the entire Work is substantially complete, or that a certificate of Substantial Completion has been improperly withheld or delayed.

B. After Contractor's notification and at a time Engineer and Owner determine to be reasonable, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer or Owner does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor. Engineer shall provide Owner and Designer sufficient advance notice of any such inspection so as to provide Owner and Designer a reasonable amount of time to make arrangements to join Engineer and Contractor during such inspection. If requested by Owner, the date and time of any such inspection shall be rescheduled to allow Owner and/or Designer to accompany Engineer and Contractor during the inspection

C. If Engineer and Owner consider the Work substantially complete, Engineer will deliver to Owner a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of minor items to be completed or corrected before final payment. Owner shall have seven

days after receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer or Owner concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the tentative certificate to Owner, notify Contractor in writing, stating the reasons therefor. If, after consideration of Owner's objections, Engineer and Owner consider the Work substantially complete, Engineer will, within said 14 days, execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Engineer and Owner believe justified after consideration of any objections from Owner.

D. At the time of delivery of the tentative certificate of Substantial Completion, Engineer and Owner will deliver to Contractor a written recommendation as to division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless Owner and Contractor agree otherwise in writing and so inform Engineer in writing prior to Engineer's issuing the definitive certificate of Substantial Completion, Engineer's aforesaid recommendation will be binding on Contractor.

E. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the tentative list.

14.05 *Partial Utilization*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 14.04.A through D for that part of the Work.

2. Contractor at any time may notify Owner and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer or Owner does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer and Owner consider that part of the Work to be

substantially complete, the provisions of Paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

14.06 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.07 *Final Payment*

A. *Application for Payment:*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, documents described in Paragraph 6.12, and other documents;

    a. Engineer shall make a formal recommendation to Owner to initiate Owner's internal procedures that would allow the County Board of Supervisors to accept the Work at a future Board meeting.

    b. Contractor may make an application for final payment following the procedure for progress payments.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:

    a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04.B.6;

    b. consent of the surety, if any, to final payment;

    c. a list of all Claims against Owner that Contractor believes are unsettled (this list must accompany the final Application for Payment regardless of whether it has been previously delivered); and

    d. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of or Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 14.07.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in

liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.

4. Paragraph 14.07.A.3 shall be interpreted in a manner consistent with the applicable California law relating to stop notices. To the extent there is any inconsistency between Paragraph 14.07.A.3 and California stop notice law, the applicable law shall prevail.

B. *Engineer's Review of Application and Acceptance:*

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of payment and present the Application for Payment to Owner for payment. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of Paragraph 14.09. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Payment Becomes Due:*

1. Thirty-five days after the filing of a Notice of Completion with the County Recorder and after presentation to Owner of the Application for Payment and accompanying documentation, the amount recommended by Engineer, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages, will become due and payable by Owner to Contractor.

14.08 *Final Completion Delayed*

A. If, through no fault of Contractor, final completion of the Work is significantly delayed, and if Engineer so confirms, Owner shall, upon receipt of Contractor's final Application for Payment (for Work fully completed and accepted) and recommendation of Engineer, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if bonds have been furnished as required in Paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to Engineer with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims listed in the final Application for Payment that were made in accordance with Paragraph 10.05.

14.09 *Waiver of Claims*

A. The making and acceptance of final payment will constitute:

1. *Blank*

2. a waiver of all Claims by Contractor against Owner other than those previously made in accordance with the requirements of Paragraph 10.05 that were listed in the final Application for Payment and expressly acknowledged by Owner in writing as still unsettled.

ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION

15.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to Contractor and Engineer which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. If Contractor believes it is entitled to an adjustment in Contract Price and/or Contract Time, or any other relief, as a result of Owner suspending Work, Contractor's exclusive remedy is set forth in Paragraph 10.05.

15.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will justify termination for cause:

1. Contractor’s persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to have Contractor’s authorized representative, required by Paragraph 2.06.B, available as reasonably needed, including the repeated absence of such authorized representative for two business days consecutively or more at a time, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04);

2. Contractor’s disregard of Laws or Regulations of any public body having jurisdiction;

3. Contractor’s repeated disregard of the authority of Engineer; or

4. Contractor’s violation in any substantial way of any provisions of the Contract Documents.

5. Contractor’s persistent failure to provide enough workers or materials to properly pursue the Work as required to complete the Work within the Contract Time;

6. Contractor’s persistent failure to perform the Work in accordance with the Contract Documents including, but not limited to providing monthly updates to the schedule

of Work and monthly updates to Record Drawings, or to correct or replace Defective Work when directed to do so;

7. Contractor's failure to make payment to subcontractors or material suppliers;

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

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

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

11. Contractor otherwise commits a material breach of the Contract.

B. If one or more of the events identified in Paragraph 15.02.A occur, Owner may, after giving Contractor (and surety) seven days written notice thereof, terminate the services of Contractor, in whole or in part, without prejudicing any other right or remedy of Owner under the Contract. After giving Contractor (and surety) such written notice of its intent to terminate, in whole or in part, the services of Contractor, Owner may:

1. exclude Contractor from the Site, and take possession of the Work and of all Contractor's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion);

2. incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere; and

3. complete the Work as Owner may deem expedient.

4. accept assignment of any or all agreements between Contractor and any Subcontractor or Supplier pursuant to Paragraph 6.06.K.

C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Owner arising out of or relating to completing the Work, such excess will be paid to Contractor. If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be incorporated in a Change Order. When exercising any rights or remedies under this Paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

D. Notwithstanding Paragraphs 15.02.B and 15.02.C, Contractor's services will not be terminated if Contractor begins within seven days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt of said notice.

E. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by Owner will not release Contractor from liability.

15.03 *Owner's Termination For Convenience*

A. Owner may, at any time, terminate the Contractor's services in whole or in part, for Owner's convenience and without cause. Termination by Owner under this paragraph shall be by a written notice of termination delivered to Contractor specifying the extent of termination and the effective date. Any such termination of Contractor's services, in whole or in part, shall not prejudice any other right or remedy of Owner under the Contract.

B. Upon receipt of a notice of termination for convenience, Contractor shall immediately, in accordance with instructions from Owner, proceed with performance of the following duties regardless of any delay in determining or adjusting amounts due under this paragraph:

1. cease operations as specified in the notice;

2. place no further orders and enter into no further subcontracts for materials, labor, services, or facilities except as necessary to complete continued portions of the Contract;

3. terminate all subcontracts and orders to the extent they relate to the Work terminated

4. proceed to complete the performance of Work not terminated; and

5. take actions that may be necessary, or that Owner may direct, for the protection and preservation of the terminated Work.

C. Upon such termination, Contractor shall recover as its sole remedy for Work performed the percentage of the Contract Price equal to the percentage of the Work performed satisfactorily and not previously paid for as determined by Engineer and Owner (so if only 10 percent of a Bid item is completed, Contractor's sole remedy for that Work completed is recovery of 10 percent of that Bid item price, or 10 percent of the Schedule of Values relating to that bid item, whichever is the lesser amount). Contractor's sole remedy for uncompleted Work shall be the recovery of those reasonable expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus a five percent markup (that would cover all overhead and profit). Contractor's sole remedy for demobilization costs shall be the recovery of those reasonable costs incurred in demobilization, reduced by

the percentage of the completed Work relating to the demobilization undertaken (so if certain reasonable demobilization costs relate to Work that is 60 percent completed, Contractor shall only be entitled to recover 40 percent of those costs). Contractor hereby waives and forfeits all other Claims for payment and damages, including, without limitation, anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

D. Owner shall be credited for: (1) payments previously made to Contractor for the terminated portion of the Work; and (2) the value of the materials, supplies, equipment, or other items that are to be disposed of by Contractor that are part of the Contract Price.

ARTICLE 16 – DISPUTE RESOLUTION

16.01 *Methods and Procedures*

A. Either Owner or Contractor may request mediation of any Claim submitted to Engineer for a decision under Paragraph 10.05. Neither Owner nor Contractor is required to mediate any Claims. The cost of any mediator or mediation service shall be shared equally by Owner and Contractor. Each party shall be responsible for its own costs relating to its participating in any mediation.

B. Once Owner and Contractor agree to mediate a Claim, Owner and Contractor shall participate in the mediation process in good faith.

C. For all civil actions filed on Claims less than or equal to three hundred seventy-five thousand dollars ($375,000), the applicable procedures set forth in Pubic Contract Code section 20104.4 and 20104.6 shall apply, including the mediation and judicial arbitration procedures set forth therein.

ARTICLE 17 – MISCELLANEOUS

17.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:

1. delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended; or

2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.02 *Computation of Times*

A. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

17.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents. The provisions of this Paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

17.04 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

17.05 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

17.06 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

ARTICLE 18 – FEDERAL REQUIREMENTS

18.01 *Funding*

A. This Contract is expected to be funded in part with funds provided by Agency. Neither Agency, nor any of its departments, entities, or employees is a party to this Contract.

A. This Contract is expected to be funded in part with funds provided by the State Water Resources Control Board. Neither the State Water Resources Control Board, nor any of its departments, entities, or employees is a party to this Contract.

18.02 *Contract Approval*

A. Owner and Contractor will furnish Owner's attorney such evidence as required so that Owner's attorney can complete and execute the following "Certificate of Owner's Attorney" (Exhibit SC-A) before Owner submits the executed Contract Documents to Agency for approval.

B. Concurrence by Agency in the award of the Contract is required before the Contract is effective.

18.03 *Conflict of Interest*

A. Contractor may not knowingly contract with a supplier or manufacturer if the individual or entity who prepared the plans and specifications has a corporate or financial affiliation with the supplier or manufacturer. Owner's officers, employees, or agents shall not engage in the award or administration of this Contract if a conflict of interest, real or apparent, would be involved. Such a conflict would arise when: (i) the employee, officer or agent; (ii) any member of their immediate family; (iii) their partner or (iv) an organization that employs, or is about to employ, any of the above, has a financial interest in Contractor. Owner's officers, employees, or agents shall neither solicit nor accept gratuities, favors or anything of monetary value from Contractor or subcontractors.

18.04 *Gratuities*

A. If Owner finds after a notice and hearing that Contractor, or any of Contractor's agents or representatives, offered or gave gratuities (in the form of entertainment, gifts, or otherwise) to any official, employee, or agent of Owner or Agency in an attempt to secure this Contract or favorable treatment in awarding, amending, or making any determinations related to the performance of this Contract, Owner may, by written notice to Contractor, terminate this Contract. Owner may also pursue other rights and remedies that the law or this Contract provides. However, the existence of the facts on which Owner bases such findings shall be an issue and may reviewed in proceedings under the dispute resolution provisions of this Contract.

B. In the event this Contract is terminated as provided in Paragraph 18.04.A, Owner may pursue the same remedies against Contractor as it could pursue in the event of a breach of this Contract by Contractor. As a penalty, in addition to any other damages to which it may be entitled by law, Owner may pursue exemplary damages in an amount (as determined by Owner) which shall not be less than three nor more than ten times the costs Contractor incurs in providing any such gratuities to any such officer or employee.

18.05 *Audit and Access to Records*

A. Owner, Agency, the Comptroller General of the United States, the State Water Resources Control Board, the Bureau of State Audits, the United States Environmental Protection Agency, and the Office of Inspector General, or any of their duly authorized representatives shall have access to any books, documents, papers, and records of Contractor which are pertinent to the Agreement, for the purpose of making audits, examinations, excerpts, and transcriptions. Contractor shall maintain all required records for six years after final payment is made and all other pending matters are closed.

18.06 *Disadvantaged Business Enterprise Program Requirements*

A. This Contract is subject to 40 CFR part 33 entitled "Participation by Disadvantages Business Enterprises in United States Environmental Protection Agency Programs." 40 CFR 33 in its entirety is incorporated herein by this reference.

The Contractor shall not discriminate on the basis of race, color, national origin or sex in the performance of this Contract. The Contractor shall carry out applicable requirements of 40 CFR part 33 in the award and administration of contracts awarded under EPA financial assistance agreements. Failure by the Contractor to carry out these requirements is a material breach of this Contract which may result in the termination of this Contract or other legally available remedies.

B. *DBEs, MBEs, and WBEs.*

1. Disadvantaged Business Enterprise (DBE) means an entity owned or controlled by a socially and economically disadvantaged individual as described by Public Law 102–389 (42 U.S.C. 4370d) or an entity owned and controlled by a socially and economically disadvantaged individual as described by Title X of the Clean Air Act Amendments of 1990 (42 U.S.C. 7601 note); a Small Business Enterprise (SBE); a Small Business in a Rural Area (SBRA); or a Labor Surplus Area Firm (LSAF), a Historically Underutilized Business (HUB) Zone Small Business Concern, or a concern under a successor program.

2. Minority business enterprise (MBE) means an entity that is at least 51% owned and/or controlled by a socially and economically disadvantaged individual as described by Title X of the Clean Air Act Amendments of 1990 (42 U.S.C. 7601 note), and Public Law 102-389 (42 U.S.C. 4370d), respectively.

3. Women's business enterprise (WBE) means an entity that is at least 51% owned and/or controlled by women.

C. If Contractor intends to let any subcontracts for a portion of the Work, Contractor shall employ the six Good Faith Efforts described in 40 CFR 33.301 to assure that DBEs are used when possible as sources of supplies, equipment, construction, and services. Good Faith Efforts shall consist of: (1) including DBEs on solicitation lists and assuring that DBEs are solicited whenever they are potential sources; (2) establishing delivery schedules, where the requirements for the Work permit, which will encourage participation by DBEs; (3) dividing total requirements, when economically feasible, into small tasks or quantities to permit maximum participation of DBEs; (4) Encouraging contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually; (5) using the services and assistance of the Small Business Administration and the Minority Business Development Agency of the U.S. Department of Commerce; and (6) requiring each party to a subcontract to take the steps in (1) through (5) of this paragraph.

D. Owner must be notified in writing by Contractor prior to any termination of a DBE subcontractor for convenience by the Contractor.

E. If a DBE subcontractor fails to complete work under the subcontract for any reason, the Contractor shall employ the six good faith efforts described in 40 CFR 33.301 if soliciting a replacement subcontractor.

F. *DBE Certifications.*

Contractors, Subcontractors, and Suppliers must be certified by one of the following:

1. The Environmental Protection Agency

2. The Small Business Administration (SBA) (both SBA 8(a) program certifications and SBA Small Disadvantaged Business (SDB) Program self-certifications);

3. The Department of Transportation's state implemented DBE Certification Program (with U.S. citizenship);

4. Tribal, State and Local governments; and

5. Recognized independent private organization certifications.

If an entity holds one of these certifications, it is considered acceptable for establishing MBE or WBE status.

18.07 *Anti-Kickback*

A. Contractor shall comply with the Copeland Anti-Kickback Act (18 U.S.C. 874 and 40 U.S.C. 276c) as supplemented by Department of Labor regulations (29 CFR Part 3, "Contractors and Subcontractors on Public Buildings or Public Works Financed in Whole or in Part by Loans and Grants of the United States.") The Act provides that Contractor or subcontractor shall be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public facilities, to give up any part of the compensation to which they are otherwise entitled. Owner shall report all suspected or reported violations to Agency.

18.08 *Clean Air and Pollution Control Acts*

A. If this Contract exceeds $100,000, Compliance with all applicable standards, orders, or requirements issued under section 306 of the Clean Air Act (42 U.S.C. 1857(h) and 42 U.S.C. 7401 et.seq.), section 508 of the Clean Water Act (33 U.S.C. 1368) and Federal Water Pollution Control Act (33 U.S.C. 1251 et seq.), Executive Order 11738, and Environmental Protection Agency regulations (40 CFR part 15) is required. Contractor will report violations to the Agency and the Regional Office of the EPA.

18.09 *State Energy Policy*

A. Contractor shall comply with the Energy Policy and Conservation Act (P.L. 94-163). Mandatory standards and policies relating to energy efficiency, contained in any applicable State Energy Conservation Plan, shall be utilized.

18.10 *Equal Opportunity Requirements*

A. If this Contract exceeds $10,000, Contractor shall comply with Executive Order 11246, "Equal Employment Opportunity," as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and as supplemented by regulations at 41 CFR part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor."

B. Contractor's compliance with Executive Order 11246 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative active obligations required by the Standard Federal Equal Employment Opportunity Construction Contract Specifications, as set forth in 41 CFR Part 60-4 and its efforts to meet the goals established for the geographical area where the Contract is to be performed. The hours of minority and female employment and training must be substantially uniform throughout the length of the Contract, and in each trade, and Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees from Contractor to Contractor or from project to project for the sole purpose of meeting Contractor's goals shall be a violation of the Contract, the Executive Order, and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

C. Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 days of award of any construction subcontract in excess of $10,000 at any tier for construction work under the Contract resulting from this solicitation. The notification shall list the name, address, and telephone number of the subcontractor; employer identification number; estimated dollar amount of subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the Contract is to be performed.

18.11 *Restrictions on Lobbying*

A. Contractor and each subcontractor shall comply with Restrictions on Lobbying (Public Law 101-121, Section 319) as supplemented by applicable Agency regulations. This Law applies to the recipients of contracts and subcontracts that exceed $100,000 at any tier under a Federal loan that exceeds $150,000 or a Federal grant that exceeds $100,000. If applicable, Contractor must complete a certification form on lobbying activities related to a specific Federal loan or grant that is a funding source for this Contract. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. 1352. Each tier shall disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Certifications and disclosures are forwarded from tier to tier up to Owner. Necessary certification and disclosure forms shall be provided by Owner.

18.12 *Environmental Requirements*

In addition to complying with other environmental requirements and constraints described elsewhere in the Contract Documents, Contractor shall comply with the following environmental constraints:

A. Wetlands- When disposing of excess, spoil, or other construction materials on public or private property, Contractor shall not fill in or otherwise convert wetlands.

B. Floodplains- When disposing of excess, spoil, or other construction materials on public or private property, Contractor shall not fill in or otherwise convert 100 year floodplain

areas delineated on the latest Federal Emergency Management Agency Floodplain maps, or other appropriate maps, i.e., alluvial soils on NRCS Soil Survey maps.

C. Historic Preservation- Any excavation by Contractor that uncovers an historical or archaeological artifact shall be immediately reported to Engineer, Owner, and representatives of Agency and the State Water Resources Control Board. Construction shall be temporarily halted pending the notification process and further direction issued by Agency after consultation with the State Historic Preservation Officer (SHPO).

D. Endangered Species- Contractor shall comply with the Endangered Species Act, which provides for protection of endangered and/or threatened species and critical habitat. Should any evidence of the presence of endangered and/or threatened species or their critical habitat be brought to the attention of Contractor, Contractor will immediately report this evidence to Engineer, Owner, and representatives of Agency and the State Water Resources Control Board. Construction shall be temporarily halted pending notification process and further directions issued by Agency after consultation with the U.S. Fish and Wildlife Service.

E. Mitigation Measures- The project has an Environmental Assessment to meet the requirements of the National Environmental Policy Act, compliance with the mitigation measures, if any, in that document are hereby included as a condition of this Contract. The Environmental Assessment is available at the following website:

http://www.slocounty.ca.gov/PW/LOWWP/DOCS/Environmental_Documents/NEPA_DOCUMENTS.htm

18.13 *Buy American (ARRA Section 1605)*

A. This Contract is funded in whole or in part using funds from the American Recovery and Reinvestment Act (ARRA). Section 1605 of the ARRA prohibits the use of these funds unless all iron, steel, and manufactured goods are produced in the United States. All iron and steel manufacturing processes must take place in the United States, except for metallurgical processes involving refinement of steel additives. There is no requirement for the origin of components and subcomponents of manufactured goods. Products listed at 48 CFR 25.104(a) have been determined to be unavailable in the United States and if required for the Project may be purchased from foreign sources. No unauthorized use of foreign iron, steel, and/or manufactured goods will be allowed on this Project.

18.14 *Davis Bacon Wage Rates (ARRA Section 1606)*

A. The ARRA requires compliance with the Davis-Bacon and Related Acts and adherence to the current U.S. Department of Labor Wage Decision ("Wage Decision"). Contractor must comply with the minimum rates for wages for laborers and mechanics as determined by the Secretary of Labor in accordance with the provisions of the Davis-Bacon and Related Acts. The Contract provisions and related matters set forth in 29 CFR Part 5- Section 5.5 are hereby made a part of this Contract. Attention is called to the fact that not less than the minimum salaries and wages set forth in the Contract Documents must be paid on this Project.

The Wage Decision, including modification, must be posted by Contractor on the Site. Contractor shall also maintain posted on site a copy of the Davis-Bacon and Related Acts poster (form WH-1321). The poster is available at the following website:

www.dol.gov/esa/WHD/regs/compliance/posters/davis.htm

The Engineer will review all certified payrolls or timesheets submitted to Engineer for compliance with the labor standards provisions. Copies of these payrolls will then be submitted to USDA Rural Development on a monthly basis along with the Application for Payment.

18.15 *Non-Discrimination*

A. During the performance of this Contract, Contractors and its Subcontractors shall not unlawfully discriminate, harass, or allow harassment against any employee or applicant for employment because of sex, race, color, ancestry, religious creed. National origin, sexual orientation, physical disability (including HIV and AIDS), mental disability, medical condition (cancer), age (over 40), marital status, and denial of family care leave.

B. Contractor and its Subcontractors shall insure that the evaluation and treatment of their employees and applicants for employment are free from such discrimination and harassment.

C. Contractors and Subcontractors shall comply with the provisions of the Fair Employment and Housing Act (Gov. Code §12990 (a-I) et seq.) and the applicable regulations promulgated thereunder (California Code of Regulations, Title 2, Section 7285 et seq.). The applicable regulations of the Fair Employment and Housing Commission implementing Government Code Section 12990 (a-I), set forth in Chapter 5 of Division 4 of Title 2 of the California Code of Regulations, are incorporated into this Contact by reference and made a part hereof as if set forth in full.

D. Contractor and Subcontractors shall give written notice of their obligations under this paragraph to labor organizations with which they have a collective bargaining or other agreement.

E. Contractor shall include the nondiscrimination and compliance provisions of this clause in all subcontracts to perform work under this Contract.

18.16 *Debarment*

A. Contractor shall not subcontract with any party who is debarred or suspended or otherwise excluded from or ineligible for participation in federal assistance programs under Executive Order 12549, "Debarment and Suspension".

B. Contractor shall not subcontract with any individual or organization on the United States Environmental Protection Agency's List of Violating Facilities. (40 CFR, Part 31 .35, Gov. Code 4477).

18.17 *Prompt Payment to Subcontractors*

A. Contractor shall pay Subcontractors for satisfactory performance no more than 30 days from the Contractor's receipt of payment from the Owner, as required by 40 CFR 33.302(a).

18.18 *Policy for Implementing the State Revolving Fund for Construction of Wastewater Treatment Facilities*

A. Contractor shall comply with the State Water Resources Control Board's "Policy for Implementing the State Revolving Fund for Construction of Wastewater Treatment Facilities," as amended from time to time.

ARTICLE 19 – BLANK

ARTICLE 20 – ADDITIONAL CALIFORNIA STATE REQUIREMENTS

20.01 In entering into a public works contract or a subcontract to supply goods, services, or materials pursuant to a public works contract, Contractor or Subcontractor offers and agrees to assign to the awarding body all rights, title, and interest in and to all causes of action it may have under Section 4 of the Clayton Act (15 U.S.C. Section 15) or under the Cartwright Act (Chapter 2 (commencing with Section 16700) of Part 2 of Division 7 of the Business and Professions Code), arising from purchases of goods, services, or materials pursuant to the public works contract or the subcontract. This assignment shall be made and become effective at the time the awarding body tenders final payment to Contractor, without further acknowledgment by the parties.

20.02 Unless otherwise indicated in the Contract Documents, all utility lines, conduits, wires, or structures shall be maintained by Contractor and shall not be disturbed, disconnected, or damaged by Contractor during the progress of the Work, provided, that should Contractor in the performance of the Work disturb, disconnect, or damage any of the above, all expenses arising from such disturbance or in the replacement or repair thereof shall be borne by Contractor. However, Contractor may be entitled to compensation in accordance with Section 4215 of the California Government Code if any existing main or trunkline utility facilities located on the Site are not indicated in the Contract Documents with reasonable accuracy.

20.03 Notwithstanding any other provision of law, every contract involving the expenditure of public funds in excess of Ten thousand dollars ($10,000) entered into by any state agency, board, commission, or department or by any other public entity, including a city, county, city and county, or district, shall be subject to the examination and audit of State auditor, at the request of the public entity or as part of any audit of the public entity, for a period of three (3) years after final payment under the Contract.

ARTICLE 21 – LABOR STANDARD PROVISIONS FOR FEDERALLY ASSISTED PROJECTS, 29 CFR PART 5

Labor standards provisions applicable to contracts funded with federal assistance authorized by the American Recovery and Reinvestment Act of 2009 and Clean Water State Revolving funds are:

§ 5.5 Contract provisions and related matters.

(a) The Owner shall insert in full in any contract in excess of $2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a public building or public work, or building or work financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in Sec. 5.1, the following clauses:

(1) Minimum wages. (i) All laborers and mechanics employed or working upon the Site of the Work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in Sec. 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the Contractor and its Subcontractors at the Site of the Work in a prominent and accessible place where it can be easily seen by the workers.

(ii)(A) The Owner shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the Contract shall be classified in conformance with the wage determination. The Environmental Protection Agency award official shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the Owner agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the Owner to the State Water Resources Control Board and the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the Owner or will notify the Owner within the 30-day period that additional time is necessary.

(C) In the event the Contractor, the laborers or mechanics to be employed in the classification or their representatives, and the Owner do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the Owner shall refer the questions, including the views of all interested parties and the recommendation of the State Water Resources Control Board, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the Owner or will notify the Owner within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii) (B) or (C) of this section, shall be paid to all workers performing work in the classification under this Contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the Contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) *Withholding*. The **Owner** shall upon its own action or upon written request of an authorized representative of the Department of Labor or the Environmental Protection Agency Award Official, withhold or cause to be withheld from the Contractor under this Contract or any other Federal contract with the same Contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same Contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any Subcontractor the full amount of wages required by the Contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the Site of the Work (or under the United States Housing Act of 1937 or under the Housing Act

of 1949 in the construction or development of the Project), all or part of the wages required by the Contract, the (Agency) may, after written notice to the Contractor, sponsor, applicant, or Owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) *Payrolls and basic records.* (i) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the Work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the Work (or under the United States Housing Act of 1937, or under the Housing Act of 1949, in the construction or development of the Project). Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The Contractor shall submit weekly for each week in which any Contract Work is performed a copy of all payrolls to Engineer, Owner, and the USDA Rural Development. Such documentation shall be available on request to the State Water Resources Control Board or the Environmental Protection Agency. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (*e.g.*, the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at http://www.dol.gov/whd/forms/ or its successor site. The Contractor is responsible for the submission of copies of payrolls by all Subcontractors. Contractors and Subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the Owner, for transmission to the State Water Resources Control Board, Environmental Protection Agency, USDA Rural Development, the Contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a Contractor to require a Subcontractor to provide addresses and social security numbers to the Contractor for its own records, without weekly submission to the Owner.

(B) Each payroll submitted shall be accompanied by a ``Statement of Compliance,'' signed by the Contractor or Subcontractor or his or her agent who pays or supervises the payment of the persons employed under the Contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under Sec. 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under Sec. 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the Contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the “Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the Contractor or Subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The Contractor or Subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State Water Resource Control Board, Environmental Protection Agency, USDA Rural Development, or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the Contractor or Subcontractor fails to submit the required records or to make them available, the Federal agency may, after written notice to the Contractor, sponsor, applicant, or Owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) *Apprentices and trainees*--(i) *Apprentices.* Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the

job Site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a Contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or Subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) *Trainees*. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job Site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) *Equal employment opportunity*. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) *Compliance with Copeland Act requirements*. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this Contract.

(6) *Subcontracts.* The Contractor or Subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the (write in the name of the Federal agency) may by appropriate instructions require, and also a clause requiring the Subcontractors to include these clauses in any lower tier subcontracts. The Contractor shall be responsible for the compliance by any Subcontractor or lower tier Subcontractor with all the Contract clauses in 29 CFR 5.5.

(7) *Contract termination: debarment.* A breach of the Contract clauses in 29 CFR 5.5 may be grounds for termination of the Contract, and for debarment as a Contractor and a Subcontractor as provided in 29 CFR 5.12.

(8) *Compliance with Davis-Bacon and Related Act requirements.* All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this Contract.

(9) *Disputes concerning labor standards.* Disputes arising out of the labor standards provisions of this Contract shall not be subject to the general disputes clause of this Contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the Contractor (or any of its Subcontractors) and the Owner, State Water Resources Control Board, Environmental Protection Agency, the U.S. Department of Labor, or the employees or their representatives.

(10) *Certification of eligibility.* (i) By entering into this Contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this Contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

(b) *Contract Work Hours and Safety Standards Act.* The following clauses set forth in paragraphs (b)(1), (2), (3), and (4) of this section in full in any Contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by Sec. 5.5(a) or 4.6 of part 4 of this title. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

(1) *Overtime requirements.* No Contractor or Subcontractor contracting for any part of the Contract Work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) *Violation; liability for unpaid wages; liquidated damages.* In the event of any violation of the clause set forth in paragraph (b)(1) of this section the Contractor and any Subcontractor

responsible there for shall be liable for the unpaid wages. In addition, such Contractor and Subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (b)(1) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1) of this section.

(3) *Withholding for unpaid wages and liquidated damages*. The Owner shall upon its own action or upon written request of the Environmental Protection Agency Award Official or an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the Contractor or Subcontractor under any such contract or any other Federal contract with the same Contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same Contractor, such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or Subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) *Subcontracts.* The Contractor or Subcontractor shall insert in any subcontracts the clauses set forth in paragraph (b)(1) through (4) of this section and also a clause requiring the Subcontractors to include these clauses in any lower tier subcontracts. The Contractor shall be responsible for compliance by any Subcontractor or lower tier Subcontractor with the clauses set forth in paragraphs (b)(1) through (4) of this section.

(c) In addition to the clauses contained in paragraph (b), in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in Sec. 5.1, the Owner shall insert a clause requiring that the Contractor or Subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, Owner shall insert in any such Contract a clause providing that the records to be maintained under this paragraph shall be made available by the Contractor or Subcontractor for inspection, copying, or transcription by authorized representatives of the Environmental Protection Agency, State Water Resources Control Board, and the Department of Labor, and the Contractor or Subcontractor will permit such representatives to interview employees during working hours on the job.

SECTION 00815
EXHIBIT GC-A

CERTIFICATE OF OWNER'S ATTORNEY

I, the undersigned, _____, the duly authorized and acting legal representative of County of San Luis Obispo, do hereby certify as follows:

I have examined the attached Contract(s) and performance and payment bond(s) and the manner of execution thereof, and I am of the opinion that each of the aforesaid agreements is adequate and has been duly executed by the proper parties thereto acting through their duly authorized representatives; that said representatives have full power and authority to execute said agreements on behalf of the respective parties named thereon; and that the foregoing agreements constitute valid and legally binding obligations upon the parties executing the same in accordance with the terms, conditions, and provisions thereof.

_____
(Attorney's Signature)

Date: _____

AGENCY CONCURRENCE

As lender or insurer of funds to defray the costs of this Contract, and without liability for any payments thereunder, the Agency hereby concurs in the form, content, and execution of this Agreement.

By: _____ Date: _____

Type Name: _____

END OF SECTION

SECTION 00820

	Contractor's Application for Payment No.	
	Application Period:	Application Date:
To (Owner):	From (Contractor):	Via (Engineer):
Project:	Contract:	
Owner's Contract No.:	Contractor's Project No.:	Engineer's Project No.:

Application For Payment
Change Order Summary

Approved Change Orders		
Number	Additions	Deductions
TOTALS		
NET CHANGE BY CHANGE ORDERS		

Contractor's Certification

The undersigned Contractor certifies that to the best of its knowledge: (1) all previous progress payments received from Owner on account of Work done under the Contract have been applied on account to discharge Contractor's legitimate obligations incurred in connection with Work covered by prior Applications for Payment; (2) title of all Work, materials and equipment incorporated in said Work or otherwise listed in or covered by this Application for Payment will pass to Owner at time of payment free and clear of all Liens, security interests and encumbrances (except such as are covered by a Bond acceptable to Owner indemnifying Owner against any such Liens, security interest or encumbrances); and (3) all Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.

By: Date:

1. ORIGINAL CONTRACT PRICE	**$**	
2. Net change by Change Orders	**$**	
3. Current Contract Price (Line 1 ± 2)	**$**	
4. TOTAL COMPLETED AND STORED TO DATE (Column F on Progress Estimate)	**$**	
5. RETAINAGE:		
a. X _____ Work Completed	**$**	
b. X _____ Stored Material	**$**	
c. Total Retainage (Line 5a + Line 5b)	**$**	
6. AMOUNT ELIGIBLE TO DATE (Line 4 - Line 5c)	**$**	
7. LESS PREVIOUS PAYMENTS (Line 6 from prior Application)	**$**	
8. AMOUNT DUE THIS APPLICATION	**$**	
9. BALANCE TO FINISH, PLUS RETAINAGE (Column G on Progress Estimate + Line 5 above)	**$**	

Payment of: $ _____
(Line 8 or other - attach explanation of the other amount)

is recommended by: _____ _____
(Engineer) (Date)

Payment of: $ _____
(Line 8 or other - attach explanation of the other amount)

is approved by: _____ _____
(Owner) (Date)

Approved by: _____ _____
Funding Agency (if applicable) (Date)

Progress Estimate **Contractor's Application**

For (contract):	Application Number:
Application Period:	Application Date:

A		B	Work Completed		E	F		G
Item		Scheduled Value	C	D	Materials Presently Stored (not in C or D)	Total Completed and Stored to Date (C + D + E)	% (F) B	Balance to Finish (B - F)
Specification Section No.	Description		From Previous Application (C+D)	This Period				
	Totals							

Progress Estimate **Contractor's Application**

For (contract):						Application Number:			
Application Period:						Application Date:			
A			B	C	D	E	F		
Item		Bid Quantity	Unit Price	Bid Value	Estimated Quantity Installed	Value	Materials Presently Stored (not in C)	Total Completed and Stored to Date (D + E)	% (F) B	Balance to Finish (B - F)
Bid Item No.	Description									
	Totals									

Stored Material Summary **Contractor's Application**

For (contract):	Application Number:
Application Period:	Application Date:

A	B	C	D		E		F		G
Invoice No.	Shop Drawing Transmittal No.	Materials Description	Stored Previously		Stored this Month		Incorporated in Work		Materials Remaining in Storage ($) (D + E - F)
			Date (Month/Year)	Amount ($)	Amount ($)	Subtotal	Date (Month/Year)	Amount ($)	
		Totals							

SECTION 00830

CHANGE ORDER

No. _____

Date of Issuance: _____ Effective Date: _____

Project: Los Osos Wastewater Project	Owner: County of San Luis Obispo	Owner's Contract No.: 300448.08.01.PS
Contract: Collection System Pump Stations		Date of Contract:
Contractor:		

The Contract Documents are modified as follows upon execution of this Change Order:

Description:

Attachments (list documents supporting change):

CHANGE IN CONTRACT PRICE	CHANGE IN CONTRACT TIMES
Original Contract Price:	Original Contract Times: ☐ Working days ☐ Calendar days
$_____	Substantial completion (days): _____
	Ready for final payment (days): _____
[Increase] [Decrease] from previously approved Change Orders No. _____ to No. _____:	[Increase] [Decrease] from previously approved Change Orders No. _____ to No. _____:
	Substantial completion (days): _____
$_____	Ready for final payment (days): _____
Contract Price prior to this Change Order:	Contract Times prior to this Change Order:
	Substantial completion (days): _____
$_____	Ready for final payment (days): _____
[Increase] [Decrease] of this Change Order:	[Increase] [Decrease] of this Change Order:
	Substantial completion (days): _____
$_____	Ready for final payment (days): _____
Contract Price incorporating this Change Order:	Contract Times with all approved Change Orders:
	Substantial completion (days): _____
$_____	Ready for final payment (days): _____

ENGINEER RECOMMENDATION BY::

Signature (Print Name and Title) Date

OWNER ACCEPTANCE BY:

Signature (Print Name and Title) Date

Signature (Print Name and Title) Date

We the undersigned Contractor, have given car eful consideration to the change(s) proposed and agree, if this proposal is approv ed, that we will provide all equipm ent, furnish the m aterials, except as m ay otherwise be noted above, and perform all services necessary for the work above specified, and will accept as full consideration therefor the change(s) in Contract Price and/or Contract Times shown above. Pursuant to par. 10.03.B. of section 700, once this Change Order is accepted by Owner and Engineer, it constitutes a final settlement of all matters referenced herein.

CONTRACTOR ACCEPTANCE BY:

Signature (Print Name and Title) Date

USDA APPROVAL BY:

Signature (Print Name and Title) Date

Technical Specifications

County of San Luis Obispo
Los Osos Wastewater Collection System

County of San Luis Obispo
Los Osos, California

Technical Specifications for the Construction of

Los Osos Wastewater Collection System Pump Stations

Volume I

REGISTERED PROFESSIONAL ENGINEER
BRUCE JAMES CORWIN
C 051414
EXP. 06/30/12
4/27/12
CIVIL
STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER
SHERWIN B. MENDOZA
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Exp. 06/30/13
4/23/12
MECHANICAL
STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER
CHARLES A. LINDQUIST II
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EXP. 3/31/14
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STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER
DEREK THU PHAM
No. C 72360
Exp. 6/30/12
4/23/12
CIVIL
STATE OF CALIFORNIA

April 2012

Division 1 General Requirements

SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.01 THE REQUIREMENT

A. The Work to be performed under this Contract shall consist of furnishing plant, tools, equipment, materials, supplies, and manufactured articles, and furnishing all labor, transportation, and services, including fuel, power, water, and essential communications, and performing all work or other operations required for the fulfillment of the Contract in strict accordance with the Contract Documents. The Work shall be complete, and all work, materials, and services not expressly indicated or called for in the Contract Documents that may be necessary for the complete and proper construction of the Work in good faith shall be provided by the CONTRACTOR as though originally so indicated, at no increase in cost to the OWNER.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

A. Description of the Work

1. The Los Osos Wastewater Project (Project) will provide wastewater collection, conveyance, treatment, and treated effluent disposal for the community of Los Osos that is currently unsewered and utilizes septic tanks. The Project consists of construction divided into four geographical areas (Area A, Area B, Area C, and Area D), Pump Station construction, Mid-Town site restoration, and water recycling facility, and roadway improvements, including storm drainage facilities.

2. The Work of this Contract consists of Pump Station construction.

B. The Pump Station Construction includes, but is not limited to, the following:

1. Nine sewage lift stations equipped with submersible solids-handling pumps.

2. Twelve ‘pocket pumps stations’ equipped with submersible grinder-type sewage pumps.

3. Each of the sewage lift stations will be equipped with back-up generators, associated system controls, valves, and accessories. The pocket pumps stations will have associated system controls, valves, and accessories.

C. Location of the Work

1. The location of the Work is in the community of Los Osos, San Luis Obispo County, at the south end of the Morro Bay estuary, west of San Luis Obispo, California and Highway 101. The project is located in the Los Osos residential and business community. The Project will be constructed in rolling to steep dune terrain with sandy soils and with shallow groundwater in low lying areas of the community.

D. Coordination of the Project

1. Close coordination with the OWNER, ENGINEER, and others will be mandatory as well as minimizing construction impacts upon the residential and business communities.

1.03 CONTRACT METHOD

A. The Work hereunder will be constructed under a single unit-price and/or lump sum contract as designated by the Bid Schedule.

1.04 WORK BY OTHERS

A. CONTRACTOR shall be responsible for coordinating the performance of its Work with the performance of other work on the Project at the Site. The following work will be performed by others concurrently with the Work of this Contract.

1. Construction of the 'Area A' Collection system, force mains, pump station wet wells and yard piping.

2. Construction of the 'Area B' Collection system, force mains, pump station wet wells and yard piping..

3. Construction of the 'Area C' Collection system, force mains, pump station wet wells and yard piping.

4. Construction of the 'Area D' Collection system, force mains, pump station wet wells and yard piping.

5. Restoration of the Mid-Town site.

6. Construction of the water recycling facility.

7. Construction of road improvements and storm drainage facilities in the County road right-of-way.

B. The OWNER will execute a subsequent separate contract for construction of a wastewater treatment and water recycling facility. This facility will treat the wastewater collected by the pipelines and pump stations constructed under this Contract and the two other packages, The CONTRACTOR for this package is not responsible for connection to the water recycling facility.

1.05 CONTRACTOR USE OF STAGING AREA

A. The CONTRACTOR's use of the construction staging areas shall be as defined in Section 01500.

1.06 PROJECT MEETINGS

A. Preconstruction Conference

1. Prior to the commencement of Work on this Contract, and within 15 days of Notice to Proceed, a preconstruction conference will be held at a mutually agreed time and place. The conference shall be attended by the CONTRACTOR's Project Manager, its superintendent, and its subcontractors as the CONTRACTOR deems appropriate. Other attendees will be:

a. Engineer and the Resident Project Representative.

b. Representatives of OWNER.

c. Governmental representatives as appropriate.

d. Others as requested by CONTRACTOR, OWNER, or ENGINEER.

2. The CONTRACTOR shall bring the preconstruction conference submittals in accordance with Section 01300 – Contractor Submittals.

3. The purpose of the conference is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The complete agenda will be furnished to the CONTRACTOR prior to the meeting date. However, the CONTRACTOR should be prepared to discuss all of the items listed below.

a. Status of CONTRACTOR's insurance and bonds.

b. CONTRACTOR's tentative schedules.

(1) CONTRACTOR shall provide a preliminary schedule as defined in Section 01311.

c. Transmittal, review, and distribution of CONTRACTOR's submittals.

d. Processing applications for payment.

e. Maintaining record documents.

f. Critical work sequencing.

g. Field decisions and Change Orders.

h. Use of Site, office and storage areas, security, housekeeping, and OWNER's needs.

i. Major equipment deliveries and priorities.

j. CONTRACTOR's assignments for safety and first aid.

k. Daily Report Form which the ENGINEER will furnish.

l. Submittal Transmittal Form which the ENGINEER will furnish.

4. The ENGINEER will preside at the preconstruction conference and will arrange for keeping and distributing the minutes to all persons in attendance.

B. Progress Meetings

1. The ENGINEER will schedule and hold regular on-Site progress meetings at least weekly and at other times as requested by CONTRACTOR or as required by progress of the Work. The CONTRACTOR, ENGINEER, and all subcontractors active on the Site shall attend

each meeting. CONTRACTOR may at its discretion request attendance by representatives of its suppliers, manufacturers, and other subcontractors.

2. The ENGINEER will preside at the progress meetings and will arrange for keeping and distributing the minutes. The purpose of the meetings is to review the progress of the Work, maintain coordination of efforts, discuss changes in scheduling, and resolve other problems that may develop. During each meeting, the CONTRACTOR shall present any issues that may impact its progress with a view to resolve these issues expeditiously.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 MOBILIZATION (Item 1)

A. MOBILIZATION shall include preparatory work and operations, including, but not limited to, those necessary for the movement of personnel, equipment, supplies and incidentals to the project site, for the establishment of all offices, buildings and other facilities necessary for work on the project, and for all other work and operations which must be performed or costs incurred prior to beginning work on the various items on the project site. Bid item for MOBILIZATION shall not exceed five percent (5%) of the original contract amount.

B. Payment

1. The lump sum price shall be paid for MOBILIZATION.

2. Partial payments for MOBILIZATION shall be in accordance with California Public Contract Code Section 10264.

1.02 SHEETING, SHORING, AND BRACING (Item 2)

A. Payment

1. The lump sum price shall be paid for SHEETING, SHORING, AND BRACING; which shall be full compensation for all costs incurred to provide sheeting, shoring, and/or bracing of open cut excavation; inclusive of all construction conforming to applicable safety orders; preparing and submitting shoring designs, labor, tools, materials, equipment, power and fuels for doing all required work, complete as specified and as indicated on the Drawings.

1.03 DEWATERING (Item 3)

A. Payment

1. The lump sum price shall be paid for DEWATERING; which shall be full compensation for all costs incurred to provide dewatering system design, installation, operation, and removal of dewatering systems inclusive of all labor, equipment, materials, and incidentals necessary to handle groundwater an surface water including but not limited to sinking well points, furnishing, installing and maintaining pumping systems including all pumps, piping, casing, and other appurtenances, filter sand required for pumping systems, erosion and sediment control, excavation of monitoring wells, providing power, maintaining excavation free of water on a continuous basis, sedimentation or other means of removing suspended solids, disinfection and neutralization, and disposal of water consistent with requirements as set forth in the Contract Documents and RWQCB permit(s).

1.04 SITE PREPARATION (Item 4)

A. Payment

1. The lump sum price shall be paid for SITE PREPARATION; which shall be full compensation for all costs incurred to provide removal of debris, clearing, grubbing, protection of trees, shrubbery, and other plantings not designated for removal, certified arborist services, tree removal including tree cutting, removal and disposal off site and stump grinding, removal and disposal off site and other incidental work pertaining to SITE PREPARATION.

1.05 HOT MIX ASPHALT PAVEMENT (HMA) (Item 5)

A. Measurement

1. Measurement for payment for HOT MIX ASPHALT PAVEMENT shall be by the ton and will be the number of tons placed in the Work; which shall be full compensation for all costs incurred to furnish all HMA, labor, materials, tools, equipment, and incidentals for work involved in placing HMA for all pavement repair and resurfacing, including dikes, berms, and miscellaneous areas to the payment limits as shown on the Drawings, and as directed by the ENGINEER.

B. Payment

1. The unit price shall be paid for HMA on a per ton basis.

1.06 AGGREGATE BASE (Item 6)

A. Measurement

1. Measurement for payment for AGGREGATE BASE shall be by the cubic yard and will be the number of cubic yards placed in the Work; which shall be full compensation for all costs incurred to furnish all aggregate base, labor, materials, tools, equipment, and incidentals for doing all work to replace aggregate base beneath existing roadway pavement, sidewalk, curb and gutter to the payment limits as shown on the Drawings, and as directed by the ENGINEER.

B. Payment

1. The unit price shall be paid for AGGREGATE BASE on a per cubic yard basis.

1.07 TRAFFIC CONTROL (Item 7)

A. Payment

1. The lump sum price shall be paid for TRAFFIC CONTROL; which shall be full compensation for all costs incurred to provide traffic control to all phases of work and include furnishing and installing: traffic control equipment and personnel; flagging; sign panels, including all mounting hardware; furnishing and installing signal equipment and controllers and other incidental work pertaining to TRAFFIC CONTROL.

1.08 POCKET PUMP STATIONS (Item 8)

A. Measurement

1. POCKET PUMP STATIONS including but not limited to: grout; pumps; pump removal accessories; valves; control panels; wiring; instrumentation; discharge piping to force main connection; site accessories; complete as specified and as indicated on the Drawings.

B. Payment

1. The unit price shall be paid for POCKET PUMP STATION per each.

1.09 DUPLEX SUBMERSIBLE LIFT STATIONS (Item 9)

A. Measurement

1. DUPLEX SUBMERSIBLE LIFT STATIONS including but not limited to: grout; pumps; pump removal accessories; valves; control panels; wiring; instrumentation; discharge piping to force main connection; site accessories; complete as specified and as indicated on the Drawings.

B. Payment

1. The unit price shall be paid for DUPLEX SUBMERSIBLE LIFT STATIONS per each.

1.10 TRIPLEX SUBMERSIBLE LIFT STATIONS (Item 10)

A. Measurement

1. TRIPLEX SUBMERSIBLE LIFT STATIONS including but not limited to: grout; pumps; pump removal accessories; valves; control panels; wiring; instrumentation; discharge piping to force main connection; site accessories; complete as specified and as indicated on the Drawings.

B. Payment

1. The unit price shall be paid for TRIPLEX SUBMERSIBLE LIFT STATIONS per each.

1.11 STANDBY POWER BUILDINGS (Item 11)

A. Measurement

1. STANDBY POWER BUILDINGS including but not limited to: generators; control panels; conduit and wiring; site grading; structural excavation, backfill, and compaction; perimeter footings; equipment foundation; building concrete and masonry; framing; thermal and moisture protection; trusses; roofing; doors; interior and exterior finishes; lighting; site work; complete as specified and as indicated on the Drawings

B. Payment

1. The unit price shall be paid for STANDBY POWER BUILDINGS per each.

1.12 INSTALL NATIVE VEGETATION (Item 12)

A. Measurement

1. Measurement for payment for INSTALL NATIVE VEGETATION will be by the square foot placed in the Work, which shall be full compensation for: soil preparation, provision and installation of native plantings and irrigation system installation at the pump station sites, ornamental gates, complete as specified and shown on the Drawings.

B. Payment

1. The unit price shall be paid for INSTALL NATIVE VEGETATION on a per square foot basis.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01046

CONTROL OF WORK

PART 1 GENERAL

1.01 PRIVATE LAND

A. Do not enter or occupy private land outside of easements, except by permission of the land owner.

1.02 PIPE LOCATIONS

A. Locate pipelines substantially as indicated on the Drawings. The ENGINEER reserves the right to make such modifications in locations as may be found desirable to avoid interference with existing structures, existing overhead or buried utilities, or for other reasons. Where fittings are noted on the Drawings, such notation is for the CONTRACTOR's convenience and does not relieve him from laying and jointing different or additional items where required.

1.03 OPEN EXCAVATIONS

A. Adequately safeguard all open excavations by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons and damage to property. Provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workmen. Remove bridges provided for access during construction when no longer required. The length or size of excavation will be controlled by the particular surrounding conditions, but shall always be confined to the limits prescribed by the ENGINEER. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the ENGINEER may require special construction procedures such as limiting the length of the open trench, prohibiting stacking excavated material in the street and requiring that the trench shall not remain open overnight.

B. Take precautions to prevent injury to the public due to open trenches. Provide adequate light at all trenches, excavated material, equipment, or other obstacles which could be dangerous to the public at night.

1.04 POTHOLING

A. Excavate potholes to locate underground pipelines or structures in advance of the construction. Backfill potholes immediately after their purpose has been satisfied, and restore and maintain the surface in a manner satisfactory to the ENGINEER.

1.05 MAINTENANCE OF TRAFFIC

A. Unless permission to close a street is received in writing from the proper authority, place all excavated material so that vehicular and pedestrian traffic may be maintained at all times. If the construction operations cause traffic hazards, repair the road surface, provide temporary ways, erect wheel guards or fences, or take other measures for safety in accordance with Section 01571 – Traffic Control.

B. Detours around construction will be subject to the approval of the ENGINEER. Where detours are permitted, provide all necessary barricades and signs as required to divert the flow of traffic. Expedite construction operations while traffic is detoured. Periods when traffic is being detoured will be strictly controlled by the OWNER.

C. Take precautions to prevent injury to the public due to open trenches. Night watchmen may be required where special hazards exist. The CONTRACTOR shall be fully responsible for damage or injuries.

1.06 CARE AND PROTECTION OF PROPERTY

A. CONTRACTOR shall be responsible for the preservation of all public and private property and use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the CONTRACTOR, restore such property to a condition similar or equal to that existing before the damage was done, or make good the damage in other manner acceptable to the ENGINEER.

1.07 WATER FOR CONSTRUCTION PURPOSES

A. CONTRACTOR shall furnish all water needed for construction and testing.

B. CONTRACTOR shall be responsible for adequate and lawful disposal of all water used for testing.

C. CONTRACTOR shall observe any water use restrictions in place during the execution of the Contract.

1.08 MAINTENANCE OF FLOW

A. Provide for the flow of sewers, drains and water courses interrupted during the progress of the work, and immediately remove all materials affecting facilities and dispose of in a legal manner. Notify the ENGINEER in writing at least one week in advance of the interruption of any flow.

1.09 COOPERATION WITHIN THIS CONTRACT

A. All firms or persons authorized to perform any work under this Contract shall cooperate with CONTRACTOR and Subcontractors or trades and assist in incorporating the work of other trades where necessary or required.

B. Cutting and patching, drilling and fitting shall be carried out where required by the trade or subcontractor having jurisdiction, unless otherwise indicated herein or directed by the ENGINEER.

1.10 CLEANUP AND DISPOSAL OF EXCESS MATERIAL

A. During the course of the work, keep the site of operations as clean and neat as possible. Dispose of all residue resulting from the construction work and, at the conclusion of the work, remove and haul away any surplus excavation, broken pavement, lumber, equipment, temporary structures and any other refuse remaining from the construction operations and leave the entire site of the work in a neat and orderly condition.

B. In order to prevent environmental pollution arising from the construction activities related to the performance of this Contract, comply with all applicable Federal, State and local laws and regulations concerning waste material disposal, as well as the specific requirements stated in this Section and in other related sections.

C. Disposal of excess excavated material in wetlands, stream corridors and plains is strictly prohibited even if the permission of the property owner is obtained. Any violation of this restriction by the CONTRACTOR or any person employed by him will be brought to the immediate attention of the responsible regulatory agencies, with a request that appropriate action be taken against the offending parties. The CONTRACTOR will be required to remove the fill and restore the area impacted at no increase in the Contract Price.

D. If CONTRACTOR elects to dispose of materials at locations other than those where arrangements have been made by OWNER, or, if material is to be disposed of and OWNER has not made arrangements for disposal of the material, the CONTRACTOR shall make arrangements for disposing of the materials outside the right of way and shall pay all costs involved. Arrangements shall include, but not be limited to, entering into agreements with property owners and obtaining necessary permits, licenses, and environmental clearances. Before disposing of any material outside the right of way, CONTRACTOR shall furnish to ENGINEER satisfactory evidence that CONTRACTOR has entered into agreements with the property owners of the site involved and has obtained the permits, licenses, and clearances.

E. When any material is to be disposed of outside the right of way, and the OWNER has not made arrangements for disposal of the material, CONTRACTOR shall first obtain written authorization from the property owner on whose property the disposal is to be made and CONTRACTOR shall file with ENGINEER the authorization or a certified copy thereof together with a written release from the property owner absolving the OWNER from any and all responsibility in connection with the disposal of material on the property. Before any material is disposed of on the property, CONTRACTOR shall obtain written permission from ENGINEER to dispose of the material at the location designated in the authorization.

F. When material is disposed of as above provided and the disposal location is visible from a highway, the CONTRACTOR shall dispose of the material in a neat and uniform manner to the satisfaction of the ENGINEER.

G. Where the OWNER has made arrangements with owners of land in the vicinity of the Project for the disposal of materials on an owner's property, the arrangements are made solely for the purpose of providing all Bidders an equal opportunity to dispose of the materials on the property. Bidders or CONTRACTORs may, upon written request, inspect the documents evidencing the arrangements between property owners and the OWNER. The CONTRACTOR may, if the CONTRACTOR so elects, exercise any rights that have been obtained, which may be exercised by a CONTRACTOR under the arrangements, subject to and upon the conditions hereinafter set forth.

H. Such arrangements are not a part of the Contract and it is expressly understood and agreed that the OWNER assumes no responsibility to the Bidder or CONTRACTOR whatsoever in respect to the arrangements made with the property owner to dispose of materials thereon and that the Contractor shall assume all risks in connection with the use of the property, the terms upon which the use shall be made, and there is no warranty or guaranty, either express or implied, as to the quantity or types of materials that can be disposed of on the property.

I. The Bidder or CONTRACTOR is cautioned to make such independent investigation and examination as the CONTRACTOR deems necessary to be satisfied as to the quantity and types of materials which may be disposed of on the property and the rights, duties and obligations acquired or undertaken under the arrangement with the property owner.

J. Notwithstanding that the CONTRACTOR may elect to dispose of materials on any such property owner's property, no material may be disposed of on that property unless the CONTRACTOR has first either:

1. Executed a document that will guarantee to hold the owner harmless from all claims for injury to persons or damage to property resulting from the CONTRACTOR's operations on the property owner's premises and also agree to conform to all other provisions set forth in the arrangement made between the OWNER and the property owner. The document will be prepared by the ENGINEER for execution by the CONTRACTOR, or

2. Entered into an agreement with the owner of the disposal site on any terms mutually agreeable to the owner and the CONTRACTOR; provided that the CONTRACTOR shall furnish to the ENGINEER a release, in a form satisfactory to the ENGINEER, executed by the owner, relieving the OWNER of any and all obligations under the OWNER's arrangement with the owner.

K. If the CONTRACTOR elects to dispose of material under (1), the use of the site shall be subject to the terms, conditions and limitations of the arrangement made between the property owner and the OWNER and the CONTRACTOR shall pay those charges that are provided for in the arrangement made by the OWNER with the property owner, and deductions will be made from any moneys due or that may become due the CONTRACTOR under the Contract sufficient to cover the charges for the material disposed of.

L. If the CONTRACTOR elects to dispose of material under (2), the CONTRACTOR shall pay those charges that are provided for in the agreement between the owner and the CONTRACTOR and deductions will not be made from any moneys due or that may become due the CONTRACTOR under the Contract to cover the charges.

M. Before acceptance of the Contract, the ENGINEER may require the CONTRACTOR to submit written evidence that the owner of the disposal site is satisfied that the CONTRACTOR has satisfactorily complied with the provisions of either - (1), the arrangement between the OWNER and the owner, or (2), the agreement between the owner and the CONTRACTOR, as the case may be.

N. Full compensation for all costs involved in disposing of materials as specified in this paragraph, including all costs of hauling, shall be considered as included in the price paid for the contract item of work involving the materials and no additional compensation will be allowed therefor.

END OF SECTION

SECTION 01050

PROJECT CONTROLS (SURVEYING)

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Provide field engineering services required for the WORK; including but not limited to:

1. Survey work required for project controls and layout.

2. Certified as-built surveys specified herein.

B. Retain the services of a registered land surveyor licensed in the State of the California to:

1. Identify existing control points and property line corners indicated on the Drawings.

2. Verify and record all existing structure locations in the vicinity of, or adjacent to, the WORK.

3. Maintain an accurate record of locations of all new buried piping and existing buried piping and other buried existing facilities (piping, conduits, and structures) encountered and/or relocated during construction of the new WORK.

1.02 SUBMITTALS

A. Submit, to the ENGINEER, the name, address and state registration and license number of proposed registered land surveyor.

B. At the end of the project, and prior to final payment, submit certified drawing(s) (with the Surveyor’s title block) of the items listed below. All surveys shall be tied to the applicable Grid System and shall indicate all pre-existing and new project benchmarks. Vertical Control shall conform to the project elevation datum designated on the plans.

1. Provide a certified survey drawn at the same scale as the ENGINEER's line drawings indicating lines, grades, elevations, and stationing at 100-ft increments, changes in alignment or grade. Provide elevations of structure inverts, pipe invert(s) and rim elevations on all flow structures.

1.03 QUALIFICATIONS OF SURVEYOR

A. Registered land surveyor, licensed in the State of California.

1.04 SURVEY REFERENCE POINTS

A. Existing basic horizontal and vertical control points for the project will be provided by the ENGINEER.

B. Locate and protect control points prior to starting site work and preserve all permanent reference points during construction.

1. Make no changes or relocations without prior written notice to and approval by the ENGINEER.

2. Report to the ENGINEER when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

3. Require the surveyor to correctly replace project control points which may be lost or destroyed. Establish replacements based on original survey control.

1.05 PROJECT SURVEY REQUIREMENTS

A. Engineer shall provide construction staking to establish the lines and grades for the WORK.

B. Execute the WORK in accordance with the lines and grades indicated.

C. If lines, levels or layouts are lost or destroyed, or if required by the OWNER or ENGINEER, verify layouts by same methods.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 RECORDS

A. Prepare and submit Record Documents as specified in Section 01720.

B. Maintain a complete, accurate log of all control and survey work as it progresses.

C. Update the project as-built survey on a monthly basis, based on the work performed during the month. Submit one copy of up to date as-built documentation with CONTRACTOR's monthly applications for payment.

D. Maintain an accurate record of new and existing piping, conduit and structure changes, revisions, relocations, and modifications.

E. At the end of the project, submit the following:

1. Four signed and sealed prints of all required as-built survey information

2. Copy of all AutoCAD files of documents specified in Article 1.03.C, above on a CD or DVD.

END OF SECTION

SECTION 01060

REGULATORY AGENCY AND UTILITY REQUIREMENTS

PART 1 GENERAL

1.01 THE REQUIREMENT

A. The CONTRACTOR shall apply for, obtain and comply with terms, conditions and requirements attached to all permits, bonds and licenses required by any local, regional, state or federal agencies to perform work, construct, erect, test and start up the Work. The CONTRACTOR shall also obtain written agreements from any private property owners with whom it arranges to use their land and/or facilities during construction.

B. The OWNER has obtained certain permits during the project design phase. These are appended to these Specifications and described in Paragraph 1.02 below. The CONTRACTOR is required to abide by the requirements of these permits and shall also obtain construction phase permits and abide by their requirements.

C. While not covered by permits or agreements, the CONTRACTOR shall also plan and execute its work in coordination with utility agencies. This shall include, but not be limited to, working adjacent to and protecting in place existing water, gas, fiber optic and other underground utilities and arranging for utility connections to the new wastewater facilities. Utility contacts are listed in the General drawings of the Contract Drawings. Also see Paragraph 1.03, below.

1.02 PERMITS AND AGREEMENTS

A. The CONTRACTOR shall abide by the conditions of all permits and agreements and shall obtain written proof of satisfaction of conditions from issuers of permits and agreements prior to acceptance of the Work by the OWNER.

B. Conditions and requirements affecting the CONTRACTOR are found in the following permits and agreements. Note, however, that this list may not be all inclusive:

1. County of San Luis Obispo Project Encroachment Permit. The OWNER has obtained an encroachment permit for constructing the project within County right of way and has incorporated the applicable provisions into the Contract Documents. The CONTRACTOR shall abide by all requirements pertaining to it. No encroachment permit related fees or trench cut fees are required to be paid by the CONTRACTOR.

2. County of San Luis Obispo, Department of Planning and Building, Approved Development Plan/Coastal Development Plan A-3-SLO-09-055/069. See “Conditions of Approval” construction phase requirements pertaining to the CONTRACTOR as presented in Paragraph 1.04, below.

3. Central Coast Regional Water Quality Control Board (RWQCB) Low Threat Discharge General Permit CAG993001, Order No. R3-2011-0223. The subject permit applies for disposal of dewatering water by the CONTRACTOR. The CONTRACTOR shall abide by the requirements of said permit including dewatering water desilting prior to disposal.

4. Central Coast Regional Water Quality Control Board Storm Water General Permit. The OWNER has submitted to the RWQCB its intent to comply with the requirements of the Storm Water General Permit. CONTRACTOR shall modify the permit to become the listed QSP. CONTRACTOR may also modify the permit as required. The CONTRACTOR shall abide by all of said permit requirements including preparing and submitting its Stormwater Pollution Prevention Plan (SWPPP) to the RWQCB. Also see Section 01570 Stormwater Pollution Prevention Plan and the erosion control plans shown in the Contract Drawings.

5. County of San Luis Obispo Fill and Grading Permits. The CONTRACTOR shall obtain a fill and grading permit for each property used for disposal of excavation spoils.

6. Easement Deed and Agreement Affecting Real Property APN: 074-263-038, Document Number 2004017916, and Quit Claim Deed, Document Number 2011060986, granting the OWNER permanent and temporary construction easements within the Knighton Property between Mountain View Avenue and South Bay Boulevard and south of Nipomo Street, as defined in the Easement Agreement.

7. Private Property Use Agreements. Should the CONTRACTOR arrange for and negotiate agreements with private property owners for use of their property for staging or laydown areas, it shall provide a copy of said agreements to the ENGINEER. These private property use agreements are subject to the approval of the ENGINEER upon verification that such use complies with all environmental permit requirements. Upon construction completion, the CONTRACTOR shall also provide a signed off copy of said agreements signifying that the property has been properly restored.

1.03 UTILITY CONNECTIONS

A. The CONTRACTOR will include all costs in its bid to contact utilities and make arrangements for and provide all utilities required for the project facilities. The foregoing shall include costs for any utility engineering, construction work that must be performed by utility forces including their facility extension costs, metering and other appurtenances, utility inspection and other fees and other costs associated with providing the utility service to the wastewater project facilities.

B. CONTRACTOR shall contact the Utilities listed on Sheet G-004 of the Contract Drawings to obtain service needed for the project facilities

1.04 CONDITIONS OF COSTAL DEVELOPMENT APPROVAL PERTAINING TO CONTRACTOR

The CONTRACTOR shall conform to the conditions of the Coastal Development Permit (CDP) and provide measures required.

A. Condition 11. Fire Safety: Prior to occupancy or final inspection, whichever comes first, the CONTRACTOR shall assist the OWNER in obtaining final inspection approval of all required fire/life safety measures.

B. Condition 12. Portable Engines: Prior to initiating grading activities, if it is determined that portable engines and portable equipment will be used, the CONTRACTOR shall contact the SLOAPCD and obtain a permit to operate portable engines or portable equipment, and such engines or equipment shall be registered in the statewide portable equipment registration

program. The SLOAPCD Compliance Division shall be contacted to determine the implementation requirements of this mitigation measure.

C. Condition 13. Encroachment Permit: see Section 1.02B.1 of this specification.

D. Condition 19. Erosion Control: Prior to commencement of grading activities for each facility, erosion control measures shall be incorporated into the grading plans to minimize the potential for erosion or loss of top soil during grading to the satisfaction of the Planning Director. Any erosion and sedimentation control netting or other erosion and sedimentation control devises used for temporary or permanent erosion and sedimentation control, shall be limited to biodegradable mesh or other biodegradable products

E. Condition 19. Erosion Control – Landscaping: Prior to commencement of grading activities for each facility, vegetation/landscaping shall be provided on the graded cut and fill slopes to reduce the long-term potential for soil erosion or loss of topsoil to the satisfaction of the ENGINEER.

F. Condition 28. Cultural Resources: The CONTRACTOR is directed to Specification 01561 – Biological and Cultural Resource Environmental Controls.

G. Condition 32. Traffic Management Plan. The CONTRACTOR is directed to Specification Sections 01571 – Traffic Control.

H. Condition 35. Construction Activity Management Plan. Prior to commencement of grading activities, the OWNER will submit a Construction Activities Management Plan for the review and approval of the SLOAPCD. The CONTRACTOR shall assist the OWNER in preparation of this Plan. This plan shall include but not be limited to the following Best Available Control Technologies for construction equipment:

1. Minimize the number of large pieces of construction equipment operating during any given period.

2. Schedule construction related truck/equipment trips during non-peak hours to reduce peak-hour emissions and overall daily and quarterly emissions.

3. Properly maintain and tune all construction equipment according to manufacturer's specifications.

4. Fuel all off-road and portable diesel powered equipment including but not limited to: bulldozers, graders, cranes, loaders, scrapers, backhoes, generators, compressors, auxiliary power units, with ARB certified motor vehicle diesel fuel.

5. All diesel construction equipment operated regularly on the Site by the CONTRACTOR and Subcontractors shall meet ARB's Tier 3 standard for off-road heavy duty diesel engines.

6. All on-road heavy-duty trucks operated regularly on the Site by the CONTRACTOR and Subcontractors shall meet the ARB's 2007 or newer certification standard for on-road heavy-duty diesel engines. This condition would not apply to deliveries and/or hauling to or from the Site by outside material suppliers or trucking companies.

7. All on and off-road diesel equipment shall not be allowed to idle for more than 5 minutes. Signs shall be posted in the designated queuing areas and or job sites to remind drivers and operators of the 5 minute idling limit.

8. Electrify portable equipment where possible throughout the project area.

9. All diesel powered portable equipment used shall have tier 2 or tier 3 engines and retrofitted with an ARB level 3 verified diesel emissions control strategy (VEDEC).

10. Locate construction staging areas at least 1000 feet from sensitive receptors.

I. Condition 36. Construction Activity Management Plan. The Construction Activity Management Plan (CAMP) should include but not be limited to the following elements:

1. Schedule construction truck trips during non-peak hours to reduce peak hour emissions.

2. Limit the length of the construction work-day period, if necessary.

3. Phase construction activities to minimize overlapping emissions.

4. Construction Equipment composition and schedule including:

a. Equipment Type

b. Equipment Model

c. Equipment Year

d. Engine Type

e. Engine Model

f. Engine Year

g. Engine Horsepower

h. Schedule of use

J. Condition 44. Noise. Equipment noise measured at the property lines shall not exceed ambient level of 50 dBA Leq. The noise from installed equipment may be attenuated through the use of a "manufacturer enclosure" or through incorporation of noise attenuation design features into the enclosure structure.

K. Condition 48. CAL-OSHA Standards. All CONTRACTORs shall comply with relevant provisions of CAL-OSHA CAC Title 8 regarding the provision of safety and rescue equipment, to the satisfaction of the County Department of Public Works in consultation with the Planning Director.

L. Condition 54. Staging-Visual. CONTRACTOR staging areas shall be located as shown in Section 01500. Construction staging areas shall conform to Estero Area Plan AES-1 and be located away from sensitive viewing areas to the extent feasible.

M. Condition 58. Monarch Butterfly Surveys. The CONTRACTOR is directed to Specification 01561 – Biological and Cultural Resource Environmental Controls.

N. Condition 63. Morro Shoulderband Snail Monitoring. The CONTRACTOR is directed to Specification 01561 – Biological and Cultural Resource Environmental Controls.

O. Condition 64. California Red-legged Frog Monitoring. The CONTRACTOR is directed to Specification 01561 – Biological and Cultural Resource Environmental Controls.

P. Condition 66. Botanical Surveys. The CONTRACTOR is directed to Specification 01561 – Biological and Cultural Resource Environmental Controls.

Q. Condition 68. Worker Education Program. The CONTRACTOR is directed to Specification 01561 – Biological and Cultural Resource Environmental Controls.

R. Condition 69. Nesting Bird Survey. The CONTRACTOR is directed to Specification 01561 – Biological and Cultural Resource Environmental Controls.

S. Condition 70. Nesting Raptor Survey. The CONTRACTOR is directed to Specification 01561 – Biological and Cultural Resource Environmental Controls.

T. Condition 73. Discovery of Human Remains. The CONTRACTOR is directed to Specification 01561 – Biological and Cultural Resource Environmental Controls.

U. Condition 74. Paleontological Resources. Although unlikely, should any vertebrate fossils or potentially significant finds (e.g., numerous well-preserved invertebrate or plant fossils) be encountered by anyone working on the site, all activities in the immediate vicinity of the find are to cease until a qualified paleontologist evaluates the find for its scientific value. If deemed significant, the paleontological resource(s) shall be salvaged and deposited in an accredited and permanent scientific institution where they will be properly curated and preserved for the benefit of current and future generations.

V. Condition 75. APCD Equipment Requirements. Prior to initiating activities, the CONTRACTOR shall:

1. Use one catalyzed diesel particulate filter (CDPF) on the piece of equipment estimated to generate the greatest emissions. If a CDPF is unsuitable for the potential equipment to be controlled, five diesel oxidation catalysts (DOC) shall be used.

2. Identify equipment to be operated during construction as early as possible in order to place the order for the appropriate filter and avoid any project delays. This is necessary so that contractors bidding on the project can include the purchase, proper installation, and maintenance costs in their bids.

3. Contact the SLOAPCD Compliance Division to initiate implementation of this mitigation measure at least two months prior to start of construction.

W. Condition 76. Dust Control. The CONTRACTOR shall comply with Section 1562 – Dust Control.

X. Condition 78. Noise Abatement Requirements. The CONTRACTOR shall adhere to the following noise attenuation requirements:

1. A construction noise control plan shall be developed for the project that identifies the nature and timing of operations designed to minimize noise exposure to noise sensitive receptors including natural resource areas.

2. Generally, construction activities shall be limited to between the hours of 7 a.m. to 9 p.m. on any day except Saturday or Sunday or between the hours of 8 a.m. to 5 p.m. on Saturday or Sunday.

3. Construction activities in the vicinity of schools should be scheduled for times when classes are not in session.

4. All construction equipment shall use noise-reduction features (e.g., mufflers and engine shrouds) that are no less effective than those originally installed by the manufacturer.

5. The noise produced by construction activities shall be monitored to insure that the noise produced by construction equipment is compliant with the emission standards listed in the project EIR (Appendix L, page 5.10-4 and in source document, FHWA Construction Noise Model, page 3).

6. Measures to minimize back-up alarm issues shall be established including such techniques as:

   a. use of self-adjusting ambient sensitive back-up alarms.

   b. manual adjustable alarms on lower settings.

   c. use of observers.

   d. scheduling of activities so that alarm noise is minimized.

   e. construction site access designed such that deliveries and trucks move through the site in a forward manner without the need to back up.

7 Construction staging and heavy equipment maintenance activities shall be performed a minimum distance of 300 feet from the nearest residence, unless safety or technical factors take precedence.

8. Stationary combustion equipment such as pumps or generators operating near any noise sensitive receptor shall, if necessary, be shielded with a noise protection barrier. Leq values at the property line of receiver locations shall not exceed 65 dB.

Y. Condition 80. Pile Driving Vibration. Prior to initiation of construction of the collection system, the CONTRACTOR shall identify all areas where pile driving, or other construction methods that would result in severe ground vibrations, could occur. Deep pile foundation designs shall favor techniques that can be constructed with minimal vibration effects. Prior to construction, using technology and standards recommended in the Caltrans Transportation and Construction Induced Vibration Manual, the CONTRACTOR shall calculate the vibration effects of pile driving and other high vibration activities using the Peak Particle Velocity (PPV) metric, and

shall ensure that the PPV does not exceed the following thresholds at any affected building: 0.5 at modern industrial/commercial or residential buildings; 0.3 for any building composed of masonry, unreinforced concrete, lath & plaster interiors or of similar construction; and 0.25 for any building identified as particularly sensitive to vibration impacts. Alternative design and/or construction methods shall be used to meet these limits. In addition, the construction CONTRACTOR shall notify all property owners and tenants adjacent to the proposed pile driving or other vibration inducing activities of the days and hours of operation. Prior to construction activities associated with this type of work, the construction CONTRACTOR shall inspect all structures within the area predicted to experience vibration in excess of 0.25 PPV to document existing characteristics of the structures. During construction, vibration shall be monitored and recorded and adjustments made to operation or to the radius of concern if the level of vibration differs from estimates. If a post construction survey indicates that damages to structures (e.g., residences, pools) occurred during the work, the property owner shall be fairly compensated for the cost of remediating damages.

Z. Condition 81, Invasive Plants: The CONTRACTOR is directed to Specification 01561 – Biological and Cultural Resource Environmental Controls.

AA. Condition 82, Los Osos Creek Environmental Requirements. The CONTRACTOR is directed to Specification 01561 – Biological and Cultural Resource Environmental Controls.

AB. Condition 94, Laterals - Biology. Installation of lateral lines will conform to the mitigation procedures contained in the “Lateral Line Installation – Biological Resources & Mitigation” report date 10-16-02.

AC. Coastal Condition 1l, Approved Development – Construction. All areas within which construction staging are to take place shall be minimized to the maximum extent feasible in order to minimize impacts on resources (e.g., terrestrial habitat, wetlands, creeks, riparian areas, or other sensitive resource areas, etc.). All measures to be taken to minimize impacts associated with construction staging and related areas shall be identified, including but not limited to screening, fencing (see Part 2 of this Specification), landscaping, signage, and designation of various activity and storage areas on the site. If additional construction staging and related areas are needed following award of the Work, such areas shall be identified in a plan and submitted for Executive Director review and approval. Copies of the signed Coastal Development Permit (CDP) shall be maintained in a conspicuous location at the construction staging area at all times, and that such copies be available for public review on request. All persons involved with the construction shall be briefed on the content and meaning of the CDP, and the public review requirements applicable to them, prior to commencement of construction. A primary construction coordinator shall be designated by the CONTRACTOR for public inquiries regarding the construction, and that their contact information (i.e., address, phone numbers, etc.) including, at a minimum, a telephone number available 24 hours a day for the duration of construction, be conspicuously posted at the construction staging area and at individual construction sites where such contact information is readily visible from public viewing areas, along with indication that the construction coordinator should be contacted in the case of questions regarding the construction (in case of both regular inquiries and emergencies). The construction coordinator shall record the name, phone number, and nature of all complaints received regarding the construction, and shall investigate complaints and take remedial action, if necessary, within 24 hours of receipt of the complaint or inquiry.

1.05 SURFACE MINE AND RECLAMATION ACT

A. Imported borrow or aggregate material must come from a surface mine permitted under the Surface Mining and Reclamation Act of 1975 (SMARA), Pub Res Code § 2710, et seq., or from an exempt site.

B. The Department of Conservation, Office of Mine Reclamation maintains a list of permitted mine sites. For the list of permitted sites, go to:

http://www.conservation.ca.gov/omr/ab_3098_list

C. If CONTRACTOR uses import borrow or aggregate material from a surface mine not on this list, CONTRACTOR shall submit proof the mine is exempt from SMARA to Engineer.

1.06 SOLID WASTE DISPOSAL AND RECYCLING

A. For the purpose of complying with San Luis Obispo County Code, Title 8, Health and Sanitation, Chapter 8.12, "Solid Waste Management," CONTRACTOR shall recycle at least 50% of the construction and demolition waste generated by the Project.

B. The following is a list of IWMA-Certified Recycling Facilities:

1. C&D Recycling Facility at Cold Canyon Landfill 805-549-8332
2. C&D Recycling Facility at Chicago Grade Landfill 805-466-2985
3. North SLO County Recycling 805-434-0043
4. API (roll-off/debris box company) 805-928-8689
5. R&R (a roll-off/debris box company) 805-929-8000
6. Recycling Facility at the Paso Robles Landfill 805-238-2028
7. Santa Maria Transfer Station 805-922-9255
8. Bedford Enterprises/SMART 805-922-4977

C. CONTRACTOR shall complete and sign the "RECYCLING PLAN" form in conformance with the provisions in Paragraph 2.05 of the General Conditions. This form must be submitted and approved by the ENGINEER prior to receiving the Notice to Proceed.

D. This form must show how at least 50% of the Project construction and demolition waste will be recycled. CONTRACTOR shall maintain receipts or other documentation for any facility or site that received waste from the Project.

E. CONTRACTOR shall submit a complete and accurate "DISPOSAL REPORT" form with original receipts and supporting documentation. This form must be submitted and approved prior to receiving the Notice of Completion.

F. If CONTRACTOR fails to submit the required information showing the 50% recycling goal was met, the OWNER could impose a penalty equal to 2 percent of the total Contract Price.

G. Full compensation for complying with these requirements shall be considered as included in the prices paid for the various items of work generating such construction and demolition waste and no additional compensation will be allowed therefor.

H. The copies of the "RECYCLING PLAN" and "DISPOSAL REPORT" forms are included at the end of this Specification Section.

PART 2 – PRODUCTS

2.01 PROTECTIVE FENCING

A. Protective fencing shall be 4-feet tall international orange high-density polyethylene resin, with 1-inch by 3 ¾-inch mesh openings to withstand a temperature service rating of -40 to 200 degrees Fahrenheit (e.g., Visi Barrier or equivalent). Protective fencing shall be at locations as indicated on the Drawings. Metal T-posts should be placed at maximum of 20-feet on-center and fencing should be secured to the posts for the entire construction period, according to the manufacturer's specifications.

PART 3 – EXECUTION

NOT USED

END OF SECTION

RECYCLING PLAN FOR COUNTY PROJECTS

SECTION 1. PROJECT INFORMATION

Contract Title	Contractor Name	
	Contractor Phone	Contractor Fax
Contract Number	Street Address	
Total Contract Amount	City, State, Zip	
Print Name and Title	Signature	Date

SECTION 2. RECYCLING PLAN

	Before Construction (estimated tons)				
	Landfill	Recycling Facility		Reuse	
Materials	(Tons)	(Tons)	Location	(Tons)	Location
Cleared Vegetation					
Asphalt Concrete					
Concrete					
Metals (including spent equipment)					
Lumber					
Drywall					
Mixed Recyclables					
Trash					
Totals					
% Diversion					

Official Use Only

Recycling Plan Approved ☐	Recycling Plan Denied ☐
Information Required:	
Print Name and Title	Signature / Date

DISPOSAL REPORT FOR COUNTY PROJECTS

SECTION 1. PROJECT INFORMATION

Contract Title	Contractor Name		
	Contractor Phone	Contractor Fax	
Contract Number	Street Address		
Total Contract Amount	City, State, Zip		

Contractor Certification: I certify under penalty of perjury that the information provided in this form is complete and accurate.

Print Name and Title	Signature	Date

SECTION 2. DISPOSAL REPORT

	After Construction (actual tons)					
	Landfill	Recycling Facility		Reuse		
Materials	(Tons)	(Tons)	Location	(Tons)	Location	
Cleared Vegetation						
Asphalt Concrete						
Concrete						
Metals (including spent equipment)						
Lumber						
Drywall						
Mixed Recyclables						
Trash						
Totals						
% Diversion						

I have reviewed and approved the information submitted in this report for completeness

Resident Engineer's Name:	Signature:	Date:

Official Use Only

Disposal Report Approved ☐	Disposal Report Denied ☐	
Information Required		
Print Name and Title	Signature	Date

SECTION 01101

SAFETY, HEALTH AND EMERGENCY RESPONSE

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Site specific health and safety procedures including a detailed accident prevention plan are required. These procedures shall be described in a Safety, Health and Emergency Response Plan (SHERP) prepared by the CONTRACTOR. The SHERP shall be submitted to the ENGINEER and be reviewed and approved by the ENGINEER and OWNER before any WORK at the site can be initiated. Implement, maintain and enforce the SHERP procedures at the appropriate time prior to and during all phases of the WORK.

B. Utilize the services of a health and safety professional designated the Health and Safety Manager (HSM) to develop and implement the SHERP, including the air monitoring program, conduct initial site specific training and provide support for all health and safety activities as needed, including the upgrading or downgrading of the level of personnel protection.

1. In addition, a Site Safety and Health Officer (SSHO) shall assist and represent the HSM in the continued implementation and enforcement of the SHERP. The SSHO shall be assigned to the site on a full time basis and shall be either the CONTRACTOR's employee or a subcontractor who reports to the CONTRACTOR and the HSM in matters pertaining to site safety and health.

C. The following definitions shall be used throughout this Safety, Health and Emergency Response Plan.

1. Health and Safety Manager (HSM): The CONTRACTOR's employee assigned to develop the SHERP and assume full responsibility for the CONTRACTOR's health and safety program.

2. Site Safety and Health Officer (SSHO): The CONTRACTOR's employee assigned to the site on a full-time basis for the duration of the project with functional responsibility for implementation of the SHERP.

3. Site: For the purpose of the SHERP, the site shall be the area within the limits of work as shown on the Drawings.

4. Physician: A licensed physician provided by the CONTRACTOR with experience in the practice of occupational medicine.

1.02 REGULATORY REQUIREMENTS AND APPLICABLE PUBLICATIONS

A. The site specific SHERP shall be consistent with the requirements of:

1. Occupational Safety and Health Administration (OSHA) Standards and Regulations contained in Title 29, Code of Federal Regulations, Parts 1910 and 1926 (29 CFR 1910 and 1926). Revised July 1, 2009.

2. United States Environmental Protection Agency (USEPA) Standard Operating Procedures. Revised November, 2007.

3. Corps of Engineers Accident Prevention and Safety and Health Requirements Manual, EM 385-1-1. Revised July, 2011.

4. Cal-OSHA Title 8, Subchapter 4 Requirements for Trench Shoring Systems. Dated July, 2001.

B. The SHERP shall include but not necessarily be limited to, the following components as required by OSHA 29 CFR 1910.120(i)(2):

1. Names of key personnel and alternates responsible for site safety and health (responsibilities and chain of command)

2. Safety and health hazard assessment and risk analysis for each site task and operation (Accident Prevention Plan).

3. Site Description and Evaluation

4. Education and Training

5. Personnel Protective Equipment

6. Medical Surveillance

7. Air Monitoring

8. Standard Operating Procedures, Engineering Controls and Work Practices

9. Site Control Measures (Work Zones, Communications and Security)

10. Personnel Hygiene and Decontamination

11. Equipment Decontamination and Record Keeping

12. Emergency Equipment and First Aid Requirements

13. Emergency Response Plan and Contingency Procedures

14. Heat/Cold Stress Monitoring

15. Logs, Reports and Record Keeping

C. Six copies of the site specific SHERP shall be submitted to the ENGINEER within 7 days following the Effective Date of the Agreement and must be approved prior to commencement of any on-site work.

D. Determination of the appropriate level of worker safety equipment and procedures shall be made by the CONTRACTOR as a result of initial site survey review of existing data and a continued safety and health monitoring program performed by the SSHO and approved by the

ENGINEER, in accordance with the requirements specified herein. Existing data indicate that all work can be performed in Level D with contingency procedures to move to Level C protection.

E. Standards delineated in this Section are in addition to or an amplification of procedures and requirements of the above referenced regulations and documents.

F. Should any unforeseen or site specific safety related factor, hazard, or condition become evident during the performance of work at this site, it shall be the CONTRACTOR's responsibility to bring such to the attention of the ENGINEER both verbally and in writing as quickly as possible, for resolution. In the interim, the CONTRACTOR shall take prudent action to establish and maintain safe working conditions and to safeguard employees, the public and the environment.

G. Should the CONTRACTOR seek relief from, or substitution for, any portion or provision of the SHERP, such relief or substitution shall be requested of the ENGINEER in writing and if approved, be authorized in writing.

1.03 SITE CONTROL

A. Communications

1. Provide portable two-way radio or portable vehicle telephone communication at the site and emergency numbers, including police, fire, ambulance, hospital and OWNER, shall be prominently posted near the radio or telephone.

1.04 EMERGENCY EQUIPMENT AND FIRST AID REQUIREMENTS

A. Develop contingency plans including evacuation procedures and routes to places of refuge or safe distances from the danger area, for the following potential emergencies: chemical exposure, personal injury, potential or actual fire or explosion, or environmental accident (spill or release).

B. Emergency medical care services shall be prearranged at a nearby medical facility with established emergency routes. The staff at the facility shall be advised of the potential medical emergencies that might result.

C. Establish emergency communications with health and emergency services. The name of this facility, name of contact, emergency routes and emergency communications arrangements shall be provided in the SHERP. In addition the CONTRACTOR shall provide the following equipment:

1. At least one first aid kit shall be provided and maintained fully stocked at a first aid station which is in close proximity to the work, but not inside a hazardous work area. First aid kit locations shall be specially marked and provided with adequate water and other supplies necessary to cleanse and decontaminate burns, wounds, or lesions.

2. Have at least one certified First Aid Technician on the site at any time there is work being performed. This person may perform other duties, but must be immediately available to render first aid when needed. Certification shall be by the American Red Cross or other approved agency and shall be submitted to the ENGINEER.

3. 2A-10 B:C type dry chemical fire extinguishers shall be provided at the site office.

1.05 EMERGENCY RESPONSE AND CONTINGENCY PROCEDURES

A. Develop an emergency response and contingency plan for on-site and off-site emergencies, as specified in OSHA 29 CFR 1910.120(l), which shall address at a minimum:

1. Pre-emergency planning

2. Personnel roles, lines of authority, training and communication

3. Emergency recognition and prevention

4. Safe distances and places of refuge

5. Site security and control

6. Evacuation routes and procedures

7. Decontamination

8. Emergency medical treatment and first aid

9. Emergency alerting and response procedures

10. Critique of response and follow-up

11. Personal Protection Equipment (PPE) and emergency equipment

B. In the event of any emergency associated with Response Action, without delay: take diligent action to remove or otherwise minimize the cause of the emergency; alert the ENGINEER and institute whatever measures might be necessary to prevent any repetition of the conditions or actions leading to, or resulting in, the emergency.

C. Emergency medical care services shall be prearranged at a nearby medical facility with established emergency routes.

D. Establish emergency communications with health and emergency services. The name of this facility, name of contact, emergency routes and emergency communications arrangements shall be posted at the site. The posted list shall include the following minimum points:

1. CONTRACTOR physician name, address and telephone number.

2. Ambulance service and fire department telephone numbers.

E. In the event that an accident for some other safety related incident occurs during the course of the project, the OWNER shall be telephoned immediately and receive a written notification within 24 hours. The report shall include the following items:

1. Name, organization, telephone number, and location of the CONTRACTOR.

2. Name and title of the person(s) reporting.

3. Date and time of accident/incident.

4. Location of accident/incident, including site location and facility name.

5. Brief summary of accident/incident giving pertinent details including type of operation ongoing at time of accident.

6. Cause of accident/incident, if known.

7. Casualties (fatalities, disabling injuries).

8. Details of any existing chemical hazard or contamination.

9. Estimated property damage, if applicable.

10. Nature of damage; effect on contract schedule.

11. Action taken by CONTRACTOR to ensure safety and security.

12. Other damage or injuries sustained (public or private).

1.06 PERSONAL PROTECTIVE EQUIPMENT

A. Provide all on-site personnel with appropriate personal safety equipment and protective clothing, and will ensure that all safety equipment and protective clothing is kept clean and well maintained. The CONTRACTOR's HSM shall establish upgrade/downgrade "action levels" from the specified minimum levels of protection based upon air monitoring results and direct contact potential. Protocols formally changing the level of protection and the communication network for doing so shall be described in the SHERP. Any changes to the minimum level of protection shall be approved by the SSHO and the ENGINEER. At a minimum the following items shall be provided:

1. Protective clothing shall be furnished for on-site personnel, consisting of:

a. Level D: use as appropriate

1) Coveralls

2) Gloves*

3) Boots/shoes, chemical-resistant steel toe and shank

4) Boots, outer, chemical-resistant (disposable)*

5) Safety glasses or chemical splash goggles*

6) Hard hat

7) Escape mask*

8) Face shield*

*Optional as applicable.

2. Footwear used on site shall be steel-toed, steel shank safety shoes or boots, with chemical resistant soles.

3. All on-site personnel shall wear a hard hat.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01110

DISPUTES REVIEW BOARD

PART 1 GENERAL

1.01 SUMMARY

A. This Section describes the purpose, procedure, function, and key features of the Disputes Review Board (DRB). Appended to this specification is a Three Party Agreement to be used for formalizing the creation of the DRB.

B. The DRB will assist and facilitate the timely and equitable resolution of Claims that have been properly referred to the DRB under this Section.

C. In order for a Claim to be properly referred to the DRB, both the OWNER and the CONTRACTOR must mutually agree in writing to refer that specific Claim to the DRB. Such writing must be signed by both parties. Either the OWNER or the CONTRACTOR can request in writing that the other party mutually agree to refer a Claim to the DRB. If the other party does not respond in writing within 10 days thereafter, the request shall be deemed denied.

D. Under no circumstances shall the referral of a Claim to the DRB relieve CONTRACTOR from complying with any of the requirements of Paragraph 10.05 of Section 700. In order for such referral to have any effect on CONTRACTORS obligations under Paragraph 10.05, the parties must agree in a separate writing approved as to form by the Office of County Counsel that the referral of the specifically identified Claim referenced therein affects the prospective application of said Paragraph 10.05 to said Claim in a particular manner. Said writing must be expressly approved as to form by the Office of County Counsel on the face of the writing in order for it to be effective.

E. The DRB shall impartially and promptly consider any Claim referred to it, and shall provide written recommendations to the OWNER and the CONTRACTOR, to assist in the resolution of these disputes.

F. Although the recommendations of the DRB should carry great weight for both the OWNER and the CONTRACTOR, the recommendations are not binding on either party.

1.02 CONTINUANCE OF WORK DURING DISPUTES

A. At all times during the course of the dispute resolution process, diligently continue with the Work as directed, without delay, conforming to the OWNER’s decision or order, and all applicable provisions of the Contract.

1.03 MEMBERSHIP

A. General: The DRB will consist of one member selected by the OWNER and approved by the CONTRACTOR, one member selected by the CONTRACTOR and approved by the OWNER, and a third member selected by the first two members and approved by both the OWNER and the CONTRACTOR. The third member shall act as Chairman.

B. Experience: It is desirable that all Board members be experienced with pipeline construction, interpretation of Contract Documents, and resolution of construction disputes. The goal in selecting the third member is to complement the experience of the first two and to provide leadership for the DRB's activities.

C. Neutral and Impartial: DRB members shall be neutral, act impartially, and not have any conflict of interest.

D. Criteria for Membership: For purposes of this Section, the term "member" also includes the member's current primary or full-time employer, and "involved" means having a contractual relationship with the OWNER or CONTRACTOR at any tier. The criteria and limitations for membership are:

1. No member shall have an Ownership interest in any Party involved in the Construction Contract, or a financial interest in the Contract, except for payment for services on the DRB.

2. Except for fee-based consulting services on other projects, no member shall have been previously employed by, or have had financial ties to, any Party involved in the Construction Contract within a period of 30 years prior to award of the Contract. The nature and extent of such fee-based consulting services shall be fully disclosed.

3. No member shall have had a close professional or personal relationship with any key member of any party involved in the Construction Contract which, in the judgment of either party, could suggest partiality.

4. No member shall have had prior involvement in the project, of a nature which could compromise his ability to participate impartially in the DRB's activities.

5. During his tenure on the DRB, no member shall be employed, including fee-based consulting services, by any party involved in the Construction Contract except with the express approval of both parties.

6. During his tenure on the DRB, no member shall engage in a discussion or make an agreement with any party involved in the Construction Contract, regarding employment after the Contract is completed.

7. All members shall be fluent in English, and be able to prepare their recommendations in English.

E. Availability: Prompt resolution of disputes is a priority. DRB members shall be able to complete their review of information, deliberations, and preparation of recommendations within the timeframes indicated herein. DRB members shall be prepared to comply with these requirements as a condition of their assignment to the DRB.

F. Disclosure Statement: Before their appointments are final, the first two prospective members shall submit complete disclosure statements for the approval of both the OWNER and the CONTRACTOR. Each statement shall include a resume of experience, together with a declaration describing all past, present and anticipated or planned future relationships, including indirect relationships through the prospective member's primary or full-time employer, to this project and with all parties involved in the Construction Contract. Disclosure of close

professional or personal relationships with all key members of all parties to the Contract shall be included. The third DRB member shall supply such a statement to the first two DRB members and to the OWNER and CONTRACTOR before his or her appointment is final.

G. Nomination and Approval of First Two Members: The OWNER and the CONTRACTOR shall each nominate a proposed DRB member and convey the nominee's name and reference information to the other party within three weeks after Award of the Contract. If the nominee is not rejected within two weeks after receipt of the name and information, he shall be deemed approved.

H. Nomination and Approval of Third Member:

1. Immediately after approval, the OWNER and CONTRACTOR will notify their members to begin selection of the third member. The first two members shall ensure that the third member meets all of the criteria listed above. The third member shall be selected within three weeks after the first two members are notified to proceed with his selection.

2. In the event of an impasse in selection of the third member, that member shall be selected by mutual agreement of the OWNER and the CONTRACTOR. In so doing, they may, but are not required to, consider nominees offered by the first two members.

I. Execution of the Three Party Agreement: The OWNER, the CONTRACTOR, and all three members of the DRB shall execute the Three Party Agreement within four weeks after the selection and approval of the third member.

1.04 OPERATION

A. General:

1. If OWNER and CONTRACTOR do not provide the DRB with a copy of operating procedures mutually agreed upon, the DRB shall formulate its own operating procedures. It is not desirable to adopt hard and fast rules for the functioning of the DRB. The entire procedure shall be kept flexible to adapt to changing situations. The DRB shall initiate, with the OWNER's and CONTRACTOR's concurrence, new procedures or modifications to old ones, whenever this is deemed appropriate.

2. Neither party shall solicit any DRB member's advice or consultation on matters concerning the conduct of the work.

B. Visits by DRB: DRB site visits will be scheduled only if the OWNER and the CONTRACTOR mutually agree on the need for visits and then will be scheduled as agreed among the OWNER, the CONTRACTOR, and the DRB.

1.05 PROCEDURE AND SCHEDULE FOR DISPUTE RESOLUTION

A. Disputes shall be considered as quickly as possible, taking into consideration the particular circumstances and the time required to prepare appropriate documentation. Steps may be omitted, as agreed by both parties, and the time periods stated below may be shortened in order to hasten resolution.

1. When a Claim is submitted to the DRB it shall be heard at a special meeting, as agreed by both Parties. For an urgent matter, the DRB shall meet within two weeks of notification.

2. During the hearing the CONTRACTOR and the OWNER shall each have ample opportunity to be heard and to offer evidence. Detailed procedures are given in Article 1.6. The DRB's recommendations for resolution of the dispute will be given in writing, to both the OWNER and the CONTRACTOR, within two weeks of completion of the hearings. In difficult or complex cases, and in consideration of the DRB's schedule, this time may be extended by mutual agreement of all parties.

3. If requested by either party, the DRB shall provide oral or written clarification of its recommendation.

4. Within two weeks of receiving the DRB's recommendations, or such other time specified by the DRB, both the OWNER and the CONTRACTOR shall respond to the other and to the DRB in writing, signifying either acceptance or rejection of the DRB's recommendations. The failure of either party to respond within the specified period shall be deemed a rejection of the DRB's recommendations. If, with the aid of the DRB's recommendations, the OWNER and the CONTRACTOR are able to resolve their dispute, the OWNER will promptly process any required Contract changes.

5. Should the Claim remain unresolved, either party may request that the DRB clarify its recommendation or, if new evidence has become available, reconsider its recommendation.

B. Although both the OWNER and the CONTRACTOR should place great weight on the DRB's recommendations, they are not binding. If the DRB's recommendations do not resolve the Claim, the written recommendations, including any minority report, will be admissible as evidence in any subsequent dispute resolution proceeding.

1.06 CONDUCT OF HEARING

A. Prehearing Submittals: Written position statements shall be submitted to the other party and each DRB member at least five business days before the hearing begins. The DRB may also request a presentation of factual documentation, prepared jointly by the parties.

B. Location: Normally the hearing will be conducted at the job site. However, any location that would be more convenient and still provide all required facilities and access to necessary documentation is satisfactory. Private sessions of the DRB may be held at any convenient location.

C. Proceedings: The third member of the DRB will act as Chairman of the hearing, or he may appoint one of the other members. A formal transcript will not be prepared. In special cases, when requested by either party, the DRB may allow preparation of a transcript by a Court Reporter. Audio or video recordings will not be permitted.

D. Participants:

1. The OWNER and the CONTRACTOR shall have representatives at all hearings. The Party requesting DRB review will first present its position, followed by the other party. Each party will then be allowed successive rebuttals until all aspects are fully covered. The DRB members may ask questions, request clarification, or ask for additional data. In difficult or

complex cases, additional hearings may be necessary in order to consider and fully understand all the evidence presented by both parties. Both the OWNER and CONTRACTOR shall be provided full and adequate opportunity to present all of their evidence, documentation and testimony regarding all issues before the DRB.

2. Attendance by, or participation of, lawyers is prohibited.

3. During the hearing, no DRB member shall express any opinion concerning the merit of any facet of the case.

E. DRB Deliberations:

1. After the hearing is concluded, the DRB shall meet to formulate its recommendations. All DRB deliberations shall be conducted in private, with all individual views kept strictly confidential. The DRB's recommendations, together with explanations of its reasoning, shall be submitted as a written report to both parties. The recommendations shall be based on the pertinent provisions of the Contract, applicable laws and regulations, and the facts and circumstances involved in the dispute. It is important for the DRB to clearly and completely express the logic and reasoning leading to the recommendations, so that both parties fully understand it.

2. The DRB shall be permitted to consult with independent legal counsel when deliberating and drafting their decision.

3. The DRB shall make every effort to reach a unanimous recommendation. If this proves impossible, the dissenting member may prepare a minority report.

1.07 COMPENSATION AND LOGISTIC SUPPORT

A. Fees and expenses of all three members of the DRB shall be shared equally by the OWNER and the CONTRACTOR. The OWNER will provide administrative services, such as conference facilities and secretarial services, and will bear the cost of these services. If the DRB desires special services, such as legal or other consultation, accounting, data research, and the like, both parties must agree, and the costs will be shared by them as mutually agreed.

B. The CONTRACTOR shall pay the invoices of all DRB members after approval by both parties. The CONTRACTOR will then bill the OWNER for 50 percent of such invoices.

DISPUTE REVIEW BOARD THREE PARTY AGREEMENT
(To Be Executed After the Award of the Construction Contract)

HIS THREE PARTY AGREEMENT (Agreement), made and entered into this_____ day of _____ 20_____, between:(OWNER) _____, hereinafter called the "OWNER," and (CONTRACTOR) _____,hereinafter called the "CONTRACTOR", and the Dispute Review Board, hereinafter called the "Board", and consisting of three members,_____,_____, _____.

WITNESSETH, that

WHEREAS, the OWNER is now engaged in the construction of the Los Osos Wastewater Project; and

WHEREAS, the Los Osos Wastewater Project Contract (CONTRACT) provides for the establishment and operation of a Board to assist in resolving disputes, claims and other controversies relating to the Work; and

WHEREAS, the Board is composed of three members, one selected by the OWNER, one selected by the CONTRACTOR, and the third member selected by these two;

NOW THEREFORE, in consideration of the terms, conditions, covenants and agreements contained herein, or attached and incorporated and made a part hereof, the parties hereto agree as follows:

DESCRIPTION OF WORK

In order to assist in the resolution of Claims between the OWNER and the CONTRACTOR, the OWNER has provided, in the Contract, for the establishment of a Dispute Review Board. The intent of the Board is to fairly and impartially consider the disputes referred to it, and to provide written recommendations to the OWNER and CONTRACTOR for resolution of these disputes. The members of this Board shall perform the services necessary to participate on this Board in accordance with the Scope of Work.

The Board is organized to recommend resolution of Claims between the OWNER and the CONTRACTOR that are properly referred to the Board under the Contract Documents, arising from or related to the Construction Contract.

SCOPE OF WORK

The Scope of Work of the Board includes, but is not limited to, the following:

A. Project Site Visits:

The frequency, time, and duration of Project site visits shall be mutually agreed upon among the Board, the OWNER and the CONTRACTOR. In case of failure to agree, the Board shall schedule the visits.

In the case of an actual or potential dispute involving an alleged differing site condition or specific construction problem, it may be advantageous for the Board to personally view any

relevant conditions. If viewing by the Board would cause delay to the project, videos, photographs, and descriptions of these conditions, collected by either or both parties will be utilized.

B. Establish Procedures

The Board shall, with the agreement of all parties, establish procedures for the conduct of its hearings of disputes. The conduct of its business shall, in general, be based on the specification provisions.

C. Recommend Resolution of Disputes

Upon receipt by the Board of a written Request for Review of a Claim signed by both the OWNER and the CONTRACTOR, the Board shall convene a hearing to review and consider the Claim.

It is expressly understood that all Board members are to act impartially and independently in the consideration of facts and conditions surrounding any Claim, and that the recommendations concerning any such Claim are advisory and not binding, unless agreed otherwise by the OWNER and the CONTRACTOR.

The Board recommendations shall be based on the applicable provisions of the Contract Documents, and the facts and circumstances involved in the dispute as conveyed by the testimony and evidence presented by the parties. The recommendations shall be furnished in writing to the OWNER and the CONTRACTOR.

D. Member Replacement

Should the need arise to appoint a replacement Board member, the replacement member shall be appointed in the same manner as the original member was appointed. The selection of a replacement Board member shall begin promptly upon notification of the necessity for a replacement and shall be completed within four weeks. This Agreement will be amended to indicate changes in Board membership.

BOARD RESPONSIBILITIES

The Board members shall become familiar with the Contract Documents necessary to address the Claim before it.

Except for providing the services required in the Agreement, the Board and its individual members shall refrain from giving any advice to either party concerning conduct of the Work or the resolution of problems, which might compromise the Board's integrity.

CONTRACTOR RESPONSIBILITIES

Except for its participation in the Board's activities as provided in the Contract Documents and in this Agreement, the CONTRACTOR shall not solicit advice or consultation from the Board or its members on matters dealing with the conduct of the Work or resolution of problems, which might compromise the Board's integrity.

The CONTRACTOR shall furnish to each Board member one copy of all documents it has, other than those furnished by the OWNER, which are pertinent to the performance of the Board. CONTRACTOR shall concurrently provide the OWNER with any documents provided to the Board.

OWNER RESPONSIBILITIES

Except for its participation in the Board's activities as provided in the Contract Documents and in this Agreement, the OWNER shall not solicit advice or consultation from the Board or its members on matters dealing with the conduct of the Work or resolution of problems, which might compromise the Board's integrity.

The OWNER shall furnish the following:

A. Contract Related Documents

The OWNER shall furnish each Board member one copy of all Contract Documents, including, but not limited to, the Specifications, Drawings, Geotechnical Report, addenda, progress schedule and updates, weekly progress reports, minutes of progress meetings, change orders, and other documents pertinent to the performance of the Contract, and necessary to the Board's work.

B. Coordination

The OWNER will, in cooperation with the CONTRACTOR, coordinate the operations of the Board.

C. Services

The OWNER will arrange for or provide conference facilities at or near the site, and provide secretarial and copying services.

TIME FOR BEGINNING AND COMPLETION

Except for choosing a third member by the first two members, the Board members shall not begin any work under the terms of this Agreement until authorized in writing by the OWNER.

PAYMENT

Invoices of the Board members shall be paid by the CONTRACTOR. Payments shall constitute full compensation for work performed and services rendered, and for all materials, supplies and incidentals necessary to serve on the Board.

A. Payment for Services and Expenses

Payment for services of the OWNER-appointed and CONTRACTOR-appointed members of the Board will be at the rates agreed to between the OWNER and the CONTRACTOR and each respective appointed Board member. Changes in the billing rates are subject to agreement between the OWNER and the CONTRACTOR and their respective appointed members.

Payment for services rendered by the third member of the Board will be paid at the rate agreed to between the OWNER, the CONTRACTOR and the third member. Changes in the billing rate are subject to agreement between the OWNER, the CONTRACTOR and the third member.

The first two members will be reimbursed for the time and expense associated with choosing the third member.

Direct, non-salary expenses will be reimbursed at the actual cost to the Board member. These expenses may include, but are not limited to, automobile mileage, parking, travel expenses from the Board member's point-of-departure to the initial point-of-arrival, automobile rental, food and lodging, printing, long distance telephone, postage and courier delivery. Air travel will be reimbursed for Coach class. Billing for these expenses shall include an itemized listing supported by copies of the original bills, invoices and expense accounts.

B. Payments

Each Board member may submit invoices for payment for work completed not more often than once per month during the progress of Work. Such invoices shall be in a format approved by the OWNER and CONTRACTOR, and accompanied by a general description of activities performed during that period. The value of work accomplished for payment shall be established from the billing rate and hours expended by the Board member together with direct, non-salary expenses. Satisfactorily submitted invoices shall be paid within 30 days.

The CONTRACTOR shall pay the invoices of all Board members after approval of both Parties. The CONTRACTOR will then bill the OWNER for 50 percent of such invoices.

C. Inspection of Cost Records

The cost records and accounts pertaining to this Agreement shall be kept available for inspection by representatives of the OWNER or CONTRACTOR for three years after final payment.

ASSIGNMENT

Board members shall not assign any of the Work of this Agreement.

TERMINATION OF AGREEMENT

This Agreement may be terminated by mutual agreement of the OWNER and the CONTRACTOR at any time upon not less than four weeks written notice to the other parties.

Board members may withdraw from the Board by providing four weeks written notice. Board members may be terminated with or without cause only by their original appointer; the OWNER may only terminate the OWNER-appointed member, the CONTRACTOR may only terminate the CONTRACTOR-appointed member, and the first two members or the OWNER and CONTRACTOR must agree to terminate the third member.

LEGAL RELATIONS

The parties hereto mutually understand and agree that each Board member, in the performance of his duties on the Board, is acting in the capacity of an independent agent and not as an employee of either the OWNER or the CONTRACTOR.

The OWNER and CONTRACTOR expressly acknowledge that each Board member is acting in a capacity intended to facilitate resolution of Claims. Accordingly, it is agreed and acknowledged that to

the fullest extent permitted by law each Board member shall be accorded quasi-judicial immunity for any actions or decisions associated with the consideration, hearing, and recommendation of resolution for disputes rightfully referred to the Board.

Each Board member shall be held harmless for any personal or professional liability arising from or related to Board activities. To the fullest extent permitted by law, the OWNER and CONTRACTOR shall indemnify all Board members for claims, losses, demands, costs and damages (including reasonable attorney fees) for bodily injury, property damage, or economic loss arising out of or related to Board members carrying out Board functions. The foregoing indemnity is a joint and several obligation.

DISPUTES REGARDING THIS THREE PARTY AGREEMENT

Any dispute among the parties hereto, arising out of the Work or other items of this Agreement, which cannot be resolved by negotiation and mutual concurrence between the parties, shall be referred to the Superior Court of theState of California.

VENUE, APPLICABLE LAW, AND PERSONAL JURISDICTION

In the event that any party deems it necessary to institute legal action or proceedings to enforce any right or obligation under this Agreement, the parties hereto agree that any such action shall be initiated in the Superior Court of theState of California. The parties hereby agree that all questions shall be resolved by application of (jurisdiction) California law and that the parties to such action shall have the right to appeal from such decisions of the Superior Court in accordance with the laws of the State of California. The Board member hereby consents to the personal jurisdiction of the Superior Court of the State of California.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the day and year first above written.

Board MEMBER Board MEMBER Board MEMBER

CONTRACTOR OWNER

By: _____ By: _____

Title: _____ Title: _____

END OF SECTION

SECTION 01115

ESCROW BID DOCUMENTS

PART 1 GENERAL

1.01 GENERAL

A. The three low bidders shall submit, within two business days of the opening of bids, one copy of all documentary information generated in preparation of bid prices for this Contract. This material is hereinafter referred to as Escrow Bid Documents (EBDs). The Escrow Bid Documents of the successful bidder will be held in escrow for the duration of the Contract.

B. The successful bidder agrees, as a condition of award of the Contract, that the Escrow Bid Documents constitute all of the information used in preparation of his bid. No other bid preparation information shall be considered in resolving any disputes or claims.

C. Nothing in the Escrow Bid documents shall change or modify the terms or conditions of the Contract.

1.02 OWNERSHIP

A. The EBDs are and shall always remain the property of the CONTRACTOR subject only to joint review by OWNER and the CONTRACTOR, except as provided for herein.

B. OWNER stipulates and expressly acknowledges that the EBDs, as defined herein, constitute trade secrets. This acknowledgment is based on the OWNER's express understanding that the information contained in the EBDs is not known outside the CONTRACTOR's business, is known only to a limited extent and only by a limited number of employees of the CONTRACTOR, is safeguarded while in the CONTRACTOR's possession, and is extremely valuable to competitors by virtue of it reflecting the CONTRACTOR's contemplated techniques of construction.

C. OWNER acknowledges that EBDs and the information contained therein are made available to OWNER only because such action is an express prerequisite to award of the Contract. OWNER acknowledges that the EBDs include a compilation of information used in the CONTRACTOR's business, intended to give the CONTRACTOR an opportunity to obtain an advantage over competitors who do not know of or use the contents of the documentation. OWNER agrees to safeguard the EBDs and all information contained therein to the fullest extent permitted by law.

1.03 PURPOSE

A. EBDs will be used to assist in the negotiation of price adjustments and variations and in the settlement of disputes, Claims and other controversies. They will not be used for pre-award evaluation of the CONTRACTOR's anticipated methods of construction or to assess the CONTRACTOR's qualifications for performing the Work.

1.04 FORMAT AND CONTENTS

A. No standard format is required for EBDs, but the submitted documentary information must be legible and complete. Documentary information shall be submitted in the format the information was generated in the preparation of Bid prices for the Project. It is not intended that extra work is required in preparing the bid but to ensure that the EBDs will be adequate to enable complete and proper understanding and proper interpretation for their intended use. The EBDs shall be in the English language only.

B. The EBDs shall clearly itemize the estimated costs of performing the work of each item contained in the Bid Schedule. Items should be separated into sub-items as required to present a complete and detailed cost estimate and allow a detailed cost review. The EBDs shall include all quantity take-offs, crews, equipment, calculations of rates of production and progress, copies of quotations from sub-Contractors and suppliers, and memoranda, narratives, consultants reports, add/deduct sheets and all other information used by the CONTRACTOR to arrive at the prices contained in the bid. Estimated costs shall be broken down into the CONTRACTOR's usual estimate categories such as direct labor, repair labor, equipment operation, equipment Ownership, expendable materials, permanent material and subcontract costs as appropriate. Plant and equipment and indirect costs should be detailed in the CONTRACTOR's usual format. The CONTRACTOR's allocation of plan and equipment, indirect costs, contingencies, mark-up and other items to each bid item shall be clearly indicated.

C. The EBDs shall clearly show in calculations, text, or both, the relationship between baseline indications presented in the contract Documents and assumptions that form the basis for the CONTRACTOR's means, methods, equipment selection, rates of production, and costs.

D. All costs shall be identified. For bid items where the extended amount is less than$10,000 estimated unit costs are acceptable without a detailed cost estimate, providing that labor, equipment, materials and subcontracts, as applicable, are included and provided that indirect costs, contingencies, and mark-up, as applicable, are allocated.

E. Bid Documents provided by OWNER should not be included in the EBDs unless needed to comply with the above requirements.

1.05 SUBMITTAL

A. The EBDs shall be submitted by the three lowest bidders in a sealed container within two business days of the bid opening. The container shall be clearly marked on the outside with the Bidder's name, date of submittal, project name, Contract No., and the words "Escrow Bid Documents".

B. The EBDs shall be accompanied by the following "Escrow Bid Documentation Certification", signed by an individual authorized by the bidder to execute the bid, stating that the material in the Escrow Bid Documentation constitutes all the documentary information used in the preparation of the bid and that he or she has personally examined the contents of the EBDs container and has found that the documents in the container are complete.

"Escrow Bid Document Certification"

THE UNDERSIGNED HEREBY CERTIFIES THAT THE BID DOCUMENTATION CONTAINED HEREIN CONSTITUTES ALL THE INFORMATION USED IN PREPARATION OF THE BID AND THAT I HAVE PERSONALLY EXAMINED THESE CONTENTS AND HAVE FOUND THAT THIS BID DOCUMENTATION IS COMPLETE.

*SIGNATURE:*_____

*NAME:*_____
(Print)

*TITLE:*_____

*FIRM:*_____

*DATE:*_____

C. Timely submission of the complete EBDs is an essential element of the bidder's responsibility and a prerequisite to contract award. Failure to provide the necessary EBDs within the specified time frame will be sufficient cause for OWNER to reject the bid.

D. If the bidder's proposal is based on subcontracting any part of the Work, each subcontractor whose total subcontract price exceeds five percent of the total contract price proposed by the bidder, shall provide separate EBDs to be included with those of the bidder. These documents will be opened and examined in the same manner and at the same time as the examination described above for the apparent successful bidder.

E. If the CONTRACTOR wishes to subcontract any portion of the Work after award, OWNER retains the right to require the CONTRACTOR to submit EBDs from the subcontractor before the subcontract is approved.

1.06 INITIAL EXAMINATION

A. Once received by OWNER, the EBDs of the apparent lowest Bidder will be promptly examined, organized, and inventoried by representatives of the OWNER and members of the Bidder's staff who are knowledgeable of how the Bid was prepared. Such members of Bidder's staff shall attend said initial examination upon being provided with 48 hour advance written notice (email and facsimile included) by the OWNER of the date and time of such examination.

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

C. Should the examination and inventory by the OWNER's designated review representatives indicate that data is incomplete or missing data, the OWNER will give notice of such to the CONTRACTOR who shall supply it within twenty four (24) hours.

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

1.07 EBDS OF OTHER BIDDERS

A. If the OWNER has reason to believe that the Contract may not be awarded to the apparent lowest Bidder, the OWNER may process the EBDs of the next apparent lowest Bidder as described above.

B. If the OWNER has reason to believe that the Contract may not be awarded to the apparent lowest Bidder, the OWNER may request the apparent fourth lowest Bidder to submit its EBDs within two business days.

C. EBDs submitted by unsuccessful Bidders will be returned unopened, unless opened as provided for above, following award of the Contract.

1.08 STORAGE

A. The EBDs shall be placed in escrow prior to award of the contract, for the life of the Contract, in a mutually agreeable institution. The cost of storage will be borne by OWNER.

1.09 EXAMINATION

A. The EBDs shall be examined by both OWNER and the CONTRACTOR, at any time deemed necessary by either OWNER or the CONTRACTOR, to assist in the negotiation of price adjustments and change orders, or the settlement of disputes.

B. Examination of the EBDs is subject to the following conditions:

1. As trade secrets, the EBDs are proprietary and confidential as described above.

2. OWNER and the CONTRACTOR shall each designate, in writing to the other party a minimum of ten days prior to examination, representatives who are authorized to examine the EBDs. No other person shall have access to the EBDs.

3. Access to the EBDs will take place only in the presence of duly designated representatives of both OWNER and the CONTRACTOR.

4. Members of the Disputes Review Board (DRB) may examine the EBDs in the presence of representatives of OWNER and CONTRACTOR if such examination would assist the DRB's review of a Claim that the parties have submitted to the DRB for review. Any mediator used by the Owner and Contractor to mediate a Claim may examine the EBDs in the presence of representatives of OWNER and CONTRACTOR if such examination would assist the mediator's review of a Claim for purposes of mediation. The EBDs may also constitute discoverable evidence in any litigation relating to the Project, to the extent allowed under applicable law.

1.10 FINAL DISPOSITION

A. The EBDs will be returned to the CONTRACTOR at such time as the Contract has been completed and final settlement has been achieved.

1.11 CONDITIONS FOR RETURN TO CONTRACTOR

A. Upon completion of the Contract, issuance of Final Payment by the OWNER, verification that all Claims have been settled, litigation has been completed, and verification that future litigation does not exist, the EBDs will be sealed and promptly returned to the CONTRACTOR by the escrow entity in charge of the EBDs.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01120

PROJECT PARTNERING

PART 1 GENERAL

1.01 THE REQUIREMENT

A. The CONTRACTOR shall participate in "project partnering" along with the ENGINEER and the OWNER for this Project. Partnering will be effective only if all parties willingly enter into this cooperative arrangement with the support of each entity at the highest level in their organizations. The OWNER and ENGINEER consider partnering important to the overall success of this project. It is desired that the CONTRACTOR will be equally concerned with cooperation, effective communication, quality, performance, budget, and schedule and will endorse and adopt partnering as an effective tool for achieving these objectives.

B. It must be recognized that the OWNER, CONTRACTOR, and ENGINEER all hold in common the goal of successful completion of this Project. Success necessarily must include the following requirements.

1. Construction of a facility that meets the project performance standards as defined in the Drawings and Technical Specifications.

2. Completion of the project on schedule.

3. Conformance to budgetary requirements and limitations.

4. Cooperation and effective communication.

In addition, it is recognized that safety, profit, liability limitation, avoidance of litigation, reputation, good will, and other factors are of significant importance to all parties involved in the Project. These goals can be achieved most readily if the CONTRACTOR, OWNER, and ENGINEER join together in a mutually beneficial alliance which recognizes the issues that each considers of greatest importance and work to accomplish them.

C. Through partnering, the three parties will agree among themselves regarding the primary goals for the Project and the methods that will be used to accomplish them. This will require development of a trust relationship, not an adversarial one, among these parties who will be working closely and cooperatively for the duration of the project. Commitment, communication and conflict resolution must be of highest importance for this relationship to succeed.

D. The CONTRACTOR should include its major subcontractors and suppliers in partnering so these participants may "buy-in" to the concept and work cooperatively with other parties on the project.

E. Partnering will include an initial one-day workshop in which the basic requirements for the partnering relationship will be established, an issue resolution ladder developed and a Partnering Charter prepared. The workshop will be held within 30 days of issuance of the Notice to Proceed at a time and date agreed upon by all parties at a neutral location away from each entities' home office and field facilities. Attendees at the workshop will include:

CONTRACTOR REPRESENTATIVES

- Principal-in-Charge
- Project Manager
- Superintendent
- General Foreman
- Major Subcontractors

OWNER REPRESENTATIVES

- Public Works Director
- Deputy Public Works Director
- Project Manager
- Environmental Programs Manager

ENGINEER REPRESENTATIVES

- Principal in Charge
- Construction Manager
- Resident Project Representatives
- Public Information Liaison
- Inspectors

F. Semi-annual half-day partnering sessions also may be held during the Project to confirm the relationship and assure the partnering effort continues to be successful. In this manner, it can best be assured that the CONTRACTOR, OWNER and ENGINEER all will work cooperatively to ensure a successful Project.

G. A partnering facilitator will be employed by the OWNER who will help establish and monitor the partnering relationship. The OWNER will pay all costs associated with employing the partnering facilitator and will pay all costs for facilities and food services at the initial workshop. The CONTRACTOR shall pay all costs associated with its own and its subcontractor's participation in partnering.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01170

SPECIAL PROVISIONS

PART 1 GENERAL

1.01 INSTALLATION OF EQUIPMENT

A. The CONTRACTOR shall be responsible for the exact alignment of equipment with associated piping and under no circumstances, will "pipe springing" be allowed.

B. All wedges, shims, filling pieces, keys, packing, grout, or other materials necessary to properly align, level and secure pipe in place shall be furnished by the CONTRACTOR.

1.02 SLEEVES AND OPENINGS

A. Provide all openings, channels, chases, etc, in new construction and furnish and install anchor bolts and other items to be embedded in concrete, as required to complete the work under this Contract. Perform all cutting, coring and rough and finish patching required in existing construction for the work of all trades.

1.03 TOOLS

A. Any special tools which may be necessary for the adjustment, operation and maintenance of any equipment shall be furnished with the respective equipment.

B. Tools shall be furnished in heavy steel tool boxes complete with lock and duplicate keys.

1.04 PIPE MARKING

A. It shall be the CONTRACTOR's responsibility to assist, as required by the ENGINEER, in identifying pipe contents, direction of flow and all else required for proper marking of pipe.

1.05 VALVE IDENTIFICATION

A. The CONTRACTOR shall prepare a valve schedule for all valves required for the work showing a number, the location, type, function, and normal operating position, for each valve. The schedule shall be submitted to the ENGINEER for approval not less than 120 days prior to start-up.

B. The CONTRACTOR shall furnish tags for all above ground valves required for the work. Valve tags shall be 2-in diameter, 19 gauge, brass or plastic, with brass hooks suitable for attaching the tag to the valve operator. Tags shall be stamped or etched with the valve number and the information on the valve schedule coded in a system provided by the OWNER. Submit two samples of the type of tag proposed and the manufacturer's standard color chart and letter styles to the ENGINEER for approval.

C. The CONTRACTOR shall install valve tags on all valves required for the WORK.

1.06 SPARE PARTS

A. Where spare parts are specified in the technical sections, furnish all spare parts recommended by the manufacturer or system supplier for one year of service. In addition, furnish all spare parts itemized in each Section.

B. Collect and store all spare parts in an area to be designated by the ENGINEER. Furnish the ENGINEER with an inventory listing all spare parts, the equipment they are associated with, the name and address of the supplier and the delivered cost of each item. Copies of actual invoices for each item shall be furnished with the inventory to substantiate the delivery cost.

C. Spare parts shall be packed in cartons, properly labeled with indelible markings with complete descriptive information including manufacturer, part number, part name and equipment for which the part is to be used and shall be properly treated for one year of storage.

1.07 RIGHT TO KNOW LAW

A. The CONTRACTOR shall submit the Material Safety Data Sheets for all substances or mixture of substances used on the Project by him or his subcontractors prior to commencing any work in accordance with the requirements of MGL Chapter 111F, Section 16.

1.08 WEATHER PROTECTION

A. In the event of inclement weather, the CONTRACTOR shall protect the WORK and materials from damage or injury from the weather. If, in the opinion of the ENGINEER, any portion of the WORK or materials has been damaged by reason of failure on the part of the CONTRACTOR to so protect the WORK, such WORK and materials shall be removed and replaced with new materials and WORK to the satisfaction of the ENGINEER.

1.09 NOISE LIMITATIONS

A. All equipment to be furnished under this Contract, unless specified otherwise in the technical specifications, shall be designed to ensure that the sound pressure level does not exceed 85 decibels over a frequency range of 37.8 to 9600 cycles per second at a distance of 3-ft from any portion of the equipment, under any load condition, when tested using standard equipment and methods. Noise levels shall include the noise from the motor. Mufflers or external baffles shall not be acceptable for the purpose of reducing noise. Data on noise levels shall be included with the shop drawing submittal.

B. Installed equipment shall comply with the noise requirements of the Coastal Development Permit as outlined in Section 01060 – Regulatory Agency and Utility Requirements.

END OF SECTION

SECTION 01292

SCHEDULE OF VALUES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Requirements for preparation, format, and submittal of Schedule of Values.

1.02 PREPARATION

A. Prepare Schedule of Values identifying costs of Major Items of Work.

B. Divide the Work into Major Items of Work, as provided in the CONTRACTOR's Schedule.

C. Assign prices to Major Items of Work which aggregate the Contract Price. Base prices on costs associated with scheduled activities based on the Project Schedule for each Major Item of Work.

1.03 SUBMITTALS

A. Submit preliminary schedule of values in accordance with Document 00700, General Conditions, Paragraph 2.05 A.3.

B. Submit corrected schedule of values within 10 days upon receipt of reviewed Schedule of Values, but no later than 10 days prior to anticipated submittal of first Application for Payment, in accordance with Document 00700, General Conditions, Paragraph 2.07.

C. Upon request, support prices with data which will substantiate their correctness.

D. If activities are added or removed from the Progress Schedule revise the Schedule of Values and resubmit.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes requirements and procedures for submitting Shop Drawings, Product Data, Samples, other submittals relating to products, and as specified in individual sections.

1.02 DEFINITIONS

A. Manufacturer's Instructions: Instructions, stipulations, directions, and recommendations issued in printed form by the manufacturer of a product addressing handling, installation, erection, and application of the product; Manufacturers Instructions are not prepared especially for the Work.

B. Shop Drawings: Drawings, diagrams, schedules, and other data specially prepared for the Work to illustrate some portion of the Work.

C. Product Data: Illustrations, standard schedules, performance charts, brochures, diagrams and other information to illustrate materials or equipment for some portion of the Work.

D. Samples: Physical examples which illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged.

E. Special Samples: Physical examples which illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged, and will be incorporated in the Work.

1.03 PROCEDURES

A. Deliver submittals electronically in PDF format through EADOC per Section 01322.

B. Submit submittals in ample time for each to serve submittals' intended purpose.

C. Prepare and submit a schedule indicating when shop drawings are required to be submitted to support the as-planned construction schedule. The submittal schedule shall allow sufficient time for preparation and submittal, review and approval, and fabrication and delivery to support the construction schedule.

D. Submit submittals which are specified or reasonably required for construction, operation, and maintenance of the Work.

E. Deliver submittals using transmittal form provided by the ENGINEER, which identifies:

1. Submittal date.

2. Project and CONTRACTOR.

3. Subcontractor and major supplier, when appropriate

4. Reference submittal to Contract Documents by Drawing, detail, and/or Specification section numbers, as appropriate.

5. Variations from Contract Documents when variations are included in submittal.

F. Submit specified number of copies of submittal.

G. In addition to the specified number of hard copies, submit electronic copy of ALL submittals on CD and in .pdf format. Electronic copy is to be organized identical to hard copy submittals utilizing bookmarks to delineate individual sections and subsections.

H. Provide or furnish products and execute the Work in accordance with accepted submittals, unless in conflict with Contract Documents.

I. When minor deviations from Contract Documents are accepted, modify Contract Documents in accordance with the Contract.

1.04 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

A. Submit Shop Drawings, Product Data, Samples, and other pertinent information in sufficient detail to show compliance with specified requirements.

1. Detailed installation drawings (sewers, equipment, piping, electrical conduits and controls, etc.) shall be prepared and submitted for review and approval by the ENGINEER prior to installing such work. Installation drawings shall be to-scale and shall be fully dimensioned.

2. Piping working drawings shall show the laying dimensions of all pipes, fittings, valves, as well as the equipment to which it is being connected. In addition, all pipe supports shall be shown.

3. Equipment working drawings shall show all equipment dimensions, anchor bolts, support pads, piping connections and electrical connections. In addition, show clearances required around such equipment for maintenance of the equipment.

B. Check, verify, and revise submittals as necessary to bring them into conformance with Contract Documents and actual field conditions.

1. Determine and verify quantities, dimensions, specified design and performance criteria, materials, catalog numbers, and similar data.

2. Coordinate submittal with other submittals and with the requirements of the Contract Documents.

C. After completion of checking, verification, and revising; sign and date submittals indicating review and approval; and submit to ENGINEER.

1. Signature indicates CONTRACTOR has satisfied shop drawing review responsibilities and constitutes CONTRACTOR's written approval of shop drawing.

2. Shop drawings without CONTRACTOR's written approval will be returned for resubmission.

D. Shop Drawings: Submit 5 copies to the ENGINEER. One copy will be returned to the CONTRACTOR with reviewer's comments and stamp.

E. Product Data and Manufacturer's Instructions: Submit 5 copies to the ENGINEER. Excise or cross out non-applicable information and clearly mark applicable information with citations to and terminology consistent with Contract Documents.

1. 1 copy will be returned with reviewer's comments.

F. Samples: Submit 2 samples labeled with reference to applicable Contract Documents. Label will be returned with reviewer's selection and comments when appropriate. Samples will not be returned unless return is requested in writing and additional sample is submitted

G. Special Samples: Submit 1 sample labeled with reference to applicable Contract Documents. Sample and 1 label will be returned for installation in the Work.

H. No portion of the work requiring a shop drawing (including working drawings and product data) or sample shall be started, nor shall any materials be fabricated or installed before approval of such item. Procurement, fabrication, delivery or installation or products or materials that do not conform to approved shop drawings shall be at the CONTRACTOR's risk. Furthermore, such products or materials delivered or installed without approved shop drawings, or in non-conformance with the approved shop drawings will not be eligible for progress payment until such time as the product or material is approved or brought into compliance with approved shop drawings. Neither the OWNER nor ENGINEER will be liable for any expense or delay due to corrections or remedies required to accomplish conformity

I. Assume risk of expense and delays when proceeding with work related to required submittals without review and acceptance.

J. Submittals in Electronic Media Format: Include with each submittal electronic copies of all product data, shop drawings as follows:

1. General: Provide all information on CDs, PC compatible using Windows XP operating system.

2. Product Data: Provide text documents and manufacturer’s literature using current version of Adobe Acrobat.

3. Shop Drawings, Diagrams: Provide all graphic submittals utilizing current version of Adobe Acrobat.

4. CONTRACTOR using other software shall be required to provide to the ENGINEER conclusive evidence of 100 percent data transfer compatibility.

5. Adobe Acrobat: Any information provided as an image file shall be in the latest version of Adobe Acrobat (i.e. PDF extension).

1.05 MANUFACTURER'S INSTRUCTIONS

A. Submit manufacturer's instructions whenever made available by manufacturers and when installation, erection, or application in accordance with manufacturer's instructions are required by the Specifications.

B. Submit manufacturer's instructions prior to installation, erection, or application of equipment and other project components. Submit manufacturer's instructions in accordance with requirements for Product Data.

1.06 ENGINEER'S REVIEW

A. ENGINEER's review of submittals shall not release CONTRACTOR from CONTRACTOR's responsibility for performance of requirements of Contract Documents. Neither shall ENGINEER's review release CONTRACTOR from fulfilling purpose of installation nor from CONTRACTOR's liability to replace defective work.

B. Do not consider submittals as Contract Documents. Purpose of submittals is to demonstrate how CONTRACTOR intends to conform with the design concepts.

C. ENGINEER's review of shop drawings, samples, or test procedures will be only for conformance with design concepts and for compliance with information given in Contract Documents. ENGINEER's review does not extend to:

1. Accuracy of dimensions, quantities, or performance of equipment and systems designed by CONTRACTOR.

2. CONTRACTOR's means, methods, techniques, sequences, or procedures except when specified, indicated on the Drawings, or required by Contract Documents

3. Safety precautions or programs related to safety which shall remain the sole responsibility of the CONTRACTOR.

D. No less than 21 calendar days will be required for ENGINEER’s review time for shop drawings and O&M manuals involving only one engineering discipline. No less than 30 calendar days will be required for ENGINEER’s review time for shop drawings and O&M manuals that require review by more than one engineering discipline. Resubmittals will be subject to the same review time.

E. For Submittals returned “APPROVED” – There are no notations or comments on the submittal. The CONTRACTOR may release the equipment and/or material for manufacture.

F. For submittals returned "APPROVED AS NOTED" - Confirmation of the notations and comments IS NOT required by the CONTRACTOR. The CONTRACTOR may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product.

G. For submittals returned "APPROVED AS NOTED/CONFIRM" - This combination is assigned when a confirmation of the notations and comments is required by the CONTRACTOR. The CONTRACTOR may release the equipment or material for manufacture; however, all notations

and comments must be incorporated into the final product. This confirmation shall specifically address each omission and nonconforming item that was noted. Confirmation is to be received by the ENGINEER within 15 calendar days of the date of the ENGINEER's transmittal requiring the confirmation.

H. For submittals returned "APPROVED AS NOTED/RESUBMIT" - This combination is assigned when notations and comments are extensive enough to require a resubmittal of the entire package. This resubmittal is to address all comments, omissions and non-conforming items that were noted. Resubmittal is to be received by the ENGINEER within 30 calendar days of the date of the ENGINEER's transmittal requiring the resubmittal.

I. For submittals returned "NOT APPROVED" – This is assigned when the submittal does not meet the intent of the contract documents. The CONTRACTOR must resubmit the entire package revised to bring the submittal into conformance. It may be necessary to resubmit using a different manufacturer/vendor to meet the requirements of the contract documents.

J. For submittals returned "COMMENTS ATTACHED" – This is assigned where there are comments attached to the returned submittal, which provide additional data to the CONTRACTOR.

K. For submittals returned "RECEIPT ACKNOWLEDGED (Not subject to ENGINEER's Review or Approval)" – This is assigned to acknowledge receipt of a submittal that is not subject to the ENGINEER's review and approval, and is being filed for informational purposes only. This code is generally used in acknowledging receipt of means and methods of construction work plans, field conformance test reports, and health and safety plans.

L. ENGINEER will be entitled to rely upon the accuracy or completeness of designs, calculations, or certifications made by licensed professionals accompanying a particular submittal whether or not a stamp or seal is required by Contract Documents or Laws and Regulations.

M. Costs incurred by OWNER as a result of additional reviews of a particular submittal after the second time it has been reviewed shall be borne by CONTRACTOR. Reimbursement to OWNER will be made by deducting such costs from CONTRACTOR's subsequent partial payments.

1.07 MINOR OR INCIDENTAL PRODUCTS AND EQUIPMENT SCHEDULES

A. Shop Drawings of minor or incidental fabricated products will not be required, unless requested.

B. Submit tabulated lists of minor or incidental products showing the names of the manufacturers and catalog numbers, with Product Data and Samples as required to determine acceptability.

1.08 SUBMITTALS FOR INFORMATION OR RECORD ONLY

A. Submit electronic PDF copy of each. None will be returned.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 SUBMITTAL SCHEDULE

A. Provide an initial submittal schedule at the pre-construction meeting for review by ENGINEER. Incorporate comments from ENGINEER into a revised submittal schedule.

B. Maintain the submittal schedule and provide sufficient copies for review by ENGINEER. An up-to-date submittal schedule shall be provided at each project progress meeting.

END OF SECTION

SECTION 01311

CONSTRUCTION SCHEDULES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Preparation, submittal, and maintenance of computerized progress schedule and reports, contract time adjustments, and payment requests, including the following:

1. Preliminary Schedule.

2. Baseline Schedule.

3. Weekly Schedule.

4. Schedule Updates.

5. Schedule Revisions.

6. Time Impact Analyses.

7. Final Schedule Submittal.

B. Related Sections:

1. Section 00700 – General Conditions

1.02 RESPONSIBLE PERSON

A. Designate, in writing and within 14 calendar days after Notice of Award, person responsible for preparation, maintenance, updating and revision of all schedules.

B. Qualifications of Responsible Person:

1. Authority to act on behalf of CONTRACTOR.

2. Five (5) years verifiable experience in preparation of complex construction schedules for projects of similar value, size and complexity.

a. Knowledge of CPM scheduling utilizing Primavera Project Planner P6

C. ENGINEER reserves the right to accept or reject scheduler when submitted by CONTRACTOR if not qualified. ENGINEER reserves the right to remove scheduler from the project if found to be incompetent.

1.03 SCHEDULING FORMAT AND SOFTWARE

A. Schedule Format: Utilize critical path method (CPM) format.

B. Prepare computerized schedule utilizing Primavera Project Planner P6.

1.04 PRECONSTRUCTION SCHEDULING MEETING

A. ENGINEER will conduct Preconstruction Scheduling Meeting with CONTRACTOR's Project Manager, General Superintendent and scheduler within 7 calendar days after Notice To Proceed. This meeting is separate from the Preconstruction Conference Meeting and is intended to cover schedule issues exclusively. At the meeting, scheduling requirements shall be reviewed with CONTRACTOR. These include schedule preparation, reporting requirements, updates, revisions, and schedule delay analysis. CONTRACTOR shall present their schedule methodology, planned sequence of operations, and present their proposed activity coding structure.

B. Coding Structure: CONTRACTOR shall submit proposed coding structure, identifying the code fields and the associated code values it intends to use in the project schedule. The coding structure shall, at a minimum, include code fields for Project Segment or Phase, Area of Work, Type of Work, Submittal/Procurement/Construction and Responsibility/Subcontractor. Refer to Article 1.09 I for listing of activity categories to be included in the schedule.

1.05 PREPARATION

A. Preparation and submittal of Progress Schedule represents CONTRACTOR's intention to execute the Work within specified time and constraints. Failure to conform to requirement may result in termination for cause under Article 15.02, Suspension of Work and Termination of the General Conditions.

B. CONTRACTOR's bid covers all costs associated with the execution of the Work in accordance with the Progress Schedule.

C. During preparation of the preliminary Progress Schedule, ENGINEER will facilitate CONTRACTOR's efforts by being available to answer questions regarding sequencing issues, scheduling constraints, interface points, and dependency relationships.

D. Prepare schedule utilizing Precedence Diagramming Method (PDM).

E. Prepare schedule utilizing activity durations in terms of working days. Do not exceed 15 working day duration on activities except concrete curing, submittal review and equipment fabrication and deliveries. Where duration of continuous work exceeds 15 working days, subdivide activities by location, stationing, or other sub-element of the Work.

F. CONTRACTOR shall coordinate holidays to be observed with the ENGINEER and incorporate them into the schedule as non-working days.

G. Failure to include an activity required for execution of the Work does not excuse CONTRACTOR from completing the Work and portions thereof within specified times and at price specified in Agreement. Failure of CONTRACTOR to include required schedule constraints, sequences or milestones in schedule shall not relieve CONTRACTOR of obligation to conform to requirements of Contract. Acceptance of schedule shall not waive Contract requirements. In event of conflict between accepted schedule and Contract requirements, terms of Contract shall govern at all times, unless requirements are waived in writing by the ENGINEER.

H. Reference schedule to working days with beginning of Contract Time as Day "1."

I. Should CONTRACTOR submit a Baseline Schedule showing project completion more than 20 working days prior to Contract completion date ENGINEER may issue Change Order, at no cost to OWNER, revising time of performance of Work and Contract completion date to match CONTRACTOR's schedule completion date. Contract milestone dates, if any, shall be adjusted accordingly.

J. Contract float is for the mutual benefit of both OWNER and CONTRACTOR. Changes to the project that can be accomplished within this available period of float may be made by OWNER without extending the Contract time, by utilizing float. No time extensions shall be granted nor delay damages owed until Work extends beyond currently accepted Contract completion date. Likewise, CONTRACTOR may utilize float to offset delays other than delays caused by OWNER. Mutual use of float shall continue until all available float shown by schedule has been utilized by either OWNER or CONTRACTOR, or both. At that time, extensions of the Contract time will be granted by ENGINEER for valid OWNER-caused or third party-caused delays which affect the planned completion date and which have been properly documented and demonstrated by CONTRACTOR.

K. Schedule Logic: Schedule shall be assembled to show order in which CONTRACTOR proposes to carry out Work, indicate restrictions of access, availability of Work areas, and availability and use of manpower, materials and equipment. Following criteria shall form basis for assembly of schedule logic.

    1. Which activities must be completed before subsequent activities can be started?

    2. Which activities can be performed concurrently?

    3. Which activities must be started immediately following completed activities?

    4. What major facility, equipment or manpower restrictions are required for sequencing these activities?

L. Non-sequestering of Float: Pursuant to float sharing requirements of Contract, use of float suppression techniques such as preferential sequencing or logic, special lead or lag logic restraints, extended activity durations or imposed dates shall be cause for rejection of any schedule submittal.

M. Interim Milestone Dates, Operational Constraints: In event there are interim milestone dates and/or operational constraints set forth in Contract, CONTRACTOR shall show them on schedule as specified in Contract. CONTRACTOR shall not use Zero Total Float constraint or Mandatory Finish Date on such Contract requirements.

N. Schedule Windows for OWNER-furnished, CONTRACTOR-installed Equipment or Materials: Immediately after Award of Contract CONTRACTOR shall obtain from ENGINEER anticipated delivery dates of OWNER furnished equipment or materials. These dates shall be shown on schedule in same manner indicated by ENGINEER.

O. Cost Loading: All schedules shall be cost loaded. Only on-site construction activities shall be cost loaded. The sum total of all cost loaded activities shall equal the current value of the Contract, including change orders, at all times. Upon acceptance by ENGINEER, the Baseline Schedule shall also be the Schedule of Values. The monthly Schedule Updates shall be the monthly

Payment Application. Submittal and acceptance of these schedules shall be a condition precedent to the making of any payments under this Contract.

1.06 SUBMITTAL OF PROGRESS SCHEDULES

A. Submit preliminary and baseline schedule in accordance with the General Conditions of the Contract.

B. Submit, on a monthly basis, updated schedules as specified. Submit final schedule update as specified.

C. Submit revised schedules and time impact analyses as specified.

D. Submit schedules in the media and number of copies as follows.

1. Three (3) sets of the CPM network and/or barchart specified on D-size sheets. Color-coding shall be included to clearly define and delineate related activities.

2. Three (3) sets of Tabular reports listing all activities sorted numerically identifying duration, early start, late start, early finish, late finish, total float, and all predecessor/successor information.

3. Two (2) CDs containing the computerized CPM Schedule data.

4. Three (3) prints of the Summary Schedule.

1.07 PRELIMINARY SCHEDULE

A. CONTRACTOR shall submit Preliminary Schedule within 10 calendar days after Notice To Proceed. Preliminary Schedule shall contain detailed plan of operations for first 90 calendar days of Work after receipt of Notice to Proceed.

1. ENGINEER and CONTRACTOR shall meet within 7 calendar days after receipt of Preliminary Schedule to review and make necessary adjustments. CONTRACTOR shall submit revised preliminary schedule within 5 calendar days after meeting.

B. CONTRACTOR shall submit schedule of costs for all activities on revised Preliminary Schedule with revised Preliminary Schedule.

C. Schedule of costs shall be Schedule of Values required under Section 01292 for first 90 calendar days of Work. Submittal and acceptance of Preliminary Schedule is condition precedent to making of progress payments for mobilization costs otherwise provided for in the Contract.

D. No pay item Work shall commence until Preliminary Schedule and schedule of costs have been accepted by ENGINEER.

E. Accepted Preliminary Schedule shall be incorporated unchanged, as first 90 calendar days of activity in CONTRACTOR's Baseline Schedule.

F. Preliminary Schedule shall be updated monthly during first 90 calendar days after Notice to Proceed. Updated Preliminary Schedule shall be the payment application required under Section 01294.

1.08 BASELINE SCHEDULE

A. No more than 45 calendar days after Notice of Award, CONTRACTOR shall submit the Baseline Schedule for all Work of the project. Baseline Schedule shall show sequence and interdependence of all activities required for complete performance of all Work, beginning with date of Notice to Proceed and concluding with date of final completion of Contract.

B. Baseline Schedule shall conform to requirements of the following Article, "Network Details and Graphical Output."

C. Acceptance of the Baseline Schedule by the ENGINEER is a condition precedent to making payments under Section 01294 after the first 90 calendar days after Notice to Proceed.

1.09 NETWORK DETAILS AND GRAPHICAL OUTPUT

A. Produce a clear, legible, and accurate calendar based, time scaled, graphical network diagram. Group activities related to the same physical areas of the Work.

B. Produce the network diagram based upon the early start of all activities. Include for each activity, the description, activity number, estimated duration in working days, total float and all activity relationship lines. Illustrate order and interdependence of activities and sequence in which Work is planned to be accomplished. Incorporate the basic concept of the precedence diagram network method to show how the start of one activity is dependent upon the start or completion of preceding activities and its completion restricts the start of following activities.

C. Indicate the critical path for the project.

D. Delineate the specified contract duration and identify the planned completion of the Work as a milestone. The time period between the planned and Contract completion dates, if any, shall be shown on the schedule as an activity identified as project float unless a Change Order is issued pursuant to Article 1.05H.

E. Identify system shutdown dates, system tie-in dates, specified interim completion or milestone dates and contract completion date as milestones. Include, in addition to Construction Activities:

F. Submission dates and review periods for major equipment submittals, shoring submittals, and proposals for allowance items.

G. Shoring Reviews: Allow 4-week review period for each shoring submittal.

H. Any activity by the OWNER or the ENGINEER that may affect progress or required completion dates.

I. Equipment and long-lead material deliveries over 8 weeks.

J. Approvals required by regulatory agencies or other third parties.

K. Produce network diagram on 22 inch by 34 inch sheets with grid coordinate system on the border of all sheets utilizing alpha and numeric designations. Identify the Execution of the following, omitting items not applicable to the Work:

1. Mobilization.
   a. All required submittals and submittal review times showing 30 calendar day duration for such activities and equal amount of time for re-submittal reviews.
   b. Equipment and materials procurement/fabrication/delivery.

2. Excavation.
   a. Shoring design and submission of detailed shoring submittals. Identify submission as a milestone.
   b. Shoring review, shoring materials procurement, shoring installation and shoring removal.
   c. Backfill and compaction.

3. Dewatering.
   a. Grading, subbase, base, paving, and curb and gutters.
   b. Fencing and landscaping.
   c. Concrete, including installation of forms and reinforcement, placement of concrete, curing, stripping, finishing and patching.
   d. Tests for leakage of concrete structures intended to hold water.

4. Masonry.

5. Metal fastenings, framing, structures, and fabrications.

6. Finish carpentry, architectural woodwork, and plastic fabrications.

7. Waterproofing and dampproofing, insulation, roofing and flashing, and sealants.

8. Doors and windows, including hardware and glazing.

9. Finishes including coating and painting, flooring, ceiling, and wall covering.

10. Building specialties including furnishings, laboratory equipment, and toilet and bath accessories.

11. Process equipment, including identification of ordering lead time, factory testing and installation.

12. Conveying equipment including hoists and cranes, conveyor systems, and materials handling equipment, including identification of ordering lead time and installation.

13. Other mechanical equipment including fans and heating, ventilating, and air conditioning equipment.

14. Trenching, pipe laying, and trench backfill and compaction.

15. Piping, fittings and appurtenances, including identification of ordering and fabrication lead time, layout, installation and testing.

16. Valves, gates and operators, including identification of order lead time installation and testing.

17. Plumbing specialties.

18. Electric transmission, service, and distribution equipment, including identification of ordering lead time, and factory testing.

19. Other electrical work including lighting, heating and cooling, and special systems, including identification of ordering lead time.

20. Instrumentation and controls, including identification of ordering lead time.

21. Preliminary testing of equipment, instrumentation and controls.

22. Final testing, including preparation time.

23. Seven-day operational test.

24. Substantial completion. Substantial completion activity shall meet all requirements set forth in Section 00800, Supplementary Conditions.

25. Punch list work.

26. Operation and maintenance training.

27. Demobilization.

1.10 SCHEDULE OF SHOP DRAWING AND SAMPLE SUBMITTALS

A. After Preliminary Schedule has been submitted and accepted by ENGINEER, CONTRACTOR shall submit a list of all shop drawings and sample submittals anticipated in first 90 calendar days after Notice to Proceed using early start dates. Submittal of this preliminary list shall be a condition precedent to making of progress payments during the first 90 calendar days after Notice to Proceed.

B. After Baseline Schedule has been submitted and accepted by ENGINEER, CONTRACTOR shall print out and submit list of all shop drawings and sample submittals for all Work using early start dates. This listing will contain all submittals required for the entire Work including those listed above. Submittal of final list shall be a condition precedent to making of progress payments after the first 90 calendar days after Notice to Proceed. These schedules shall conform to the requirements of the General Conditions, Article 2.05.

1.11 REVIEW AND ACCEPTANCE OF SCHEDULES

A. ENGINEER will review Baseline Schedules, Schedule Updates, Schedule Revisions and Time Impact Analyses to ascertain compliance with specified project constraints, compliance with milestone dates, reasonableness of durations and sequence, accurate inter-relationships and completeness.

B. ENGINEER will issue written comments following completion of review of Baseline Schedule within 21 calendar days after receipt. Written comments on review of Schedule Updates and Schedule Revisions and Time Impact Analyses will be returned to CONTRACTOR within 14 calendar days after receipt by ENGINEER.

C. Revise and resubmit schedule in accordance with ENGINEER's comments within 7 calendar days after receipt of such comments, or request joint meeting to resolve objections. If a meeting is requested the CONTRACTOR and all major subcontractors shall participate in the meeting with ENGINEER. Revise and resubmit schedule within 7 calendar days after meeting.

D. When schedule reflects ENGINEER's and CONTRACTOR's agreement of project approach and sequence, schedule will be accepted by ENGINEER. Use accepted schedule for planning, organizing and directing the work and for reporting progress.

E. Provide all items specified in Article 1.06, Submittal of Project Schedules.

1.12 UPDATING THE SCHEDULE

A. Update the schedule on a monthly basis, using a data date as specified by the ENGINEER. Since monthly Schedule Update is the application for progress payment required under Section 01294, Applications for Payment, submittal and acceptance of the monthly Schedule Update is a condition precedent to the making of any progress payments.

B. Should monthly Schedule Update show project completion earlier than current Contract completion date, CONTRACTOR shall show early completion time as schedule activity, identified as "Project Float."

C. Should monthly Schedule Update show project completion later than current Contract completion date, CONTRACTOR shall prepare and submit a Schedule Revision in accordance with Article 1.18, Revisions to Schedule.

1.13 REVISIONS TO SCHEDULE

A. Submit revised schedule within 5 calendar days:

1. When delay in completion of any activity or group of activities indicates an overrun of the Contract time or milestone dates by 20 working days or 5% of the remaining duration, whichever is less.

2. When delays in submittals, deliveries, or work stoppages are encountered making necessary the replanning or rescheduling of activities.

3. When the schedule does not represent the actual progress of activities.

4. When any change to the sequence of activities, the completion date for major portions of the work, or when changes occur which affect the critical path.

5. When Contract modification necessitates schedule revision, submit schedule analysis of change order work with cost proposal.

B. Submit revised schedule and materials as specified under Article, "Submittal of Progress Schedule."

C. Make revisions on most recently accepted version of schedule. Schedule Revisions shall not be prepared or submitted with Schedule Updates. They shall be separate submittals and shall be noted as Schedule Revisions. Only upon acceptance of a revision by the ENGINEER shall it be reflected in the next monthly Schedule Update.

D. Schedule Revisions submitted for the purpose of mitigating a CONTRACTOR caused project delay (Recovery Schedule) shall not be implemented until the ENGINEER reviews and accepts the Schedule Revision.

1.14 PAYMENT REQUESTS AND CASH FLOW

A. After Baseline Schedule has been submitted and accepted by the ENGINEER, the CONTRACTOR shall submit on a monthly basis, a tabular report showing anticipated earnings each month of the contract period. This tabulation will be based on the summation of the cost-loaded activities each month. CONTRACTOR shall submit an updated payment schedule each month showing actual earned amounts and anticipated remaining earnings.

B. Utilize cost loaded monthly Schedule Updates as the applications for payment specified in Section 01294, Applications for Payment. Payment application shall be a listing in Excel format of all schedule activities showing cost and percentage completion during the current month for which payment is sought. Submittal of the monthly Schedule Update shall be a condition precedent to the issuance of any payment under this Contract.

1.15 WEEKLY SCHEDULE

A. Submit to ENGINEER, on the last working day of every week, a progress schedule showing the activities completed during the previous week and the CONTRACTOR's schedule of activities for the following 2 weeks.

B. The Weekly Schedule may be a CPM schedule or a bar chart but shall utilize the logic and conform to the status of the current progress schedule. In the event that the Weekly Schedule no longer conforms to the current schedule CONTRACTOR may be required to revise the schedule in accordance with Article "REVISIONS TO SCHEDULE."

C. The activity designations used in the Weekly Schedule shall be consistent with those used in the Baseline Schedule and the monthly Schedule Updates.

D. The format of the Weekly Schedule shall be as agreed upon between the CONTRACTOR and the ENGINEER.

1.16 SCHEDULE OF VALUES

A. Requirements for Schedule of Values are specified in Section 01292, Schedule of Values and Paragraph "Cost Loading."

B. Submit, in conjunction with the Progress Schedule, a Schedule of Values identifying costs of all on-site construction activities as generated by the cost loaded schedule. Equate the aggregate of these costs to the Lump Sum Contract Price.

1.17 ADJUSTMENT OF CONTRACT TIMES

A. If the CONTRACTOR believes that the OWNER has impacted its work, such that the project completion date will be delayed, the CONTRACTOR must submit proof demonstrating the delay to the critical path. This proof, in the form of a Time Impact Analysis, may entitle the CONTRACTOR to an adjustment of contract time.

B. The Time Impact Analysis:

1. The Time Impact Analysis submitted by the CONTRACTOR shall utilize the accepted schedule update that is current relative to the time frame of the delay event (change order, third party delay, or other OWNER-caused delay). The CONTRACTOR shall represent the delay event in the schedule by 1) inserting new activities associated with the delay event into the schedule, 2) revising activity logic, or 3) revising activity durations.

2. If the project schedule's critical path and completion date are impacted as a result of adding this delay event to the schedule, a time extension equal to the magnitude of the impact may be warranted.

3. The Time Impact Analysis submittal shall consist of 1) a fragment of the portion of the schedule affected by the delay event, 2) a narrative explanation of the delay issue and how it impacted the schedule, and 3) a diskette containing the schedule file used to perform the Time Impact Analysis. When a delay to the project as a whole can be avoided by revising preferential sequencing or logic, and the CONTRACTOR chooses not to implement the revisions, the CONTRACTOR will be entitled to a time extension and no compensation for extended overhead.

4. Indicate clearly that the CONTRACTOR has used, in full, all project float available for the work involved in the request, including any float that may exist between the CONTRACTOR's planned completion date and the Contract completion date. Utilize the latest version of the Schedule Update accepted at the time of the alleged delay, and all other relevant information, to determine the adjustment of the contract time.

C. Float shall be for the mutual benefit of the OWNER and the CONTRACTOR. Adjustment of the Contract Times will be granted only when the Contract Float has been fully utilized and only when the revised date of completion of the Work has been pushed beyond the contract completion date. Adjustment of the Contract Times will be made only for the number of days that the planned completion of the work has been extended.

D. Actual delays in activities which do not affect the critical path work or which do not move the CONTRACTOR's planned completion date beyond the Contract completion date will not be the basis for an adjustment to the contract time.

E. The CONTRACTOR shall not be entitled to job-site or home office overhead beyond the CONTRACTOR's originally planned occupancy of the site if completion of the project occurs within the specified contract time.

F. Notify ENGINEER of a request for contract time adjustment. Submit request in accordance with ARTICLE 10 - CHANGES IN THE WORK; CLAIMS, of the General Conditions. In cases where the CONTRACTOR does not submit a request for contract time adjustment for a specific

change order, delay, or CONTRACTOR request within the specified period of time, then it is mutually agreed that the particular change order, delay, or CONTRACTOR request has no time impact on the Contract completion date and no time extension is required.

G. The ENGINEER will, within 30 calendar days after receipt of a contract time adjustment, request any supporting evidence, review the facts and advise the CONTRACTOR in writing.

H. The new Progress Schedule data, if accepted by the ENGINEER, shall be included in the next monthly Schedule Update.

1.18 FINAL SCHEDULE SUBMITTAL

A. As a condition precedent to the release of retainage the final Schedule Update shall be identified by the CONTRACTOR as the As-Built Schedule.

B. The As-Built Schedule shall reflect the exact manner in which the project was constructed by reflecting actual start and completion dates for all activities accomplished on the project.

C. The As-Built Schedule shall be signed and certified by the CONTRACTOR's Project Manager and scheduler as being an accurate record of the way in which the project was actually constructed.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01313

CONSTRUCTION AND SCHEDULE CONSTRAINTS

PART 1 GENERAL

1.01 THE REQUIREMENT

A. Work shall be scheduled, sequenced, and performed in a manner which minimizes disruption to the public and to the operation and maintenance of existing facilities along the pipeline alignments.

B. The CONTRACTOR shall perform the Work in compliance with project permits and agreements and in coordination with utility and other agencies and other contractors working in adjacent Project Areas. See Paragraph 1.07, below.

C. The CONTRACTOR shall incorporate the construction and schedule constraints of this Section in preparing the construction schedules required under Section 01311 –Construction Scheduling.

1.02 PROJECT CONSTRAINTS

A. Street Restrictions: Refer to Section 01571 – Traffic Control and the Contract Drawings traffic control drawings for requirements associated with work in arterial, collector, and minor streets.

B. Working Hours: Refer to Section 01571 – Traffic Control for requirements associated with work in arterial, collector, and minor streets. Working hours for Site locations not within street right-of-ways shall be limited to Monday through Friday, 7:00 a.m. to 6:00 p.m.

C. Noise Requirements: Refer to Section 01561 – Biological and Cultural Resources Environmental Controls including, but not limited to, Conditions of Approval – Item 78.

D. Dust Control: For dust mitigation requirements refer to Section 01562 – Dust Control and Section 01561 – Biological and Cultural Resources Environmental Controls including, but not limited to, Conditions of Approval – Item 76.

E. Mud Control: The CONTRACTOR shall perform its work to prevent mud on roads. Mud control shall include, but not be limited to, providing gravel pads at exits from areas where earthwork is being performed to enable mud removal and street sweeping and/or washing.

F. Air Emissions: For air emissions requirements refer to Section 01060 – Regulatory Agency and Utility Requirements including, but not limited to, Conditions of Approval – Items 35 through 40.

G. Environmental Constraints: For environmental constraints refer to Section 01561 – Biological and Cultural Resources Environmental Controls and the Contract Drawings.

H. Cultural Resources Constraints: For cultural resources constraints refer to Section 01561 – Biological and Cultural Resources Environmental Controls.

I. Interim Milestones: The Contractor shall conduct its construction activities to comply with the following interim milestones:

1. To facilitate the Work under this Contract, the contractors for pipeline installation packages shall complete all construction work at each individual pump station site by August 31, 2013. The contractors for the pipeline installation packages may coordinate with the Area Pump Station CONTRACTOR to continue to use the pump station wetwells for the conveyance of dewatering water to disposals sites until April 30, 2014. All site work, testing, and usage of facilities at the pump station sites must be completed by the contractors for the pipeline installation packages no later than April 30, 2014.

J. Existing Live Sanitary Sewers. Existing live sanitary sewers are present at various locations in the project, as shown on the Contract Drawings. These existing sewer systems discharge to existing community septic systems or to a package wastewater treatment plant. The CONTRACTOR shall plan and execute its work to ensure continued operation of these systems until their connection to the new sanitary sewer collection system when the new facilities are ready to receive flow.

K. Existing Septic Systems. The Los Osos community is currently served by septic systems. The great majority of septic systems are located on private property; however, leach fields and septic tanks themselves may be encountered within public right of way. Should the latter be encountered, the CONTRACTOR shall provide temporary piping around new pipelines to enable the septic system to continue to operate.

L. Sewer Laterals. Sanitary sewer laterals shall be extended to the property line and plugged in accordance with the detail provided in the contract drawings. Sewer laterals shall be installed at the location shown and shall not be moved at property owner request without prior ENGINEER approval. The ENGINEER will not allow property owners to connect to the lateral until the treatment plant and collection system are ready to receive flow and their upper lateral (private property section of lateral) has been inspected and accepted by the ENGINEER.

M. Collection System Use During Construction. The CONTRACTOR may elect to use portions of the collection system pipelines for conveyance and disposal of dewatering water. If so used, the CONTRACTOR shall thoroughly clean all facilities prior to acceptance by the ENGINEER. The CONTRACTOR shall provide its own temporary pumps and piping as needed to facilitate this use.

1.03 BYPASSING

A. Bypassing of untreated or partially treated sewage, including septic tank contents or effluent, to surface waters or drainage courses is prohibited during construction. In the event accidental bypassing is caused by the CONTRACTOR's operations, the ENGINEER shall immediately be entitled to employ others to stop the bypassing and costs incurred therefore (including any fines that might be levied by regulatory agencies) will be deducted from the CONTRACTOR's construction progress payments.

1.04 OUTAGE REQUESTS

A. Modifications to existing facilities, the construction of new facilities, and the connection of new to existing facilities may require the temporary outage or bypass of existing treatment processes or facilities. In such cases, the CONTRACTOR shall coordinate Work with the ENGINEER as

described below. The CONTRACTOR shall submit a detailed outage plan and time schedule for all construction activities which will make it necessary to remove a tank, pipeline, channel, electrical circuit, equipment, structure, road, or other facilities from service.

B. The outage plans shall be submitted to the ENGINEER for acceptance a minimum of 2 weeks in advance of the time that such outages are required. The outage plans shall be coordinated with the construction schedule and shall meet the restrictions and conditions of this Section. The outage plan shall describe the length of time required to complete the operation; any necessary temporary power, controls, instrumentation, or alarms required to maintain control, monitoring, and alarms for the affected processes; and the manpower, plant, and equipment which the CONTRACTOR shall provide in order to ensure proper operation of associated units. All costs for preparing and implementing the outage plans shall be the responsibility of the CONTRACTOR as part of the Work.

C. The Outage Request shall be accompanied by a contingency plan describing how to return facilities to operation should the Outage Request work not be able to be completed with the allotted time. The CONTRACTOR shall perform a "dry run" in advance of beginning Outage Request work to confirm that all necessary labor, equipment and materials are available to accomplish the Work.

D. The CONTRACTOR shall not begin an alteration affecting existing facilities until specific written approval has been granted by the ENGINEER in each case.

E. The ENGINEER will coordinate the CONTRACTOR's planned procedure with the affected facility personnel. The ENGINEER has the authority to modify any proposed shutdown procedures if such procedures would adversely impact operations.

F. The ENGINEER shall be notified in writing at least one week in advance of the required outage if the schedule for performing the work has changed or if revisions to the outage plan are required. The CONTRACTOR shall provide written confirmation of the shutdown date and time 2 working days prior to the actual shutdown.

1.05 TEMPORARY CONNECTIONS

A. The making of connections to existing facilities or other operations that interfere with the operation of the existing facilities shall be thoroughly planned in advance, and all required equipment, materials, and labor shall be on hand at the time of undertaking the connections. Work shall be completed as quickly as possible and with as little delay as possible, and shall proceed continuously (24 hours a day and seven days a week) if necessary to complete modifications and/or connections in the minimum time.

B. The cost of any temporary facilities and night, weekend, or holiday work and overtime payments required during process interruptions shall be included in the price of the Work.

C. Temporary piping shall be located to minimize interference with CONTRACTOR's construction facilities and OWNER's operation and maintenance existing facilities. Unless otherwise indicated, each temporary pipeline shall be of the same size as its connection to the existing or permanent facility at the downstream end of the pipeline. Piping materials shall be suitable for the material being conveyed and be as required in the Contract Specifications.

D. When temporary electrical power, controls, instrumentation, or alarms are required for routine continuous operations of existing or new equipment, the CONTRACTOR shall provide the necessary equipment and appurtenances. Prior to installing said equipment and appurtenances, CONTRACTOR shall furnish a submittal on the proposed components and installation for ENGINEER's review and approval.

E. A plan showing the size and location of the temporary facilities and piping shall be submitted to the ENGINEER at the same time as the outage plan required under this Section. All costs for design, provision, operation, and removal of temporary facilities and piping shall be the responsibility of the CONTRACTOR.

1.06 CONSTRUCTION SEQUENCING

A. All construction activities shall be scheduled and sequenced to ensure continuous operation of the existing facilities. The CONTRACTOR's scheduling shall develop all construction sequencing so that the work will not adversely impact operations. The CONTRACTOR shall be responsible for development of the construction sequencing.

1.07 PERMITS, AGREEMENTS AND COORDINATION

A. See Section 01060 – Regulatory Agency and Utility Requirements.

1.08 SCHEDULE CONSTRAINTS

A. General: It is the CONTRACTOR's responsibility to coordinate and plan the construction activities to integrate each schedule constraint into performance of the overall work.

B. The listing of schedule constraints in 1.02 does not mean that all constraints or special conditions have been identified. The list does not substitute for the CONTRACTOR's coordination and planning for completion of the Work within the Contract Times.

C. Refer to Paragraph 1.02 – Project Constraints for items that affect the construction schedule.

1.09 WORKING WITH THE PUBLIC

A. The project will be constructed in residential and business communities. It is essential that the CONTRACTOR conduct its work to minimize impacts on the public and businesses and that it communicates effectively with them. Also see Section 01566 – Public Information Program.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01322

WEB BASED CONSTRUCTION DOCUMENT MANAGEMENT (EADOC)

PART 1 GENERAL

1.01 DESCRIPTION

A. The CONTRACTOR, ENGINEER and DESIGNER shall use EADOC LLC's EADOC system for electronic submittal of all data and documents throughout the duration of the Contract. EADOC is a web-based electronic media site that is hosted by EADOC LLC. using their EADOC web solution. The EADOC system will be made available to all CONTRACTOR project personnel, subcontractor personnel and suppliers. The joint use of this system is to facilitate electronic exchange of information, automation of key processes, and overall management of the Contract. EADOC shall be the primary means of project information submission and management. Paper or hard copy documents will also be required as specified or as directed by the ENGINEER. In the event of discrepancy between the electronic version and paper documents, the paper documents will govern. EADOC is a registered trademark of EADOC LLC.

1.02 USER ACCESS LIMITATIONS

A. The ENGINEER will control the CONTRACTOR's access to EADOC by allowing access and assigning user profiles to accepted CONTRACTOR personnel. User profiles will define levels of access into the system; determine assigned function-based authorizations (determines what can be seen) and user privileges (determines what they can do). Sub-contractors and suppliers will be given access to EADOC through the CONTRACTOR. Entry of information exchanged and transferred between the CONTRACTOR and its sub-contractors and suppliers on EADOC shall be the responsibility of the CONTRACTOR.

B. Joint Ownership of Data - Data entered in a collaborative mode (entered with the intent to share as determined by permissions and workflows within the EADOC system) by the ENGINEER and the CONTRACTOR will be jointly owned.

1.03 AUTOMATED SYSTEM NOTIFICATION AND AUDIT LOG TRACKING

A. Review comments made (or lack thereof) by the ENGINEER on CONTRACTOR submitted documentation shall not relieve the CONTRACTOR from compliance with requirements of the Contract Documents. The CONTRACTOR is responsible for managing, tracking, and documenting the Work to comply with the requirements of the Contract Documents. ENGINEER’s acceptance via automated system notifications or audit logs extends only to the face value of the submitted documentation and does not constitute validation of the CONTRACTOR's submitted information.

1.04 SUBMITTALS

A. See Section 01300 SUBMITTALS.

B. Preconstruction Submittals:

1. List of CONTRACTOR's key EADOC personnel, include descriptions of key personnel's roles and responsibilities for this project. CONTRACTOR should also identify their organization's administrator on the list.

1.05 COMPUTER REQUIREMENTS

A. The CONTRACTOR shall use computer hardware and software that meets the requirements of the EADOC system as recommended by EADOC LLC. to access and use EADOC. As recommendations are modified by EADOC, the CONTRACTOR will upgrade their system(s) to meet the recommendations or better. Upgrading of the CONTRACTOR's computer systems will not be justification for a cost or time modification to the Contract. The contractor will ensure that connectivity to the EADOC system (whether at the home office or job site) is accomplished through DSL, cable, T-1, or wireless communications systems. The minimum bandwidth requirement for using the system is 128kb/s. It is recommended a faster connection be used when uploading pictures and files into the system.

B. EADOC currently supports Mozilla's Firefox v3.0-3.6, Apple's Safari V3.0-5.0, and Microsoft's Internet Explorer v7.0-8.0 web browsers for accessing the application.

1.06 CONTRACTOR RESPONSIBILITY

A. The CONTRACTOR shall be responsible for the validity of their information placed in EADOC and for the abilities of their personnel. Accepted users shall be knowledgeable in the use of computers, including Internet Browsers, email programs, cad drawing applications, and Adobe Portable Document Format (PDF) document distribution program. The CONTRACTOR shall use the existing forms in EADOC to the maximum extent possible. If a form does not exist in EADOC the CONTRACTOR must include a form of their own or provided by the ENGINEER as an attachment to a submittal. Adobe PDF documents will be created through electronic conversion rather than optically scanned whenever possible. The CONTRACTOR is responsible for the training of their personnel in the use of EADOC (outside what is provided by the ENGINEER) and the other programs indicated above as needed.

B. User Access Administration - Provide a list of CONTRACTOR's key EADOC personnel for the ENGINEER's acceptance. CONTRACTOR is responsible for adding and removing users from the system. The ENGINEER reserves the right to perform a security check on all potential users. The CONTRACTOR will be allowed to add additional personnel and sub contractors to EADOC.

1.07 CONNECTIVITY PROBLEMS

A. EADOC is a web-based environment and therefore subject to the inherent speed and connectivity problems of the Internet. The CONTRACTOR is responsible for its own connectivity to the Internet. EADOC response time is dependent on the CONTRACTOR's equipment, including processor speed, Internet access speed, etc. and current traffic on the Internet. The Owner will not be liable for any delays associated from the usage of EADOC including, but not limited to: slow response time, down time periods, connectivity problems, or loss of information.

B. The CONTRACTOR will ensure that connectivity to the EADOC system (whether at the home office or job site) is accomplished through DSL, cable, T-1, or wireless communications systems. The minimum bandwidth requirement for using the system is 128kb/s. It is recommended a faster connection be used when uploading pictures and files into the system. Under no circumstances shall the usage of the EADOC system be grounds for a time extension or cost adjustment to the Contract.

PART 2 PRODUCTS

2.01 DESCRIPTION

A. EADOC project management application (no equal). Provided by EADOC LLC www.EADOCsoftware.com

PART 3 EXECUTION

3.01 EADOC UTILIZATION

A. EADOC shall be used in connection with submittal preparation and information management required by the CONTRACT. Requirements of this Section are in addition to requirements of all other Sections of the CONTRACT.

B. Related Sections:

1. Section 01010 Summary of Work

2. Section 01046 Control of Work

3. Section 01170 Special Provisions

4. Section 01300 Submittals

5. Section 01311 Construction Scheduling

6. Section 01313 Construction and Schedule Constraints

C. Design Document Submittals

1. All design drawings and specifications shall be submitted as cad ".dwg" files or PDF attachments to the EADOC submittal work flow process and form.

D. Shop Drawings

1. Shop drawing and design data documents shall be submitted as cad ".dwg" files or PDF attachments to the EADOC submittal work flow process and form.

E. Product Data

1. Product catalog data and manufacturer's instructions shall be submitted as PDF attachments to the EADOC submittal work flow process and form.

F. Samples

1. Sample submittals shall be physically submitted as specified in Section 01300 SUBMITTALS. CONTRACTOR shall enter submittal data information into EADOC with a copy of the submittal form(s) attached to the sample.

G. Administrative Submittals

1. All correspondence and pre-construction submittals shall be submitted using EADOC.

H. Compliance Submittals

1. Test reports, certificates, and manufacture field report submittals shall be submitted on EADOC as PDF attachments.

I. Record and Closeout Submittals

1. Operation and maintenance data and closeout submittals shall be submitted on EADOC as PDF documents during the approval and review stage as specified, with actual set of documents submitted for final.

J. Financial Submittals

1. Schedule of Values, Pay Estimates and Change Request Proposals shall be submitted on EADOC. Supporting material for Pay Estimates and Change Requests shall be submitted on EADOC as PDF attachments.

END OF SECTION

SECTION 01381

AUDIO VIDEO TAPING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials and equipment to furnish color digital audio video taping of the project site as specified herein.

B. Furnish to the Owner an original and one copy of a continuous color digital audio video tape recording around the entire site. The recording shall be taken prior to any construction activity associated with this contract.

C. Furnish to the Owner an original and one copy of a continuous digital audio video tape recording of the Manufacturer's training sessions. CONTRACTOR shall be responsible for performing the video taping.

D. The Owner reserves the right to reject the digital audio video taping because of poor quality, unintelligible audio, or uncontrolled pan or zoom. Any taping rejected by the Owner shall be re-taped at no cost to the Owner. Under no circumstances shall construction begin until the Owner has received and accepted the pre-construction digital audio video tape(s).

E. The taping shall be performed by a qualified member of the CONTRACTOR's team that is knowledgeable in construction practices and experienced in the implementation of established inspection procedures.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 COLOR DIGITAL AUDIO VIDEO SURVEY

A. Furnish a continuous color digital audio video tape recording around the entire site and adjacent areas.

B. Coverage shall include, but not be limited to, all existing roadways, sidewalks, curbing, driveways, buildings and structures, above ground utilities, landscaping, trees, signage and other physical features located within the zone of influence of the construction. The coverage may be expanded if directed by ENGINEER.

C. All exterior taping will be done during daylight hours. No taping shall be performed if weather is not acceptable, such as rain, fog, etc. Lighting shall be provided as required.

3.02 AUDIO AND VIDEO

A. Audio video cassettes shall be professional grade video tapes, digital format.

B. Each tape shall begin with the OWNER's name, Contract name and number, CONTRACTOR's name, date and location information such as street name, direction of travel, viewing side, etc.

C. Information appearing on the tape must be continuous and run simultaneously by computer generated transparent digital information. No editing or overlaying of information at a later date will be acceptable.

D. Time must be accurate to within 1/10 of a second and continuously generated.

E. Engineering station numbers (where applicable) must be continuous, be accurate and correspond to project stationing. The symbols should be the standard engineering symbols (i.e., 16+64).

F. Written documentation must coincide with the information on the tape so as to make easy retrieval of locations sought for at a later date.

G. The video system shall have the capability to transfer individual frames of video electronically into hard copy prints or photographic negatives.

H. Audio shall be recorded at the same time as the video recording and shall have the same information as on the viewing screen. Special commentary will be given for unusual conditions of buildings, sidewalks and curbing, foundations, trees and shrubbery, etc.

I. All tapes shall be transferred to DVD.

J. All discs and boxes shall have labels with the following information:

1. Tape Number
2. OWNER's Name
3. Date of Taping
4. Project Name and Number
5. Location and Standing Limit of Tape
6. Discs shall be searchable by street name or intersection.

END OF SECTION

SECTION 01445

PIPELINE TESTING AND CLEANING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and test and clean all new pipelines installed under this Contract as specified herein.

B. Unless specified otherwise in individual Sections, the cleaning and testing of pipelines shall follow the requirements of this Section.

1.02 RELATED WORK

A. Buried pipelines are included in Division 2.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. Furnish all necessary equipment and labor for cleaning and testing the pipelines. The procedures and methods shall be approved by the ENGINEER.

B. Make any taps and furnish all necessary caps, plugs, etc., as required in conjunction with testing pipelines. Furnish a test pump, gauges and any other equipment required in conjunction with carrying out the hydrostatic tests.

3.02 CLEANING PIPELINES

A. As pipe laying progresses and at the conclusion of the work thoroughly clean all new pipelines by flushing with water or other means to remove all dirt, stones, pieces of wood or other material which may have entered during the construction period. If, after this cleaning, obstructions remain, they shall be removed.

3.03 TESTING PRESSURE PIPELINES

A. All pressure pipelines shall be pressure and leakage tested. Pipelines shall be subjected to a hydrostatic pressure of 50 percent above the normal operating pressure and this pressure maintained for at least 10 minutes. The leakage test shall be conducted at the maximum operating pressure as determined by the ENGINEER, and this pressure shall be maintained for at least two hours. The test pump and water supply shall be arranged to allow accurate measurement of the water required to maintain the test pressure. The amount of leakage which will be permitted shall be in accordance with AWWA C600.

3.04 TESTING GRAVITY PIPELINES

A. All gravity pipelines shall be tested for leakage by an infiltration or exfiltration test. Buried piping shall be tested by an infiltration test if the groundwater is more than 2-ft above the crown of the pipe for the full length of the section to be tested. Air testing may be used in lieu of an exfiltration test subject to approval of the ENGINEER.

B. Exfiltration Test

1. Leakage tests by exfiltration shall be made by creating a head in the pipeline to be tested by filling the line and either a manhole or temporary riser on one end of the line with water. The length of pipe to be tested shall be such that the head over the crown at the upstream end is not less than 2-ft and the head over the downstream crown is not more than 6-ft. The pipe shall be plugged by pneumatic bags or mechanical plugs in such a manner that the air can be released from the pipe while it is being filled with water. Before any measurements are made, the pipe shall be kept full of water long enough to allow absorption and the escape of any trapped air to take place. Following this, a test period of at least one hour shall begin. Provisions shall be made for measuring the amount of water required to maintain the water at a constant level during the test period.

2. If any joint shows an appreciable amount of leakage, the jointing material shall be removed and the joint repaired. If any pipe is defective, it shall be removed and replaced. If the quantity of water required to maintain a constant head in the pipe does not exceed 1.9 gallons per inch of diameter per day per 100-ft of pipe and if all the leakage is not confined to a few joints, workmanship shall be considered satisfactory.

C. Infiltration Test

1. Pipe shall be tested for infiltration after the backfill has been placed and the ground water allowed to return to normal elevation. The length of line to be tested shall be not less than the length between adjacent manholes and not more than the total length of each size of pipe. The allowable infiltration shall be 1.9 gallons per inch of diameter per day per 100-ft of pipe in each section tested. There shall be no gushing or spurting leaks.

2. If an inspection of the completed pipeline or any part thereof shows pipes or joints which allow noticeable infiltration of water, the defective work or material shall be replaced or repaired as directed.

3. Rates of infiltration shall be determined by means of V-notch weirs, pipe spigots, or by plugs in the end of the pipe installed in an approved manner and at such times and locations as may be directed by the ENGINEER.

D. When the pipeline to be tested is reinforced concrete pipe, the allowable leakage in the above tests shall be 4.7 gallons per inch of diameter per 100-ft of pipe.

E. Low Pressure Air Test

1. Low-pressure air tests shall be made with equipment specifically designed and manufactured for the purpose of testing pipelines using low-pressure air. The equipment shall be provided with an air regulator valve or air safety valve so set that the internal air pressure in the pipeline cannot exceed 8 psig. Pneumatic plugs shall have a sealing length

equal to or greater than the diameter of the pipe to be tested. All air used shall pass through a single control panel.

2. Install plugs at manholes. Brace plugs securely as required for safety and allow no one in the manholes while pressurizing the line or during the test.

3. Low-pressure air shall be introduced into the sealed line until the internal air pressure reaches 4 psig. The internal air pressure in the sealed line shall not be allowed to exceed 8 psig. At least 2 minutes shall be allowed for the air pressure to stabilize in the section under test. After the stabilization period, the low-pressure air supply hose shall be quickly disconnected from the control panel. The time required in minutes for the pressure in the section under test to decrease from 3.5 to 2.5 psig shall not be less than that shown in Table 1 of ASTM F1417.

4. If the pipe section does not pass the air test, sectionalize the section tested to determine the location of the leak. Once the leak has been located, repair and retest.

END OF SECTION

SECTION 01500

TEMPORARY FACILITIES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, equipment, materials, and incidentals necessary and provide separate temporary facilities for the CONTRACTOR's use as specified herein and as shown on the Drawings.

B. Operate and maintain temporary facilities for the duration of the project and as directed by the ENGINEER. All cost and use charges for temporary facilities shall be included in the Contract Price.

1.02 SUBMITTALS

A. Submit shop drawings and product data, in accordance with Section 01300, showing materials of construction and details of installation for:

1. Site Plan: Show the proposed locations for temporary facilities including offices, temporary utilities, storage containers/buildings, vehicle access and parking areas, material laydown and staging areas, temporary fencing, and other security measures.

2. CONTRACTOR's Field Office: Dimensioned floor plan, office systems, furnishings, and equipment.

3. Temporary Fence: Layout drawings which indicate dimensions, access to fire hydrants, gate locations and opening sizes, and other site specific requirements.

4. Project Sign: Layout, graphics, and wording.

B. Submittals shall be received by the ENGINEER no later than the date of the Preconstruction Meeting.

1.03 QUALITY ASSURANCE

A. Temporary facilities shall comply with all applicable state and local ordinances, codes and regulations.

B. Coordinate with authorities having jurisdiction to inspect (and test if required) temporary facilities.

C. Obtain all required permits for temporary facilities.

1.04 DEFINITIONS

A. Duration of the project: The period of time from the date of the Notice to Proceed to the date of Final Completion, inclusive.

1.05 CONTRACTOR USE OF CONSTRUCTION STAGING AREAS

A. The CONTRACTOR's use of the construction staging areas designated Figure 1 in this Section and on the Drawings shall be limited to its storage of materials and equipment, project component fabrication facilities, and field offices.

B. CONTRACTOR is advised that all construction staging areas designated on the final plans are located within or in close proximity to residential neighborhoods.

C. CONTRACTOR shall NOT use construction staging areas for:

1. Storage of vehicles or equipment not directly used for construction of the project.

2. Overnight camping or overnight accommodations for non-security personnel

3. Storage of motor fuel in excess of 5 gallons, unless in the onboard tank of engine driven equipment or self-propelled vehicle.

D. Equipment maintenance and materials fabrication in staging areas must be conducted during normal working hours in accordance with the Noise Abatement Requirements of Section 01060.

E. CONTRACTOR shall assume full responsibility for security of all its subcontractors materials and equipment stored at the construction staging areas.

F. If directed by the OWNER or ENGINEER, move any stored items which interfere with operations of OWNER or other contractors

G. Obtain and pay for use of additional construction staging, storage or equipment maintenance areas if needed to perform the Work.

H. Construction staging areas beyond those shown shall be identified on a site plan and submitted to the ENGINEER for review and approval. CONTRACTOR shall not utilize any additional area for construction staging without first obtaining approval from the ENGINEER.

I. CONTRACTOR shall submit a site plan for all construction staging and related areas, and all development associated with such areas. All areas within which construction staging are to take place shall be minimized to the maximum extent feasible in order to minimize impacts on resources (e.g., terrestrial habitat, wetlands, creeks, riparian areas, or other sensitive resource areas, etc.). All measures to be taken to minimize impacts associated with construction staging and related areas shall be identified on the site plan, including but not limited to screening, fencing, landscaping, signage, and designation of various activity and storage areas on the site.

J. Copies of the signed COASTAL DEVELOPMENT PERMIT shall be maintained in a conspicuous location at all construction staging areas at all times.

K. Use of any building or site in a residential area for field offices or related purposes not previously designated in the project's COASTAL DEVELOPMENT PERMIT, is prohibited.

PART 2 PRODUCTS

2.01 MATERIALS

A. Temporary Fence: Fabric shall be No. 9 gauge galvanized wire woven in 2-in diamond mesh with top and bottom twisted selvage. Intermediate and terminal posts shall be galvanized steel H or pipe, minimum 2-3/8-in OD line posts, 2-7/8-in OD corner and pull posts, and 1-5/8-in OD top rails.

B. Project Sign: Plywood shall be A-A EXT-APA grade, 1-in thick. Posts and braces shall be pressure treated lumber.

2.02 EQUIPMENT

A. Fire Extinguishers: Provide portable, UL-rated with class and extinguishing agent required by locations and classes of fire exposure. Provide at least one for each trailer/office.

B. Temporary Heat: Provide vented, self-contained, liquid propane gas or fuel oil heaters with individual space thermostatic control. Equipment shall be listed and labeled for type of fuel consumed and marked for intended use.

PART 3 EXECUTION

3.01 CONTRACTOR'S FIELD OFFICE

A. Provide a temporary field office(s) for the CONTRACTOR's use for the duration of the project. An authorized representative of the CONTRACTOR shall be present at all times while the WORK is in progress. Instructions received at the CONTRACTOR's field office from the ENGINEER shall be considered delivered to the CONTRACTOR.

B. Locate field office(s) in accordance with approved shop drawings and as directed by the OWNER.

C. Establish and occupy field office within 30 days of the Notice to Proceed, unless otherwise approved by the ENGINEER or OWNER.

3.02 TEMPORARY POWER AND LIGHT

A. CONTRACTOR shall furnish temporary light and power, including 220 Volt service for welding, complete with wiring, lamps and similar equipment as required to adequately light all work areas and with sufficient power capacity to meet the project needs. Make all necessary arrangements with the local electric company for temporary electric service and pay all expenses in connection therewith.

B. Provide connections to existing facilities sized to provide service required for power and lighting. CONTRACTOR shall pay the costs of power used.

C. Provide properly configured NEMA polarized outlets to prevent insertion of 110-120 Volt plugs into higher voltage outlets. For connection of power tools and equipment, provide outlets equipped with ground-fault circuit interrupters, reset button and pilot light.

D. Provide grounded extension cords. Use heavy duty cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if more than one length is required.

E. Provide general service incandescent lamps as required for adequate illumination. Provide guard cages or tempered glass enclosures where exposed to breakage. Provide exterior fixtures where exposed to moisture.

3.03 WEATHER PROTECTION

A. The CONTRACTOR shall furnish temporary heating units (UL or FM listed) to maintain reasonable temperatures within temporary enclosures.

3.04 TEMPORARY AIR AND WATER

A. The CONTRACTOR and each subcontractor shall provide all air and water including piping and appurtenances required for testing pipelines and equipment installed by them. Remove temporary piping and appurtenance on completion of testing.

3.05 SANITARY FACILITIES

A. Provide self-contained, single occupant toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed in a fiberglass or other approved non-absorbent shell.

3.06 CONSTRUCTION AIDS

A. Provide temporary elevators, hoists, cranes, scaffolding and platforms as necessary to perform the WORK. Provide temporary stairs where ladders are not adequate. Protect permanent stairs from damage from construction operations.

3.07 VEHICLE ACCESS AND PARKING

A. Provide temporary access roads, parking areas, traffic control devices and staging areas as approved by the ENGINEER and OWNER.

B. Provide minimum 12-ft by 24-ft by 6-in deep dense graded crushed stone or paved parking area adjacent to CONTRACTOR's field office for the duration of the project.

3.08 TEMPORARY FENCE

A. Provide temporary fence as specified herein, and as the CONTRACTOR requires for site security.

1. Provide 6-ft high chain link fence with at least two vehicle and two pedestrian access gates. Gates shall be equipped with locking hardware and padlocks. Furnish two sets of keys to OWNER. Coordinate with local first responders for access during non-work hours.

2. Fence installation shall comply with ASTM F567. Post spacing shall not exceed 8-ft on center. Posts shall be set plumb in concrete footings.

3. Perform daily inspections of fence and immediately repair or replace damaged or compromised sections and as directed by the ENGINEER.

3.09 WASTE MANAGEMENT

A. Provide covered dumpster, minimum 4-cubic yards, dedicated for field office waste. Provide separate covered dumpster of adequate size for construction debris. Empty dumpsters on a regular basis and as directed by the ENGINEER. Dumpsters shall not exceed their capacities at any time.

3.10 PROJECT SIGNS

A. Furnish and install the project signs indicated in the Contract Documents. Signs shall be placed as directed by the ENGINEER; and, shall remain maintained in good condition for the life of the construction period.

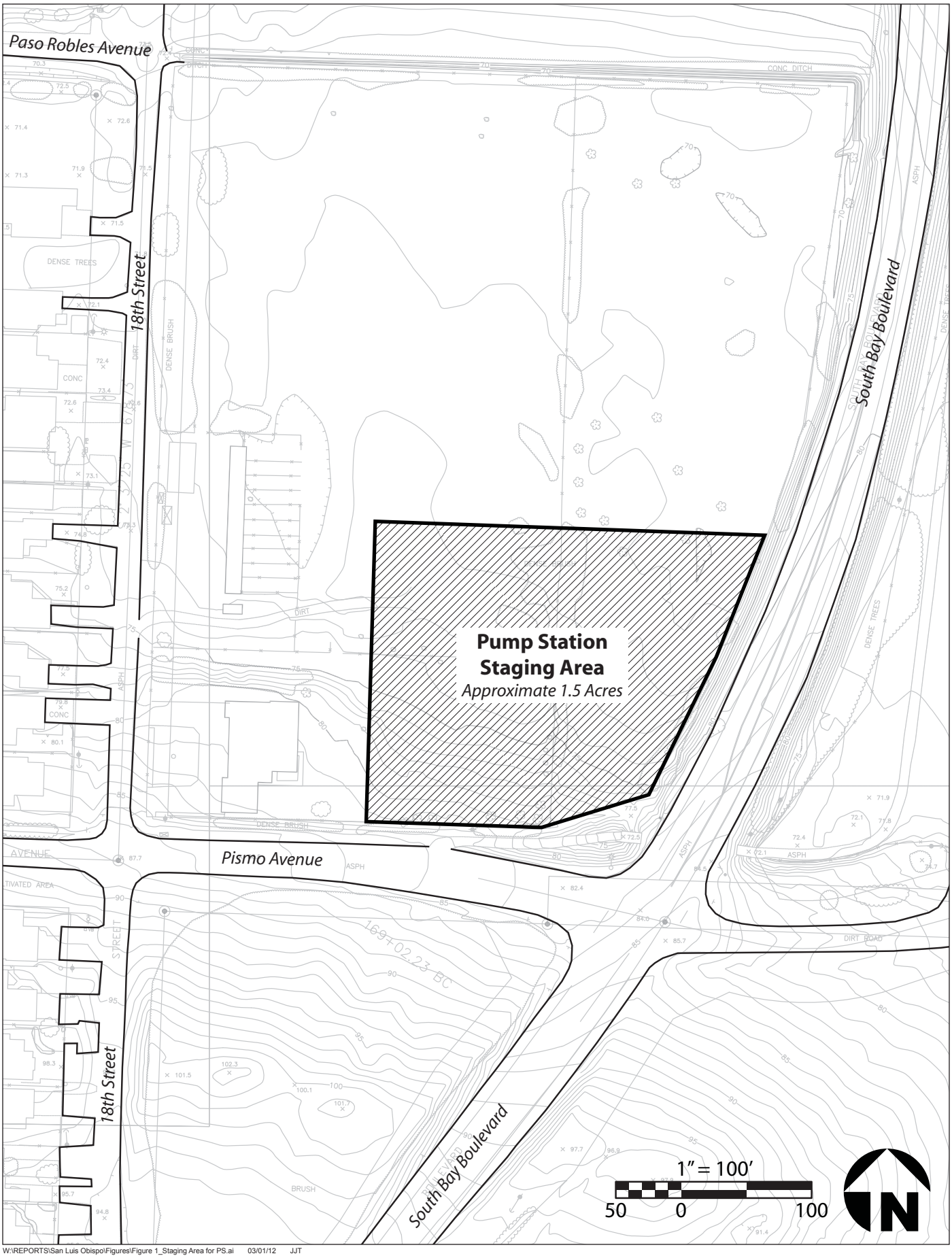
B. Remove signs at final acceptance, unless otherwise directed.

3.11 REMOVAL AND RESTORATION

A. Remove each temporary facility complete when need for its service has ended and as approved by the ENGINEER. Coordinate removal of temporary facilities with authorities having jurisdiction.

B. Restore all improvements damaged by the installation, operation, and removal of the temporary facilities. Obtain prior approval from OWNER and ENGINEER for restoration work. Comply with the restoration requirements of Section 01046.

END OF SECTION



W:\REPORTS\San Luis Obispo\Figures\Figure 1_Staging Area for PS.ai 03/01/12 JJT

CDM Smith

Figure 1
Staging Area for PS

SECTION 01561

BIOLOGICAL AND CULTURAL RESOURCES ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.01 BIOLOGICAL RESOURCES

A. The CONTRACTOR shall conform to the Conditions of Approval for the California Coastal Commission, Coastal Development Permit CDP A-3-SLO-09-055/069 (appended to these Specifications). The CONTRACTOR's attention is also directed to the Final Environmental Impact Report (EIR) for the Los Osos Wastewater Project Report dated March 2009 (EIR is located at http://www.slocounty.ca.gov/PW/LOWWP/DOCS/Environmental_Documents/Final_EIR_1_0.htm).

B. The CONTRACTOR shall conform to the applicable requirements of the Federal Endangered Species Act and California Environmental Species Act as it relates to the protection of threatened and endangered species and special status species, see Biological Opinion (appended to these Specifications)

C. The CONTRACTOR's onsite personnel shall participate in an environmental awareness training session provided by OWNER's Environmental Monitor and adhere to guidelines and directions provided in the session.

D. The CONTRACTOR's attention is directed to Environmental Resource Drawings included in Contract Drawings, General Drawings for locations of sensitive biological resources within the Project area.

E. The CONTRACTOR shall adhere to OWNER protocol concerning Special-Status Species outlined in Part 3 Section 3.01.

F. The CONTRACTOR shall identify a Project Liaison to consult with OWNER's Environmental Monitors during construction.

1.02 CULTURAL RESOURCES

A. The CONTRACTOR shall conform to the applicable requirements of the National Historic Preservation Act of 1966 (16 U.S.C. 470) and 36 CFR 800, which provides for the preservation of potential historical architectural, archaeological, or cultural resources (hereinafter called "cultural resources").

B. The CONTRACTOR shall conform to the applicable requirements of Historic Resources Evaluation and Treatment Plan prepared by Far Western Anthropological Research Group Inc., March 2010 (available prior to construction) by the State Historic Preservation Office (Condition 28).

C. The CONTRACTOR shall conform to the applicable requirements of the National Historic Preservation Act of 1966 as it relates to the preservation of cultural resources. The entire Project Area as described in the Cultural Resources Treatment Plan shall be considered an area

of archaeological sensitivity and the CONTRACTOR shall assume that all areas of subsurface construction have a high likelihood of encountering significant archaeological resources. (Condition 73)

D. The CONTRACTOR shall adhere to OWNER protocol concerning Archaeological Resources outlined in Part 3 Section 3.02.

E. The CONTRACTOR's onsite personnel shall participate in an environmental awareness training session provided by OWNER's Environmental Archaeological Monitor and adhere to guidelines and directions provided in the session.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 SPECIFIC BIOLOGICAL RESOURCES REQUIREMENTS

A. The CONTRACTOR shall attend a meeting prior to construction that will describe in detail the protocol and CONTRACTOR responsibilities concerning sensitive species. The OWNER's Environmental Monitor will advise the CONTRACTOR if the protocol changes as more information is received and project permits from the US Fish and Wildlife Service are obtained.

General conditions of the protocol are:

1. CONTRACTOR shall attend a pre-construction meeting to review the protocol.

2. All CONTRACTOR workers shall attend pre-construction biological training session and be able to recognize sensitive species and understand and employ proper protocol if any are encountered.

3. The CONTRACTOR shall obtain approval from the OWNER or OWNER's Environmental Monitor in advance of construction for activity areas in vegetated, sandy or otherwise unimproved portions of the construction area including areas of proposed disturbance, equipment storage, stockpiles and access roads and areas. The CONTRACTOR shall consult with the OWNER's Environmental Monitor prior to removal of vegetation.

4. The CONTRACTOR shall submit a schedule to the OWNER or OWNER's Environmental Monitor at least four weeks prior to construction. The schedule shall indicate proposed construction dates and locations. The CONTRACTOR shall provide written weekly updates on construction progress to the ENGINEER and OWNER's Environmental Monitor.

5. The CONTRACTOR shall post signs in neighborhoods where construction equipment and/or activities would obstruct travel at least one week prior to start of construction. The CONTRACTOR shall identify alternate access in consultation with the OWNER and/or OWNER's Environmental Monitor in accordance with a construction traffic mitigation program. The OWNER shall provide signs to the CONTRACTOR at least two weeks prior to start of construction.

6. The OWNER or the OWNER's Environmental Monitor shall conduct pre-construction surveys of construction areas and/or materials stockpiles in sensitive areas including but not limited to coastal scrub, wetlands and chaparral where required. Refer to Environmental Resource Drawings included in Contract Drawings, General Drawings, and Appendix Drawings for general locations of sensitive areas. The CONTRACTOR shall be responsible for following the OWNER's Environmental Monitor's recommendations that include but are not limited to limiting access to an area, limiting disturbance of an area, suggest alternate routing or areas for materials stockpiling and limiting activity to designated access routes and construction areas.

7. The CONTRACTOR shall temporarily halt construction on an unimproved right-of-way or in vegetated areas during rainy or foggy weather at the direction of the OWNER or OWNER's Environmental Monitor..

8. The CONTRACTOR shall not bring road base or other materials for deposition onto sandy areas of the construction areas, roads or stockpile areas until approved by the OWNER and/or the OWNER's Environmental Monitor.

9. CONTRACTOR shall clearly mark construction areas with high visibility flagging or fencing. Construction equipment and personnel will be restricted to the marked areas.

B. WINTERING MONARCH BUTTERFLY ROOST SITES. The ENGINEER will provide a map to the CONTRACTOR prior to construction outlining potential wintering monarch butterfly roost sites based upon preconstruction surveys conducted during the months of October to February within 500 feet of the Broderson construction site, and on Rosina Avenue and Pecho Road. The OWNER's Environmental Monitor shall fence these potential roost sites and avoid disturbance of these areas if butterflies are present. The CONTRACTOR shall be responsible for any damage to these fenced areas resulting from physical disturbance and/or dust originating from its operations. The CONTRACTOR's responsibility to protect these fenced areas shall be continued until the CONTRACTOR is relieved of further responsibility by the ENGINEER. Refer to Environmental Drawings included in Contract Drawings, General Drawings, and Appended Drawings for preliminary locations. (Condition 58)

C. MORRO SHOULDERBAND SNAIL MONITORING. The ENGINEER will provide to the CONTRACTOR a map showing the location of habitats for the Morro shoulderband snail on or within the Project Area. The OWNER's Environmental Monitor shall monitor all construction activities that will take place within suitable habitat for the Morro shoulderband snail. Monitoring activities shall be required daily until completion of initial disturbance at each construction area. The OWNER's Environmental Monitor shall be granted full authority to stop work at his or her discretion. The OWNER's Environmental Monitor shall be responsible for implementing avoidance and minimization measures during construction. The OWNER's Environmental Monitor shall stop work if project-related activities occur outside the demarcated boundaries of the construction footprint. The OWNER's Environmental Monitor shall stop work if any Morro shoulderband snails are detected within the proposed construction footprint, and shall implement measures to relocate them to suitable habitat out of harm's way prior to construction activities resuming. If no suitable habitat opportunities are available in the immediate vicinity of the construction footprint, salvaged and relocated specimens may also be transported to an offsite location approved by the USFWS. (Condition 63)

D. CALIFORNIA RED-LEGGED FROG MONITORING. The OWNER's Environmental Monitor shall be present at the active work sites until such time that the initial survey for California red-legged frogs, instruction of workers, and (upland) habitat disturbance have been completed. After this time, the CONTRACTOR shall designate a qualified person to monitor on-site compliance with all minimization measures. The OWNER's Environmental Monitor shall ensure that this individual receives appropriate training as to the identification of frogs, potential hazards to the species, inappropriate and allowable work monitor on-site compliance with all minimization measures. The OWNER's Environmental Monitor shall ensure that this individual receives appropriate training as to the identification of frogs, potential hazards to the species, inappropriate and allowable work activities, and appropriate contacts for immediate, professional biological support.

During work activities, all trash that may attract predators shall be properly contained, removed from the work site and disposed of regularly. Following construction, all trash and construction debris shall be removed from work areas. All fueling and maintenance of vehicles and other equipment and staging areas shall occur a minimum of 100 feet from all open water, stream, wetland, and riparian habitat. The CONTRACTOR shall ensure that contamination of habitat does not occur during such operations. (Condition 64)

Prior to the onset of work near any riparian habitat, the CONTRACTOR shall prepare and submit a plan to the ENGINEER for prompt and effective response to any accidental spills.

E. NESTING BIRD SURVEY. The ENGINEER will provide to the CONTRACTOR a map showing the location of nest trees and other areas where nesting birds or species protected by State and/or Federal laws are present on or within the Project Area. The areas will be identified during preconstruction surveys (February through August) and also possibly during winter surveys. All potentially suitable nesting trees identified will be removed prior to or after the breeding season as feasible. The nest trees and areas identified in the spring and early summer preconstruction surveys will be fenced or otherwise demarcated by the OWNER's Environmental Monitor and a 250-foot non-disturbance buffer or a buffer area will be established. This no-disturbance buffer will be established until the nesting activity is completed and young have fledged, CONTRACTOR is responsible to ensure construction activities do not encroach upon the buffer area. Construction in the area of the buffer and nest trees will be allowed to resume only after nesting activities have been completed as indicated by the OWNER's Environmental Monitor. (Condition 69)

F. NESTING RAPTOR survey. The ENGINEER will provide to the CONTRACTOR a map showing the location of nest trees and other areas where nesting raptors or species protected by State and/or Federal laws are present on or within the Project Area. The areas will be identified during preconstruction surveys (February through August) and also possibly during winter surveys. All potentially suitable nesting trees identified will be removed prior to or after the breeding season as feasible. The nest trees and areas identified in the spring and early summer preconstruction surveys will be fenced or otherwise demarcated by the OWNER's Environmental Monitor and a 500-foot non-disturbance buffer or a buffer area will be established. This no-disturbance buffer will be established until the nesting activity is completed and young have fledged, CONTRACTOR is responsible to ensure construction activities do not encroach upon the buffer area. Construction in the area of the buffer and nest trees will be allowed to resume only after nesting activities have been completed as indicated by the OWNER's Environmental Monitor. (Condition 70)

G. RELOCATION OF SENSITIVE SPECIES. Prior to construction the CONTRACTOR shall provide access and allow adequate time for the OWNER's Environmental Monitors to remove as many Morro shouldered snails as practicable from any area of proposed disturbance. (Condition 63)

H. CONTROL OF INVASIVE EXOTIC PLANTS. To control introduction of invasive exotic plants on site, the CONTRACTOR shall implement the following measures during construction and incorporate into the design guidelines of the proposed percolation fields, as appropriate.

1. Use only clean fill material (free of weed seeds) within the construction zone of the proposed project.

2. Thoroughly clean all construction equipment prior to being moved onto and used at the site.

3. Prohibit planting or seeding of disturbed areas with nonnative plant species.

4. Control the establishment of invasive exotic weeds in all disturbed areas. Remove existing stands of invasive exotic plants, including but not limited to veldt grass, pampas grass and ice plants, in order to limit their spread.. (Condition 81)

I. WORKER EDUCATION PROGRAM. The OWNER's Environmental Monitor shall provide construction personnel specific instruction on general detection and avoidance of sensitive resources during construction. The worker education program shall include: descriptions and pictures of listed species; the provisions of the Endangered Species Act; those specific measures being implemented to avoid and minimize take or impacts to listed or otherwise sensitive species (e.g. conserve listed and sensitive species as they relate to the project); and the project boundaries within which the work will occur. (Condition 68)

J. LOS OSOS CREEK ENVIRONMENTAL REQUIREMENTS. All construction activities across Los Osos Creek shall be restricted to low-flow periods of June 15 through November 1. Construction work must be conducted when Los Osos Creek is dry, and can occur as early as June 1. Restricting construction activities to this work window will minimize impacts to migrating adult and smolt steelhead, if present. The OWNER's Environmental Monitor shall be on site during all stream crossing activities associated with Los Osos Creek. The OWNER's Environmental Monitor will be authorized to halt construction if impacts to steelhead are evident. Prior to construction, a spill prevention plan for potentially hazardous materials shall be prepared by the CONTRACTOR and implemented. The plan shall include the proper handling and storage of all potentially hazardous materials, as well as the proper procedures for cleaning up and reporting of any spills. If necessary, containment berms shall be constructed to prevent spilled materials from reaching the creek channel. CONTRACTOR to provide specific construction methodology to ENGINEER for permit evaluation. Allow up to six (6) months for OWNER to obtain environmental permits.

Prior to construction, silt fencing shall be installed in all areas where construction occurs within 100 feet of known or potential steelhead habitat. All silt fencing, erosion control and landscaping specifications shall only include natural fiber, biodegradable products for meshes and coir rolls to minimize impacts to species and the environment during use.

During construction, spoil sites shall be restricted to upland locations so they do not drain directly into Los Osos Creek. If a spoil site drains into a water body, catch basins shall be

constructed to intercept sediment before it reaches the channels. If required, spoil sites shall be graded to reduce the potential for erosion.

During construction, equipment and materials shall be stored at least 50 feet from Los Osos Creek. No debris such as trash and spoils shall be deposited within 100 feet of waterways. Staging and storage areas for equipment, materials, fuels, lubricants and solvents, shall be restricted to locations outside of the stream channel and banks. Stationary equipment such as motors, pumps, generators, compressors and welders, located within or adjacent to the stream shall be positioned over drip pans at all times. Any equipment or vehicles driven and/or operated within or adjacent to the stream shall be checked and maintained daily to prevent leaks of materials that if introduced to water could be deleterious to aquatic life. Vehicles shall be moved away from the stream prior to refueling and lubrication.

During construction, proper and timely maintenance for all vehicles and equipment used shall be provided to reduce the potential for mechanical breakdowns leading to a spill of materials into or around the creek. Maintenance and fueling shall be restricted to safe areas away from Los Osos Creek that meet the criteria set forth in the spill prevention plan.

Immediately following construction, all construction work areas shall be restored to preconstruction channel conditions, including streambed composition, compaction, and gradient. If required, channel banks shall be returned to original grade slope and appropriate bank stabilization techniques shall be implemented to reduce the potential for erosion and sedimentation. A plan describing pre-project conditions and restoration methods shall be prepared prior to construction by the CONTRACTOR.

Immediately following construction, all appropriate construction work areas will be re-vegetated with an appropriate assemblage of native upland vegetation, and if necessary, riparian vegetation, suitable for the area. A plan describing pre-project conditions, restoration and monitoring success criteria shall be prepared prior to construction by the CONTRACTOR and submitted to the ENGINEER for approval. (Condition 82)

3.02 SPECIFIC CULTURAL RESOURCES REQUIREMENTS

A. The CONTRACTOR shall provide a construction plan and schedule to the ENGINEER who shall provide the plan to the OWNER's Archaeological Environmental Monitor for development of the cultural resources monitoring schedule.

B. In the event potential cultural resources are discovered during subsurface excavations at the site of construction (Condition 28), the following procedures shall be instituted:

1. The OWNER's Archaeological Environmental Monitor will inform the ENGINEER of the find and the ENGINEER will issue a Field Order directing the CONTRACTOR to cease all construction operations at the location of such potential cultural resources find.

2. Such Field Order shall be effective until such time as the OWNER's Archaeological Monitor assesses the significance of these potential cultural resources and make recommendations to the State Historic Preservation Office.

C. In the event human remains are discovered during subsurface excavations at the site of construction (Condition 73), the following procedures shall be instituted:

1. The CONTRACTOR shall stop work. The OWNER's Archaeological Environmental Monitor will inform the ENGINEER of the find and the ENGINEER shall issue a Field Order directing the CONTRACTOR to cease all construction operations at the location of the human remain.

2. Such Field Order shall be effective until such time as the Archaeological Environmental Monitor consults with the County Coroner and provisions in the California Public Resources Code (Section 5097.98 and 5097.99 and Health and Safety Code Section 7050.5, as amended by Assembly Bill 2641) are completed and if Native American Remains are found, recommendations of the Most Likely Descendent as designated by the Native American Heritage Commission are completed.

D. If the OWNER's Archaeological Environmental Monitor determines that the potential find is a bona fide cultural resource, at the direction of the OWNER's Archaeological Monitor and State Historic Preservation Office, or a human remain at the direction of the Coroner or Native American Heritage Commission, the CONTRACTOR shall suspend work at the location of the find. The CONTRACTOR shall resume work upon direction of the OWNER and/or Archaeological Environmental Monitor.

E. Preemptive Backhoeing – In the areas noted on the Archaeological Sensitivity Map (appended) CONTRACTOR shall remove asphalt and carefully excavate the trench section to a depth up to 4 feet at the direction of Archaeological Environmental Monitor to allow Archaeological Environmental Monitor to conduct a survey of the materials that are carefully excavated prior to the CONTRACTOR's normal operations of installing the pipelines. CONTRACTOR shall coordinate with ENGINEER and Archaeological Environmental Monitor to develop a schedule for the preemptive backhoeing excavations. CONTRACTOR's preemptive backhoeing work and coordination with the Archaeological Environmental Monitor in the areas shown on the Archaeological Sensitivity Map shall be considered incidental to the work and no additional payment will be allowed therefore.

F. Pre-excavation Archaeological Surveys – CONTRACTOR shall saw cut, remove and dispose of asphalt pavement to allow Archaeological Environmental Monitor to conduct site surveys for a period of up to 10 days at the locations shown on plan sheets A-PP-181 and A-PP-183. The CONTRACTOR shall incorporate the survey time into the Construction Schedule, shall provide trench plates over trench at end of each work day, and shall provide traffic control during survey period. CONTRACTOR's coordination with the Archaeological Environmental Monitor for Pre-excavation Archaeological Surveys shall be considered incidental to the work and no additional payment will be allowed therefore.

END OF SECTION

SECTION 01562

DUST CONTROL

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Perform dust control operations, in an approved manner, whenever necessary or when directed by the ENGINEER, even though other work on the project may be suspended. Dust control shall be generally accomplished by the use of water; however, the use of calcium chloride may be used when necessary as approved by ENGINEER to control dust nuisance.

B. Calcium chloride shall conform to AASHTO M144, Type I except the requirements for "total alkali chlorides" and other impurities shall not apply.

C. Methods of controlling dust shall meet all air pollutant standards as set forth by Federal and State regulatory agencies, and in compliance with the Coastal Development Permit.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 SPECIFIC REQUIREMENTS

A. Reduce the amount of the disturbed area where possible,

B. Use water trucks or sprinkler systems in sufficient quantities to prevent airborne dust from leaving the site. Increased watering frequency will be required whenever wind speeds exceed 15 mph. Dewatering water should be used whenever possible.

C. All dirt stockpile areas will be sprayed daily as needed,

D. Permanent dust control measures identified in the re-vegetation and landscape plans will be implemented as soon as possible following completion of any soil disturbing activities.

E. Exposed ground areas that are planned to be reworked at dates greater than one month after initial grading will be covered with fiber, mulch, mats or other erosion control material.

F. All disturbed soil areas not subject to revegetation will be stabilized using approved chemical soil binders, jute netting, or other methods approved in advance by the APCD. Any erosion and sedimentation control netting or other erosion and sedimentation control devises used for temporary or permanent erosion and sedimentation control, shall be limited to biodegradable mesh or other biodegradable products.

G. All roadways, driveways, sidewalks, etc. to be paved will be completed as soon as possible. In addition, building pads will be laid as soon as possible after grading unless seeding or soil binders are used.

H. Vehicle speed for all construction vehicles will not exceed 15 mph on any unpaved surface at the construction site.

I. All trucks hauling dirt, sand, soil, or other loose materials are to be covered or will maintain at least two feet of freeboard (minimum vertical distance between top of load and top of trailer) in accordance with CVC Section 23114.

J. Install wheel washers where vehicles enter and exit unpaved roads onto streets, or wash off trucks and equipment leaving the site.

K. Sweep streets at the end of each day if visible soil material is carried onto adjacent paved roads. Water sweepers with reclaimed water should be used where feasible.

L. If visible emissions of fugitive dust persist beyond a distance of 200 feet from the boundary of the construction site, all feasible measures shall be implemented to eliminate potential nuisance conditions at off-site receptors (e.g., increase frequency of watering or dust suppression, install temporary wind breaks where appropriate, suspend excavation and grading activity when winds exceed 25 mph).

M. The CONTRACTOR will designate a person or persons to monitor the dust control program and to order increased watering, as necessary, to prevent transport of dust offsite. Their duties will include holidays and weekend periods when work may not be in progress. The name and telephone number of such persons will be provided to the SLOAPCD prior to the start of construction.

N. If the above mitigation measure do not bring the construction emissions below the thresholds, the ENGINEER reserves the right to assess damages to the CONTRACTOR to secure emission reductions from other projects in close proximity to the construction site.

END OF SECTION

SECTION 01566

PUBLIC INFORMATION PROGRAM

PART 1 GENERAL

1.01 THE REQUIREMENT

A. The OWNER has committed to provide useful information regarding the Project to the public on a regular and timely basis.

B. The CONTRACTOR shall support the public information program and conform to its requirements.

1.02 PUBLIC INFORMATION PROGRAM

A. The ENGINEER shall develop a comprehensive public information program for the construction phase of the Project. The program shall include the following components.

1. Community outreach

2. Communication with the public

3. Media relations.

1.03 PROGRAM OBJECTIVES

A. The Public Information Program shall include following communications objectives.

1. Ensure the public receives timely information regarding construction activity.

2. Establish policies and procedures to ensure proper communications during unexpected or emergency situations.

3. Establish policies and procedures to collect, document and respond to all Project related questions, concerns or other inquiries.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 CONTRACTOR RESPONSIBILITIES

A. The CONTRACTOR shall provide the following services.

1. The CONTRACTOR shall support the public information program and provide information regarding its construction activities to the ENGINEER.

2. The CONTRACTOR shall refer any and all inquiries from the public, media, and all others to the ENGINEER's designated Community Liaison. The Community Liaison shall serve as the single point of contact for all public inquiries, complaints, and disputes, and for contact with and statements to the press.

3. The CONTRACTOR shall be required to place door hanger notices provided by the ENGINEER at each residence and business a minimum of 72 hours in advance of any ground disturbing construction activities. Door hangers shall not be placed in mail boxes. This work shall be under the control of the Contractor and subject to Section 00700 Article 12.03 E.

END OF SECTION

SECTION 01570

STORM WATER POLLUTION PREVENTION PLAN

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The CONTRACTOR shall implement a site-specific Storm Water Pollution Prevention Plan (SWPPP) for this Project pursuant to the requirements of the National Pollution Discharge Elimination System (NPDES) General Permit [Order No. 2009-0009-DWQ] for Storm Water Discharges Associated with Construction and Land Disturbance Activities (General Permit). CONTRACTOR shall implement the SWPPP as shown and as specified by the document in Appendix C to these Specifications prior to start of construction and shall amend the SWPPP as necessary to ensure compliance. The CONTRACTOR shall submit an amended SWPPP to the ENGINEER for review, acceptance, and forwarding to other County and/or regulatory agencies, as appropriate as, no later as 30 days after NTP.

B. The project has been assigned a Risk Level Type 2 LUP (LUP2). The water quality sampling points necessary for the compliance with the risk based system shall be as shown or as amended and approved. CONTRACTOR will be fully responsible for compliance with, execution and implementation of the SWPPP.

C. The CONTRACTOR will provide both a Qualified SWPPP Developer (QSD) and a Qualified SWPPP Practitioner (QSP) for this Project. The QSD and QSP shall both meet the requirements listed in section 1.05 below.

D. The CONTRACTOR shall perform all necessary erosion control and storm water management measures in compliance with all federal, state and local requirements for erosion control and pollution prevention, including all requirements set forth in the SWPPP. Requirements for erosion control and disposal of surface water during construction may include, but are not limited to, conducting a sampling, monitoring and reporting program, construction of sedimentation ponds, ditches, culverts, silt fences, straw wattles, pumping, draining and other measures required for the removal or exclusion of water from the excavations, stockpile, and other incidental work areas.

E. The CONTRACTOR QSP shall conduct the water quality monitoring, sampling, analysis, and reporting program required by the General Permit. This program includes a minimum of 3 samples per day at each discharge location, including characterization for a minimum, but not limited to, turbidity, pH, and suspended sediment concentrations. The sampling program will be governed by the project's risk level, LUP2, in accordance with the General Permit, the CONTRACTOR shall ensure that all storm water sample collection preservation and handling requirements are in accordance with the "Storm Water Sample Collection and Handling Instructions" and the General Permit.

F. The CONTRACTOR QSP shall ensure that photographs of the site are taken before, during, and after storm events during inspections, and submitted through the State Water Board's SMARTS website once every three rain events.

G. The CONTRACTOR QSP shall conduct daily inspections and observations during working hours or in after hour emergency storm events and at least once each 24-hour period during extended storm events. CONTRACTOR QSP shall conduct visual inspections to identify and record BMPs that need maintenance to operate effectively, that have failed, or that could fail to operate as intended and correct any deficiencies within a 24 hours time period.

H. The CONTRACTOR shall install a rain gauge on-site at an accessible and secure location with readings made during all rainfall events. When readings are unavailable, data from the closest rain gauges may be used for nearby sites for example as listed in these links (http://cdec.water.ca.gov/cgiprogs/staMeta?station_id=lso) or other data as approved by the ENGINEER.

I. The CONTRACTOR QSD shall develop and implement Rain Event Action Plans (REAP) designed to protect all exposed portions of their sites within 48 hours prior to any likely precipitation event in accordance with the General Permit.

J. CONTRACTOR will be fully responsible for compliance with, execution and implementation of the SWPPP and all related requirements, including any fines or penalties assessed for non-compliance of the General Permit.

K. All work included in this Section and necessary to comply with the General Permit is deemed incidental work and shall be included in CONTRACTOR's Total Bid Price.

1.02 RELATED SECTIONS

A. Document APPENDIX: Permits and Agreements to be obtained by the OWNER

B. Section 01060: Environmental Requirements

C. Section 01300: Submittal Requirements

D. Section 01500: Temporary Facilities

E. Section 02270: Erosion and Sedimentation Control

F. Section 02140: Dewatering

G. Section 02200: Earthwork

1.03 REFERENCES

A. National Pollution Discharge Elimination System (NPDES) General Permit [Order No. 2009-0009-DWQ] for Storm Water Discharges Associated with Construction and Land Disturbance Activities

B. Project Environmental Impact Report.

C. SWPPP, Section 01570/APPENDIX XX.

1.04 REGULATORY REQUIREMENTS

A. The Clean Water Act (CWA), as amended in 1972, prohibits the discharge of pollutants into the waters of the United States from storm water. No debris, soil, ash, silt, sand, cement or concrete, or washing thereof, oil or petroleum products or other organic materials from CONTRACTOR's operation shall be allowed to enter or be placed where it may be washed by rainfall or runoff directly into creek or other waters of the United States.

B. As part of the permitting process for working within a creek or waterway, the OWNER will obtain a 404 permit from the U.S. Army Corps of Engineers, a 1602 Streambed Alteration Agreement from CDFG, and a 401 Certification from the Regional Water Quality Control Board, as applicable. See Document 01060 for Permits and Agreements to be obtained by the OWNER.

C. National Pollution Discharge Elimination System (NPDES) General Permit [Order No. 2009-0009-DWQ] for Storm Water Discharges Associated with Construction and Land Disturbance Activities (General Permit).

D. CONTRACTOR shall comply with all provisions of the SWPPP and comply with the Central Coast Water Board's Basin Plan water quality objectives.

E. Any governing provisions related to storm water pollution prevention, erosion and sediment control and water quality which are in conflict for this specification shall be guided by the terms of the General Permit, the Central Coast Water Board and the State Water Resources Control Board.

F. CONTRACTOR shall avoid or minimize impacts on the seasonal wetland and creeks:

1. CONTRACTOR shall stabilize exposed slopes and stream banks immediately on completion of construction/installation activities.

2. CONTRACTOR shall restore the banks of creeks in a manner that encourages vegetation to reestablish to its pre-project condition and reduces the effects of erosion on the drainage system.

G. Under no circumstances shall a creek or natural waterway be disturbed, filled in, dammed or altered.

H. CONTRACTOR shall report any serious sediment release immediately to the ENGINEER so that his appropriate public agencies are notified. CONTRACTOR will be responsible for payment of all fines, cleanup and restoration efforts related to such sediment release.

1.05 SWPPP CERTIFICATION REQUIREMENTS

A. Qualified SWPPP Developer: The CONTRACTOR shall provide a Qualified SWPPP Developer (QSD). The CONTRACTOR shall submit qualifications for the QSD including one of the following registrations or certifications, and appropriate experience, as required for and provide the required information:

1. A California registered professional civil engineer, California registered professional geologist or engineering geologist, California registered landscape architect, professional hydrologist registered through the American Institute of Hydrology, Certified Professional in Erosion and Sediment Control (CPESC)TM registered through Enviro Cert International, Inc, Certified Professional in Storm Water Quality (CPSWQ) TM registered through Enviro Cert International, Inc, or professional in erosion and sediment control registered through the National Institute for Certification in Engineering Technologies (NICET). Proof of QSD credentials shall be included in the SWPPP.

2. Effective September 1, 2011, the QSD shall have completed a State Water Board-sponsored or approved QSD training course as specified in the General Permit and shall include proof of approved coursework in the SWPPP.

3. The CONTRACTOR shall list the name and telephone number of the currently designated QSD in the SWPPP including a 24-hour emergency telephone number.

4. The CONTRACTOR shall ensure that the SWPPP is written and amended by a QSD, as needed, to address the specific circumstances for each construction site covered by this General Permit prior to commencement of construction activity for any stage.

B. Qualified SWPPP Practitioner: The CONTRACTOR shall provide a Qualified SWPPP Practitioner (QSP) to ensure that all elements of any SWPPP for each project will be implemented. The CONTRACTOR assigned QSP is a person responsible for non-storm water and storm water visual observations, sampling and analysis, and for ensuring full compliance with the permit and implementation of all elements of the SWPPP. The CONTRACTOR shall ensure that the QSP shall be either a QSD or have one of the following certifications and provide the required information:

1. A certified erosion, sediment and storm water inspector registered through Certified Professional in Erosion and Sediment Control, Inc. or certified inspector of sediment and erosion control registered through Certified Inspector of Sediment and Erosion Control, Inc. Proof of QSP credentials shall be included in the SWPPP.

2. Effective September 1, 2011, a QSP shall have completed a State Water Board-sponsored or approved QSP training course and shall include proof of approved coursework in the SWPPP.

3. The CONTRACTOR shall list the name and telephone number of the currently designated QSP in the SWPPP including a 24-hour emergency telephone number.

4. The CONTRACTOR shall ensure that the SWPPP include a list of names of all contractors, subcontractors, and individuals who will be directed by the QSP, and who is ultimately responsible, as assigned by the CONTRACTOR for implementation of the SWPPP. The SWPPP shall include a list contacts, telephone numbers and work addresses for all of these parties. Specific areas of responsibility of each subcontractor and 24-hour emergency contact numbers shall also be included.

1.06 SWPPP AMENDMENTS, ANNUAL COMPLIANCE CERTIFICATION AND QUARTERLY REPORTING REQUIREMENTS

A. When changes in the SWPPP are required during the course of the Project, CONTRACTOR QSD shall prepare, certify and sign an amendment to the SWPPP and submit it to the ENGINEER for review and forwarding to the Central Coast Water Board. CONTRACTOR QSD shall prepare an amendment to the SWPPP when one or more of the following conditions exist:

1. No later than 30 days after execution of Contract.

2. Whenever there is a change in construction or operations which may affect the discharge of pollutants to surface waters, groundwater(s), or a municipal separate storm sewer system.

3. Annually, prior to the defined rainy season, if required by the Project's Contract Documents or when deemed necessary by the ENGINEER or governing resource agency.

B. CONTRACTOR shall include the following information with each proposed amendment to the SWPPP:

1. Describe who requested the proposed amendment.

2. Describe the location of the proposed change.

3. Describe reason for change.

4. Describe the new BMP proposed.

C. All proposed amendments to the SWPPP shall be submitted electronically to the ENGINEER in accordance with Section 01300. All proposed amendments shall include a completed SWPPP Certification and Approval form signed by CONTRACTOR and the CONTRACTOR’s QSD. CONTRACTOR shall include a listing of the date of initial preparation and the date of each amendment in the SWPPP.

D. CONTRACTOR shall insert all accepted amendments into the CONTRACTOR's SWPPP. CONTRACTOR shall also record all accepted amendments in the SWPPP amendment log.

E. In no event will CONTRACTOR be entitled to increases in the Contract Sum or the Contract Time for SWPPP amendments and resulting Work caused by CONTRACTOR's failure to comply with the General Permit, the SWPPP, or the requirements set forth in this Specification.

F. CONTRACTOR QSD shall annually report and certify that the site is in compliance with the requirements of the General Permit. The CONTRACTOR will be required to provide information and submit an annual report no later than August 1 of each year using the Storm water Multi-Application Reporting and Tracking System (SMARTS). The Annual Report must include a summary and evaluation of all sampling and analysis results, original laboratory reports, chain of custody forms, a summary of all corrective actions taken during

the compliance year, and identification of any compliance activities or corrective actions that were not. The CONTRACTOR is required to retain paper or electronic copies of all records required by the project's General Permit for a period of at least three years from the date generated or the date submitted to the State Water Board or Central Coast Water Board. The CONTRACTOR must retain records for a period beyond three years as directed by Regional Water Board.

G. The CONTRACTOR shall perform Quarterly Reporting requirements in accordance with the General Permit.

H. The CONTRACTOR will not be entitled to increases in the Contract Price or the Contract Time for SWPPP amendments and/or work caused by CONTRACTOR's failure to comply with the General Permit, the SWPPP, or the requirements set forth in this Specification.

PART 2 PRODUCTS

2.01 MATERIALS

A. Use certified, weed free, natural/biodegradable imported erosion control materials (e.g. straw wattles, hay bales).

B. Fiber or sediment roll consisting of biodegradable (plastic monofilament netting shall not be allowed because of potential entanglements of wildlife in these materials) fibers.

C. Erosion control mat (plastic monofilament netting shall not be allowed because of potential entanglements of wildlife in these materials).

D. Filter fabric, filter mesh and filter bags

E. General use of more environmentally safe, biodegradable materials on construction sites to minimize the potential risk to water quality.

PART 3 EXECUTION

3.01 EROSION AND STORM WATER CONTROL, HOUSEKEEPING, CLEAN UP AND DISPOSAL

A. The CONTRACTOR shall implement the SWPPP, amend and maintain the SWPPP document to be made available at the Project Site at all times. The SWPPP shall be made available to the OWNER and the Central Coast Water Board during normal working hours and on a 24-hour basis during emergencies or non-compliances. The CONTRACTOR shall abide by all SWPPP requirements contained therein.

B. CONTRACTOR shall arrange to have sediment catch basins cleaned on a routine basis so that sediment does not enter receiving bodies of water, storm drains and reservoirs.

C. The CONTRACTOR shall remove all erosion and sediment control devices and material, equipment, and temporary structures used for the control and disposal of storm water from the Site once work is completed.

END OF SECTION

SECTION 01571

TRAFFIC CONTROL

PART 1 GENERAL

1.01 REQUIREMENTS

A. The CONTRACTOR shall provide all traffic control required to construct the Work, to ensure public safety, and to minimize traffic impacts and delays. Traffic control shall be as required in the California Manual on Uniform Traffic Control Devices, 2012 Edition (CA MUTCD), the 2010 State Standard Specifications (Caltrans) Section 7, Section 12, and other sections as well as with Caltrans traffic control manuals and plans, as applicable.

B. CONTRACTOR shall conform with all requirements of these provisions, including but not limited to, preparation of Traffic Control Plans; construction and maintenance of temporary pavement (if any); placement of signs, barricades, and safety devices; providing flag person, providing and placement of temporary striping, traffic cones, and other channelizing devices; and all activities to conform to requirements of the State Standard Specifications and these specifications.

C. The CONTRACTOR shall be responsible for the safety of vehicular traffic within the Project limits and on the approaches to the Project. The CONTRACTOR shall be responsible for the safety of pedestrians, cyclists, and animals within the Project limits.

1.02 TRAFFIC CONTROL PLAN

A. The traffic control plans and specifications included in these Contract Documents are guidelines for the CONTRACTOR. The CONTRACTOR shall prepare and submit its own Traffic Control Plan for review and approval by the ENGINEER prior to construction.

B. If the CONTRACTOR's Traffic Control Plan deviates from the Contract Documents' traffic control plans and specifications and/or the CA MUTCD or 2010 State Standard Plans and Specifications, traffic control manuals and plans, the CONTRACTOR's Traffic Control Plan shall be prepared by a California Registered Civil Engineer.

C. The CONTRACTOR shall submit 8 copies of its Traffic Control Plan to the ENGINEER for review a minimum of 14 days prior to construction.

D. The ENGINEER shall observe the execution of the approved Traffic Control Plan during construction and may request changes as field conditions warrant. Said changes shall be performed at no additional cost/time to the Contract.

1.03 STREET DESIGNATIONS

A. The streets within the Project are designated as arterial, collector, and minor as follows:

1. Arterial Streets

a. Los Osos Valley Road

b. South Bay Boulevard

2. Collector Streets

a. Nipomo Avenue

b. Binscarth Road

c. Ramona Avenue

d. El Moro Avenue (between 2nd Street and 12th Street)

e. Santa Ysabel Avenue

f. Pecho Road

g. Pecho Valley Road

h. Pine Avenue

i. Bayview Heights Drive

j. 2nd Street (between El Moro and Santa Ysabel Ave)

k. 7th Street

l. 9th Street (between Los Osos Valley Road and Ramona Ave)

m. 11th Street

3. Minor Streets

a. All remaining streets not designated as arterial streets or collector streets.

B. Business Street Segments. In addition to the above designations, the following street segments shall be identified as business street segments:

1. Los Osos Valley Road between Palisades Avenue and South Bay Boulevard.

2. Los Olivos Avenue between 9th Street and Fairchild Way.

3. Santa Ynez Avenue between 9th Street and 11th Street.

4. 9th Street between Los Osos Valley Road and Santa Ynez Avenue.

5. 10th Street between Los Osos Valley Road and Santa Ynez Avenue.

6. 2nd Street between El Moro Avenue and Santa Ysabel.

1.04 STREET RESTRICTIONS

A. Arterial Streets

1. Two lanes of through traffic shall be maintained at all times in all arterial streets.

2. Only one construction activity at a single location shall be allowed on all arterial streets at any given time.

B. Collector Streets

1. Two lanes of through traffic, or a single lane of through traffic with flagpersons, shall be maintained at all times on collector streets.

2. Only one construction activity at a single location shall be allowed in one east-west collector street and in one north-south collector street at any given time.

C. Minor Streets

1. A minor street segment, limited to the distance between two adjacent street intersections, may be closed to through traffic for the Area construction of various pipelines during working hours.

2. The CONTRACTOR shall maintain at least one minimum 11-feet wide lane for local traffic to accommodate residents, visitors, and deliveries to properties in the subject segment and for emergency vehicles during the working hours.

D. Business Street Segments

1. The CONTRACTOR shall maintain vehicular access to business driveways and parking areas for business customers at all times.

2. Where compliance with the above is not possible, and with the ENGINEER's approval, access may be interrupted for a period not to exceed four hours per day for a maximum of two days per business.

3. The CONTRACTOR shall provide temporary signs to advise potential customers that the subject business remains open during construction and indicates the location of the alternative access.

E. Street Intersections

1. Major street intersection traffic control shall be performed in accordance with the specific traffic control plans included in the Contract Drawings. The CONTRACTOR shall use these drawings as the basis for developing its own staged traffic control plans.

2. All other street intersection traffic control shall be performed in accordance with the traffic control typical details included in the Contract Drawings.

F. Traffic Restoration. All streets shall be restored through traffic at the close of working hours by either backfilling and compacting the excavation (including providing temporary or permanent

pavement) and/or covering with steel plates, as specified herein. Likewise, access shall be restored to all residence and business driveways at the end of each day.

1.05 CONSRUCTION LIMITATIONS

A. No equipment or material shall be parked or stored within any traffic lanes or within 8 feet from the edge of traveled way at any time of day or night, including holidays and weekends, without an approved lane or road closure unless otherwise approved by the County of San Luis Obispo. Road closures and detours will be authorized only in special circumstances and must be approved by the County of San Luis Obispo a minimum of two weeks in advance.

B. Working Hours

1. Working hours for arterial streets shall be limited from 8:30 A.M. until 3:00 P.M., Monday through Friday. With a minimum of 48 hours advance notification by the CONTRACTOR, Saturday work may be approved by the ENGINEER on a case by case basis. With a minimum of two weeks advance notification by the CONTRACTOR, night work on arterial streets or weekend work may be approved by the ENGINEER on a case by case basis.

2. Working hours for collector streets shall be limited from 7:00 A.M. until 6:00 P.M., Monday through Friday.

3. Construction activities within one block of any school during student drop-off or pick-up hours, which are generally 7:30 A.M. until 8:30 A.M. and 2:30 P.M. until 3:30 P.M. respectively, Monday through Friday, shall be precluded.

C. No activities that interfere with public traffic during the holiday season (defined as the four-day Thanksgiving weekend and December 18 through January 1) shall be conducted on the following streets:

1. Los Osos Valley Road

2. 9th Street

3. 10th Street

4. 11th Street

5. 2nd Street between El Moro Avenue and Santa Ysabel Avenue

6. South Bay Boulevard.

D. Either Los Osos Valley Road between South Bay Boulevard and Turri Road or South Bay Boulevard north of Los Osos Valley Road shall be open, with no traffic restrictions, at all times.

E. Lane closures on Los Osos Valley Road and South Bay Boulevard are not permitted on Friday afternoons preceding three-day Federal Holiday weekends.

F. No lane closures shall be permitted on Los Osos Valley Road from 7:00 am to 8:30 am, or from 3:00 pm to 6:00 pm on any weekday.

G. No lane closures shall be permitted on South Bay Boulevard from 7:00 am to 8:30 am, or from 3:00 pm to 6:00 pm on any weekday.

H. No lane closures shall be permitted on Santa Ysabel Avenue from 7:00 am to 8:30 am, or from 5:00 pm to 6:00 pm on any weekday.

I. Traffic Signal Coordination and Detection: When work shall be done within 300 feet of any intersection with an existing traffic signal, the CONTRACTOR shall comply with the following conditions.

1. Roadway Approaches with Video Detections Systems – The CONTRACTOR shall provide in the Traffic Control Plan the specific lane dimensions and configurations for the roadway during various construction phases to the ENGINEER and alert the ENGINEER a minimum of ten working days prior to commencement of work. Engineer will then coordinate review with the County Traffic Engineer to assess impacts for traffic detection at the intersection. The County Traffic Engineer will then adjust the video detection system to apply to the approved Traffic Control Plan and only after this is coordinated may work commence within 300 feet of the intersection. Any alterations to the approved Traffic Control Plan or other agreed phases of work will need to be processed as indicated to account for intersection video detection.

2. Roadway Approaches without Video Detection Systems – The CONTRACTOR shall be aware that all other approaches to existing traffic signals have in pavement loop detection systems that will need to remain in operation during the construction operations. Submitted Traffic Control Plans will need to indicate whether these systems will be disturbed during construction. Any disruption of the loop detectors shall be indicated to the ENGINEER at least ten working days prior to commencement of work. If the system is removed during construction, the CONTRACTOR shall provide a temporary detection system for the roadway approach which will be operational at all times during the intersection construction.

a. A temporary detection system shall consist of the placement of preformed loop detection, as described in this specification, and have the induction loops connected to the traffic signal control system. The preformed loop detection loop shall be anchored into place through grinding existing pavement and repaving the road surface to secure the loop detection system. The CONTRACTOR shall be responsible for the continuous operation of the diction system during the construction phase.

b. The CONTRACTOR may propose alternative methods for signal detection to the ENGINEER at least fifteen working days prior to commencing work. ENGINEER will review alternatives with the County Traffic Engineer. No system shall be deployed without the consent of the ENGINEER.

c. At the conclusion of the project, the CONTRACTOR shall be responsible for replacement of the original loop detection system to its pre-construction layout and operation. Replacement loop detection system shall comply with the requirements of the CA MUTCD and 2010 State Standard Plans and Specification. The CONTRACTOR may leave the temporary preformed loop system in place if it meets the intent of the pre-construction condition and is approved by the ENGINEER.

1.06 ACCESS

A. The CONTRACTOR shall provide emergency services access to all residences and businesses at all times. The CONTRACTOR shall have an adequate number of steel traffic plates and equipment to place the plates or shall backfill the trench and make it passable for emergency vehicles.

B. The CONTRACTOR shall be responsible for maintaining local property access and access to existing public cross-streets within the limits of this Contract. CONTRACTOR shall perform road closures on half block increments or alternating streets.

C. The CONTRACTOR shall contact the South Bay Fire Department that maintains a list of disabled persons in Los Osos and shall incorporate a plan to accommodate their special access needs.

1.07 NOTIFICATION

A. The CONTRACTOR shall provide written notice at least three working days in advance of construction work to South Bay Fire Department, County Sheriff Department, California Highway Patrol, and Regional Transit (if applicable) and other emergency services including ambulance/paramedics.

B. The CONTRACTOR shall provide written notification to residences and businesses a minimum of 72 hours in advance of performing any construction work. Notifications shall be by written notice to the resident placed on or near the building entrance or the property access point to be closed. Refer to Section 01566 – Public Information Program for additional requirements.

C. The CONTRACTOR shall provide, place and maintain all construction signage in accordance with the Caltrans standard specifications and plans. The CONTRACTOR shall also provide portable electronic changeable message signs at the beginning and end of each pipeline heading/work area to inform the community of the anticipated work duration, that traffic is subject to delays and other pertinent information. The CONTRACTOR's Public Liaison shall coordinate the foregoing with the OWNER's Public Information Program (PIP) Consultant.

D. General advisory signs shall be posted 10 days in advance of construction activities.

E. The CONTRACTOR shall provide 72 hour advance notice with a CMS of lane closures on arterial roads.

F. The CONTRACTOR shall notify all public agencies (post offices, sheriff, California Highway Patrol, ambulance services, mass transit, trash/sanitation, etc.) of all road closures at least three working days in advance of each closure.

G. The CONTRACTOR shall notify residents of Sunny Oaks Mobile Home Park at least thirty days in advance by U.S. mail of any construction activities at the Sunny Oaks Pump Station. Construction activities shall be conducted in a manner to maintain driveway ingress and egress to the Mobile Home Park at all times. The CONTRACTORS's access to the site shall be developed from Los Osos Valley Road and shall not use the Mobile Home Park driveway. The CONTRACTOR may temporarily remove the Sunny Oaks Mobile Home Park entrance sign and associated lighting for the duration of construction activities. If removed, the sign and lighting shall be restored to original condition after construction activities are completed.

H. The CONTRACTOR shall notify adjoining property owner, Dr. Knighton, 2239 Bayview Heights Dr., Los Osos, CA 93402, at least thirty days in advance by U.S. mail of any construction activities at the Mountain View Avenue Standby Power Facility site. The CONTRACTOR shall complete all work in the temporary construction easement within a six month period. All fencing, landscaping, and irrigation improvements within the temporary and permanent easement shall be stored to original condition. The description of the temporary and permanent easement will be furnished by the ENGINEER by request of the CONTRACTOR.

PART 2 PRODUCTS

2.01 TEMPORARY CRASH CUSHION MODULE

A. The CONTRACTOR shall furnish, install, and maintain sand filled temporary crash cushion modules in groupings or arrays at each location shown the Drawings, as specified herein, or where designated by the ENGINEER. The grouping or array of sand filled modules shall form a complete sand filled temporary crash cushion in conformance with the detail shown on the Drawings and these Specifications and/or the 2010 State Standard Plans and Specifications.

B. Whenever the work or the CONTRACTOR's operations established a fixed obstacle, the exposed fixed obstacle shall be protected with a and filled temporary crash cushion. The sand filled temporary crash cushion shall be in place prior to opening the lanes adjacent to the fixed obstacle to public traffic.

C. Sand filled temporary crash cushions shall be maintained in lace at each location, including times when work is not actively in progress. Sand filled temporary crash cushions may be removed during a work period for access to the work provided that the exposed fixed obstacle is 15 feet or more from a lane carrying public traffic and the temporary crash cushion is reset to protect the obstacle prior to the end of the work period in which the fixed obstacle was exposed. When no longer required, as determined by the ENGINEER, sand billed temporary crash cushions shall be removed from the site of the work.

D. Sand filled temporary crash cushion modules shall be from the Caltrans Pre-Qualified Products List available online at http://www.dot.ca.gov/hq/esc/approved_products_list/pdf/highway_safety_features.pdf .:

E. Modules contained in each temporary crash cushion shall be of the same type at each location. The color of the modules shall be the standard color, as furnished by the vendor, with black lids. The modules shall exhibit good workmanship free from structural flaws and objectionable surface defects. The modules need not be new, but must be manufactured after March 31, 1997. Good used undamaged modules conforming to color and quality of the types specified herein may be used. If used Fitch modules requiring a seal are furnished, the top edge of the shall be securely fastened to the wall of the module by a continuous strip heavy duty tape.

F. Modules shall be filled with sand in conformance with the directions, and to the sand capacity in pounds for each module shown on the Drawings. Sand for filling the modules shall be clean washed concrete sand commercial quality. At the time of placing in the modules, the sand shall contain no more than 7 percent water as determined by California Test 226.

G. A Type R or P marker panel shall be attached to the front of the crash cushion as shown on the Drawings, when the closest point of the crash cushion array is within 12 feet of the traveled way. The marker panel, when required, shall be firmly fastened to the crash cushion with commercial quality hardware or by other methods determined by the ENGINEER.

H. At the completion of the project, temporary crash cushion modules, sand filling, pallets or frames, and marker panels shall become the property of the CONTRACTOR and shall be removed from the site of the work, Temporary crash cushion modules shall not be installed in the permanent work,

I. Temporary crash cushion modules placed in conformance with Section 7 and 12 of the 2010State Standard Specifications will not be measured nor paid for.

2.02 FLASHING ARROW BOARDS

A. All trailer-mounted flashing arrow boards shall meet or exceed the physical and operational requirement of the "California Manual on Uniform Traffic Control Devices".

B. The unit shall have been evaluated by the NTPEP.

C. The display housing shall meet the minimum size requirements of a Type C panel with a 15- or 25-lamp configuration.

2.03 PREFORMED LOOP DETECTION

A. Preformed inductive loops shall be the type shown as required under this specification and detailed in the approved Traffic Control Plan.

B. The loop shall be 6-foot square at a minimum. The loop shall consist of 4 turns of No. 16, or larger, wire with Type THWN or TFFN insulation.

C. The loop wires shall be encased in 3/8 inch, minimum, Schedule 40 or Schedule 80 PVC or polypropylene conduit. The conduit shall be sealed to prevent the entrance of water and the movement of wires within the conduit.

D. The loop wires from the preformed loop to the adjacent pull box shall be twisted together into a pair (at least 2 turns per foot) and encased in Schedule 40 or Schedule 80 PVC or polypropylene conduit between the preformed loop and the adjacent pull box or detector handhole. The lead-in conduit shall be sealed to prevent the entrance of water at the pull box or handhole end.

E. In existing pavement, preformed loop installation shall conform to the following:

1. Preformed loops and lead-in conduits shall be placed in slots, 1-1/4 inches, minimum width, cut into the existing pavement. The top of the conduit shall be 2 inches, minimum, below the top of pavement.

2. Slots in hot mix asphalt pavement shall be filled with elastomeric sealant or hot-melt rubberized asphalt sealant.

F. ENGINEER shall approve the manufacture of the Preformed Loop prior to installation.

PART 3 EXECUTION

3.01 STREET USE

A. Nothing herein shall be construed to entitle the CONTRACTOR to the exclusive use of any public street, alleyway, or parking area during the performance of the Work. The CONTRACTOR shall conduct its operations to prevent interference with the authorized work of utility companies or other agencies in such streets, alleyways, or parking areas.

B. No street shall be closed to the public without first obtaining permission of the ENGINEER.

C. The CONTRACTOR shall maintain two 10-foot or one 11-foot wide traffic lane(s) at all times. For single lane traffic provide signage and flagpersons at all times.

3.02 PROTECTION

A. During the CONTRACTOR's operations that require aerial work over vehicle lanes, the CONTRACTOR shall close such lanes to public traffic. Lane closure shall be subject to the restrictions of this Section. The CONTRACTOR may use flagpersons if the work is intermittent.

B. All street traffic plates shall be provided with raised weld bead or non-skid coating. Plates placed on arterial roads shall be recessed to be flush with top of pavement, all plates on other streets shall be pinned, wedged, or otherwise secured. Provide cold or hot mix pavement around the edges of the plate for smooth passage of traffic.

C. Toe boards shall be provided to retain excavated material if required by the ENGINEER or the OWNER.

D. Fire hydrants on or adjacent to the Work shall be kept accessible to firefighting equipment at all times.

E. Temporary provisions shall be made by the CONTRACTOR to assure the use of sidewalks and the proper functioning of all gutters, drain inlets, and other drainage facilities.

F. The CONTRACTOR shall install and maintain temporary Type K railing and/or fencing around the construction areas.

G. At the conclusion of each work day, all paved traveled-way surfaces shall be restored to an all-weather, traversable condition. There shall not be a drop-off along the edge of traveled way greater than 0.15-feet. "Low Shoulder" signs shall be placed along the traveled way where there is any drop-off. Drop-offs greater than 0.15-feet shall require either:

1. Backfilling the drop-off to a minimum 4:1 slope.

2. Providing appropriate steel plates over excavation.

3. Providing temporary concrete railing along the work zone in conformance with the 2010 State Standard Plans and Specifications.

H. The CONTRACTOR shall provide temporary crash cushion modules for end treatments as shown on the Drawings in accordance with this Specification.

I. All flaggers shall hold current certifications. As defined under Cal OSHA Construction Safety Order Section 1599, all flaggers on the roadway shall be trained by qualified and experienced personnel to the aspects noted in Section 1599. The CONTRACTOR shall use trained personnel only. All workers within the roadway shall wear Type 2 CAL-OSHA high-visibility vests.

3.03 TRAFFIC CONTROL

A. For the protection of traffic in public or private streets and ways, the CONTRACTOR shall provide, place and maintain all necessary barricades, traffic cones, warning signs, lights and other safety devices in accordance with the requirements of the CONTRACTOR's Traffic Control Plan and "California Manual on Uniform Traffic Control Devices" or the Standard Plans.

B. Construction area signs shall be furnished, installed, maintained and removed when no longer required in accordance with Section 12 of the State Standard Specifications.

C. Prior to initiating work, the CONTRACTOR shall install all required traffic control devices. In addition to these signs, the CONTRACTOR shall install barricades with steady burn flashers at 200-feet O.C. minimum and post-delineators at 50-feet O.C. minimum.

D. Attention is directed to Section 7-1.08 "Public Convenience", Section 7-1.09 "Public Safety", Section 12-3.04 "Portable Delineators" of the State Standard Specifications.

E. The CONTRACTOR shall cooperate with local authorities relative to handling traffic through the area and shall make arrangements relative to keeping the work area clear of parked vehicles.

F. All trenches shall be protected during the hours work is not in progress so that no person or animal could fall into or be injured by an open trench.

G. The CONTRACTOR shall take all necessary precautions for the protection of the Work and the safety of the public. All barricades and obstructions shall be illuminated at night and all lights shall be turned on from sunset until sunrise. The CONTRACTOR shall station such guards or flagpersons and shall conform to such special safety regulations relating to traffic control as may be required by the public authorities within their respective jurisdictions. All signs, signals, and barricades shall conform to the requirements of CAL-OSHA and Sub-part B, Part 1926, of the OSHA Safety and Health Standards for Construction.

H. Traffic control devices shall be placed and maintained at all times during and after working hours of each day until the next phase of construction traffic control is being placed. At the end of the construction, all signing and striping shall be restored to the existing conditions, except that existing thermoplastic striping and payment markings shall be replaced with painted striping and markings. The roadway is defined as "that area of the highway used for vehicular, pedestrian, and bicycle travel".

3.04 PEDESTRIAN REQUIREMENTS

A. The CONTRACTOR shall maintain pedestrian access at all times. Where sidewalks or shoulder areas are closed by construction, an alternate route shall be provided. The alternate route shall

consist of a smooth surface a minimum of 48 inches in clear width. The surface may consist of asphalt concrete, aggregate base, or compacted earth. Signs and barricades shall be installed at the limit of construction to direct pedestrians to the alternate route.

B. Fences or railings shall be placed adjacent to areas utilized by pedestrians when a vertical difference in excess of 6 inches exists between the elevation of the pedestrian walkway and the elevation any excavation adjacent to the walkway.

C. The CONTRACTOR shall provide access to bus stops at all times or provide temporary bus stop location and signage. When access to existing bus stops is not practical due to construction activities, the CONTRACTOR shall provide a nearby temporary bus stop location until the existing location is accessible. The CONTRACTOR shall verify location of existing bus stops, confirm the current bus schedule, and coordinate the location of temporary bus stop location with the Transit Authority and School District. The CONTRACTOR shall provide signage at the existing bus stop and at the temporary bus stop.

D. The CONTRACTOR shall not close a bike lane unless approved by the ENGINEER or Public Works Director.

3.05 DRIVEWAY ACCESS

A. Except as provided below, the CONTRACTOR shall maintain access to all driveways. All materials and equipment shall be stored in such a manner as to not block access or egress to any driveway.

B. The CONTRACTOR shall notify the property owner or occupant (if not property owner-occupied) of the pending closure of any driveway for more than one 8-hour work day at least three working days in advance of such closure. The CONTRACTOR shall minimize the inconvenience and the time period that the driveway will be closed. The CONTRACTOR will fully explain to the property owner or occupant the start and duration of the closure.

C. Arrangement for access to the construction site over private property shall be mutually agreed upon by the CONTRACTOR and the property owner before start of construction. CONTRACTOR shall provide the property owner with a copy of the written arrangement or agreement.

3.06 PAVEMENT RESTORATION

A. The CONTRACTOR shall provide and maintain roadway until permanent pavement is installed. All trench excavation within improved areas shall be restored in accordance with the pavement restoration details shown in the Contract Drawings and Section02460 – Full Depth Restoration, Section 02576 – Pavement Repair and Resurfacing, and Section 02577 – Hot Mix Asphalt Pavement. Pavement shall be installed within 45 days of initiating excavation.

B. Temporary pavement or all-weather surface is limited to a maximum of 45 days prior to final pavement repair..

3.07 COORDINATION WITH PROJECT LIAISON

A. It is understood and agreed that proper traffic control is necessary to minimize public impacts and to ensure their safety. The CONTRACTOR shall on a daily basis communicate all traffic control notifications to the ENGINEER including necessary changes in anticipated traffic control measures.

END OF SECTION

SECTION 01614

WIND DESIGN CRITERIA

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Wind design criteria for the following:

1. Equipment located around the project site, associated with the Work.

B. Related Sections:

1. Section 01300 – Submittals.

1.02 REFERENCES

A. California Building Standards Commission (CBSC):

1. California Building Code (CBC) – 2010 Edition.

B. American Society of Civil Engineers (ASCE):

1. SEI/ASCE 7, Minimum Design Loads for Buildings and Other Structures – 2005 Edition.

C. American Concrete Institute (ACI):

1. ACI 318, Building Code Requirements for Structural Concrete and Commentary.

1.03 SYSTEM DESCRIPTION

A. Design Requirements: Design in accordance with the requirements of the CBC and ASCE 7.

1. Basic Wind Speed: 85 miles per hour.

2. Wind Exposure: D.

3. Importance Factor: 1.15.

4. Use cast-in anchors wherever practical for resisting wind forces on components. Post-installed anchors, where used, shall have current ICC Evaluation Service Reports.

a. Determine capacities for cast-in-place and post-installed anchors in accordance with ACI 318, Appendix D and any appropriate ICC

Evaluation Service Reports. Capacities shall account for provided anchor spacing and edge distance.

b. ICC Evaluation Service Reports shall indicate the anchors are adequate to resist loads in cracked concrete.

c. Shallow anchors (embedment length/diameter <8) shall not be allowed unless approved in writing by the ENGINEER.

d. Post-installed anchor embedment shall not be less than the manufacturer's recommended minimum embedment and with consideration of slab thickness.

e. Anchor design shall be controlled by yielding of the steel anchor as opposed to shear failure of the concrete whenever practical.

5. For attachment of items to concrete or masonry, use only anchors, bolts or other commonly used fasteners which rely on direct bearing or tension developed by properly designed bearing plates for resisting wind loads.

a. Fasteners shall be designed using only commonly accepted design methodologies, current design codes, and ICC Evaluation Service Reports, where available.

1.04 SUBMITTALS

A. All submittals shall be in accordance with Section 01300.

B. Calculations: Submit anchorage design calculations for all equipment and other wind resisting systems not completely detailed in the Drawings. Calculations shall be prepared and sealed by a Professional civil or structural engineer registered in the State of California.

PART 2 PRODUCTS

2.01 ANCHORS – GENERAL

A. For components weighing 400 pounds or more using cast-in-place anchors, the minimum anchor size shall be 5/8-inch with minimum 5-inch embedment and as required by submitted seismic calculations.

B. For components weighing 400 pounds or more using post-installed anchors, the minimum anchor size shall be as required by submitted seismic anchorage calculations.

C. For all components weighing less than 400 pounds, the minimum anchor size shall be 3/8-inch diameter with minimum 3-inch embedment.

D. All anchors securing components to be grouted shall be furnished with leveling nuts, the faces of which shall be tightened against flat surfaces to not less than 10 percent of the bolt's safe tensile stress.

E. See Section 05500 for anchor products.

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01615

SEISMIC DESIGN CRITERIA

PART 1 GENERAL

1.01 SUMMARY

A. Section includes seismic requirements for all components to be furnished under this contract.

B. Design anchorage for components and install them in conformance with the seismic requirements contained in the California Building Code, its referenced standards, and as amended in this Section. Components shall be restrained such that the component forces are transferred to the structure.

C. A continuous load path of sufficient strength and stiffness between the component and structure shall be demonstrated through analysis.

D. Components associated with the Work, include but are not limited to:

1. Mechanical equipment

2. Electrical equipment

3. Exhaust Plenum

4. Exhaust Silencer

1.02 REFERENCES

A. California Building Standards Commission:

1. California Building Code – 2010 Edition

B. American Society of Civil Engineers (ASCE):

1. SEI/ASCE 7, Minimum Design Loads for Buildings and Other Structures – 2005 Edition

C. American Concrete Institute (ACI):

1. ACI 318, Building Code Requirements for Structural Concrete and Commentary – 2008 Edition

1.03 SYSTEM DESCRIPTION

A. Component seismic design parameters:

1. Seismic Design Category: D

2. Importance Factor: $I_p = 1.5$

3. Maximum design spectral response acceleration factors:

a. $S_{DS} = 0.984$

b. $S_{D1} = 0.894$

4. Apply horizontal and vertical seismic forces in accordance with ASCE 7 Section 13.3.

5. Apply nonstructural component amplification and response modification factors (a_p and R_p) using ASCE 7-05 Tables 13.5-1 and 13.6.1-1.

B. Anchorage:

Use cast-in anchors wherever practical for resisting seismic forces on components. Post-installed anchors, where used, shall have current ICC Evaluation Service Reports.

1. Determine capacities for cast-in-place and post-installed anchors in accordance with ACI 318, Appendix D and any appropriate ICC Evaluation Service Reports. Capacities shall account for provided anchor spacing and edge distance.

2. ICC Evaluation Service Reports shall indicate the anchors are adequate to resist seismic loads in cracked concrete.

3. Shallow anchors (embedment length/diameter < 8) shall not be allowed unless approved in writing by the ENGINEER.

4. Post-installed anchor embedment shall not be less than the manufacturer's recommended minimum embedment and with consideration of slab thickness.

5. Anchor design shall be controlled by yielding of the steel anchor as opposed to shear failure of the concrete whenever practical.

C. Do not use frictional resistance produced by the effects of gravity to resist seismic forces.

1.04 SUBMITTALS

A. Calculations: Submit seismic restraint calculations for all components identified in this Specification. Calculations shall be prepared and sealed by a Professional Civil or Structural Engineer registered in the State of California. The anchorage selection in the calculations shall reflect what is shown in the appropriate component shop drawing. See Section 3.02 of this Specification for additional requirements.

B. Seismic Qualification Certification: Submit certification by the supplier that the mechanical or electrical components identified in this Specification will remain operable following the design level earthquake in accordance with ASCE 7 Section 13.2.2. Such certification shall be based on approved shake table testing or experience data. Seismic qualification certification need not be submitted for pre-qualified structurally rugged equipment as listed in Table 01615-1:

Table 01615-1
Pre-qualified structurally rugged equipment

Valves
Generators
Horizontal and vertical pumps
Hydraulic and pneumatic operators
Motor operators
Compressors
Transformers with anchored internal coils
Air handling equipment and fans (without internal or external vibration isolators)
Low and medium voltage switchgear (<13.8 kV)
Instrumentation cabinets
Distribution panels
Battery chargers
Motor control centers
Instrument racks
Batteries
Inverters

C. In addition to the above requirements, where equipment with complex component structural systems (i.e., systems involving components with multiple degrees of freedom and higher order modes of vibration) contains low weight components (e.g., circuit boards, relays, or solenoids), an empirical evaluation for such low weight components shall be certified in writing by a Professional Civil or Structural Engineer registered in the State of California, to satisfy the functionality requirements set forth above. At a minimum, such certification shall be based on an empirical evaluation of direct on-site observation by such equipment as installed, including physical "hand" shake and pull tests, and general calculations (if required to verify capacity overload) necessary to satisfy such engineer of compliance with the above functionality requirements. Certification shall be in the form of a letter from the registered engineer incorporating the nature of the observations and/or calculations performed including the registered engineer's seal.

1.05 QUALITY ASSURANCE

A. Testing and special inspection of anchorage installation shall be performed in accordance with Chapter 17 of the CBC.

B. Testing and special inspection will be paid for by the OWNER.

C. The Special Inspector shall keep a record of inspections and furnish inspection reports to the OWNER and ENGINEER. The reports shall indicate that work inspected was performed in conformance with the Contract Documents. Discrepancies shall be brought to the immediate attention of the CONTRACTOR for correction. Discrepancies not corrected shall be brought to the attention of the ENGINEER. A final report of inspections documenting required special inspections and correction of any discrepancies noted in the inspections shall be submitted periodically at a frequency agreed upon at the start of work.

D. Test for new Post-Installed Anchoring System:

1. When directed by the Engineer, anchors shall be tested as follows:

a. The testing of post-installed anchors and dowels shall be performed in the presence of the Special Inspector, and a report of the test results shall be submitted to the Engineer. The Special Inspector shall randomly select anchors to be tested. Testing will be paid for by the OWNER.

b. Test minimum 50 percent of bolts and dowels in a group.

c. Anchors and dowels shall be tested to 125% of their tension design strength (as defined in ACI 318 Section D.3.3.3 with strength reduction factors as defined in ACI 318 Section D.4.4) and the relevant International Code Council - Evaluation Service Report (ICC-ESR). Tension test load will vary based on each anchor's or dowel's product data, embedment, and edge distance. Tension test load need not exceed 80% of the nominal yield strength of the anchor element (0.8 times A_{se} times f_{ya}).

d. If any anchor or dowel fails in testing, all anchors or dowels of the same type (i.e., installed by the same trade but not previously tested) shall be tested until twenty (20) consecutive anchors pass. Initial test frequency may then be resumed.

e. Test new anchors and dowels by any method approved by the Engineer that will effectively measure the testing tension - such as direct pull with a hydraulic jack or calibrated spring-loaded devices. Test load shall be maintained for a minimum of 15 seconds and shall exhibit no discernable movement during the test (including loosening of the washer under the nut).

f. Failed anchors and dowels shall be replaced as directed by the Engineer.

PART 2 PRODUCTS

2.01 ANCHORS – GENERAL

A. For components weighing 400 pounds or more using cast-in-place anchors, the minimum anchor size shall be 5/8-inch with minimum 5-inch embedment and as required by submitted seismic calculations.

B. For components weighing 400 pounds or more using post-installed anchors, the minimum anchor size shall be as required by submitted seismic anchorage calculations.

C. For all components weighing less than 400 pounds, the minimum anchor size shall be 3/8-inch diameter with minimum 3-inch embedment.

D. All anchors securing components to be grouted shall be furnished with leveling nuts, the faces of which shall be tightened against flat surfaces to not less than 10 percent of the bolt's safe tensile stress.

E. See Section 05500 for anchor products.

PART 3 EXECUTION

3.01 GENERAL

A. All components designed to be fixed in position shall be securely fastened in place in conformance with the 2010 CBC, ASCE 7-05, and as specified in this section. For other components the component manufacturer shall provide recommended anchorage information to the CONTRACTOR for use in component installation.

3.02 STRUCTURAL INTEGRITY AND ANCHORAGE

A. It shall be the responsibility of the component manufacturer/supplier to provide the engineering anchorage calculations and figures to the CONTRACTOR for submission to the ENGINEER. As a minimum, the component manufacturer/supplier shall determine the supplier, type, number, dimensions, material, location, embedment, and installation conditions of all anchors to be installed in accordance with these Specifications and Drawings.

B. Engineering anchorage calculations and figures shall be prepared and sealed by a Professional Civil or Structural Engineer registered in the State of California. Calculations shall include the following steps as a minimum:

1. Indicate parameters used to determine demand lateral loads including a_p, R_p, z, h_r, S_{DS}, importance factor, operating weight and component center-of-mass.

2. Determine the component shear and moment due to application of the seismic force at the component's centroid.

3. Determine the shear and tension forces at each anchor due to application of the seismic force at the component's centroid.

4. Where anchoring to concrete, determine anchor capacities in accordance with ACI 318 Appendix D, any applicable ICC Evaluation Service Reports, while accounting for concrete compressive strength, thickness of member, edge distance, and anchor spacing.

5. Where anchoring to masonry, determine anchor capacities in accordance with ACI 530, and any applicable ICC Evaluation Service Reports, while accounting for masonry compressive strength, thickness of wall, edge distance, and anchor spacing.

6. Selection of anchors based upon the maximum shear and tension forces calculated above.

7. Include details indicating number of bolts, materials, diameter, total length, embedded length, required edge distance, and bolt dimensions. The embedded length of bolts shall be suitable to develop the ultimate tensile capacity of the anchorage for ductile failure.

8. Where vibration isolation devices are used, include manufacturer's product information indicating class and type. Indicate load ratings as published in manufacturer's data or shop drawings. Indicate proper orientation of devices in plan.

C. Anchorage shall be designed to resist the horizontal seismic force in at least two orthogonal directions in combination with component service loads, as appropriate. In addition to the horizontal seismic force, anchorage shall be designed to resist a vertical seismic force in accordance with ASCE 7 Section 13.3.1.

D. Supports and anchorage shall be designed to resist seismic forces occurring at each of the three principal directions separately as well as simultaneously. Seismic forces shall be combined on a square root of the sum of the squares (SRSS) basis, using one hundred percent (100%) of the forces in three directions. However, neglect vertical effects where inclusion of vertical loads results in a less conservative design.

E. Install anchors in full compliance with the manufacturer's recommendations.

END OF SECTION

SECTION 01630

SUBSTITUTIONS AND PRODUCT OPTIONS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Furnish and install products specified, under options and conditions for substitutions stated in this Section.

B. Whenever a product, material or item of equipment is specified or described by using the name of a proprietary product or the name of a particular manufacturer or vendor, followed by the phase "or equal," the specific item mentioned shall be the basis upon which bids are to be prepared, and shall be understood as establishing the type, function, dimension, appearance and quality desired. Other manufacturer's or vendor's products not named will be considered as substitutions, provided the required information is submitted in the manner set forth in this section and provided the substitution will not require substantial revision to the Contract Documents.

1.02 RELATED WORK

A. Substitutions during the Bidding Period are included in Article 11 of Section 00200.

B. Bid Form is included in Section 00410.

1.03 SUBMITTAL OF LIST OF PROPOSED SUBSTITUTIONS

A. Bidders shall submit their list of proposed substitutions and the proposed monetary changes associated therewith to the ENGINEER on the standard form provided together with their bids.

1.04 CONTRACTOR'S OPTIONS

A. For Products specified only by reference standard, select product meeting that standard, by any manufacturer.

B. For Products specified by naming several products or manufacturers, select any one of products and manufacturers named which complies with Specifications.

C. For products specified by naming one or more products or manufacturers and stating "or equal," submit a request as for substitutions, for any product or manufacturer which is not specifically named.

D. For products specified by naming only one product and manufacturer, there is no option and no substitution will be allowed.

1.05 SUBSTITUTIONS

A. In order for substitutions to be considered, the CONTRACTOR shall submit, within 30 days of issuance of Notice of Award, complete data as set forth herein to permit complete analysis of all proposed substitutions noted on his substitutions list. No substitution shall be considered unless the CONTRACTOR provides the required data in accordance with the requirements of this Section within the 30 day period.

B. Submit separate request for each substitution. Support each request with:

1. Complete data substantiating compliance of proposed substitution with requirements stated in Contract Documents:

a. Product identification, including manufacturer's name and address.

b. Manufacturer's literature; identify:

1) Product description.

2) Reference standards.

3) Performance and test data.

4) Operation and maintenance data.

c. Samples, as applicable.

d. Name and address of similar projects on which product has been used, and date of each installation.

2. Itemized comparison of the proposed substitution with product specified; List significant variations. Substitution shall not change design intent and shall perform equal to that specified.

3. Data relating to impact on construction schedule occasioned by the proposed substitution.

4. Any effect of substitution on separate contracts.

5. List of changes required in other work or products.

6. Accurate cost data comparing proposed substitution with product specified.

a. Amount of any net change to Contract Sum.

7. Designation of required license fees or royalties.

8. Designation of availability of maintenance services, sources of replacement materials.

C. Substitutions will not be considered for acceptance when:

1. They are indicated or implied on shop drawings or product data submittals without a formal request from Contractor.

2. They are requested directly by a subcontractor or supplier.

3. Acceptance will require substantial revision of Contract Documents.

D. Requests for substitutions submitted after Notice of Award will not be considered unless evidence is submitted to the ENGINEER that all of the following circumstances exist:

1. The specified product is unavailable for reasons beyond the control of the CONTRACTOR. Such reasons shall consist of strikes, bankruptcy, discontinuance of manufacturer, or acts of God.

2. The CONTRACTOR placed, or attempted to place, orders for the specified products within 10 days after Notice of Award.

3. Request for substitution is made in writing to the ENGINEER within 10 days of the date on which the CONTRACTOR ascertains that he cannot obtain the item specified.

4. Complete data as set forth herein to permit complete analysis of the proposed substitution is submitted with the request.

E. The ENGINEER's decision regarding evaluation of substitutions shall be considered final and binding. Requests for time extensions and additional costs based on submission of, acceptance of, or rejection of substitutions will not be allowed. All approved substitutions will be incorporated into the Agreement by Change Order.

1.06 CONTRACTOR'S REPRESENTATION

A. In making formal request for substitution, CONTRACTOR represents that:

1. He has investigated proposed product and has determined that it is equal to or superior in all respects to that specified.

2. He will provide same warranties or bonds for substitution as for product specified.

3. He will coordinate installation of accepted substitution into the Work, and will make such changes as may be required for the Work to be complete in all respects.

4. He waives claims for additional costs caused by substitution which may subsequently become apparent.

5. Cost data is complete and includes related costs under his Contract, but not:

a. Costs under separate contracts.

b. ENGINEER's costs for redesign or revision of Contract Documents.

1.07 ENGINEER DUTIES

A. Review CONTRACTOR's requests for substitutions with reasonable promptness.

B. Notify CONTRACTOR, in writing, of decision to accept or reject requested substitution.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01658

TELEVISION INSPECTION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Where indicated on the Drawings or other Specifications, pipelines shall be inspected by means of a closed-circuit television (CCTV). The inspection will be done one section at a time and the section being inspected will be suitably isolated from the remainder of the sewer line as required.

PART 2 PRODUCTS

2.01 MATERIALS

A. A self propelled television camera shall be used for the inspection of pipelines. Lighting for the camera shall be suitable to allow a clear picture for the entire periphery of the pipe. The camera shall be operative in 100 percent humidity conditions. The camera, television monitor and other components of the video system shall be capable of producing a minimum 500 line resolution video picture. Picture quality and definition shall be to the satisfaction of the ENGINEER. The Lighting System shall minimize reflective glare.

PART 3 EXECUTION

3.01 PERFORMANCE

A. The camera shall be moved through the line in either direction at a uniform rate, stopping when necessary to insure proper documentation of the sewer's condition but in no case will the television camera be pulled at a speed greater than 30 fpm. Manual winches, power winches, TV cable and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line. If, during the inspection operation the television camera will not pass through the entire mainline section, the CONTRACTOR shall notify the ENGINEER and re-set up his/her equipment in a manner so that the inspection can be performed from the opposite manhole

B. Documentation of the television results shall be as follows:

1. Television Inspection Logs sheets shall be provided to the ENGINEER.

2. Video recordings of the data on the television monitor shall be made by the CONTRACTOR copies of which, in a digital format playable in Windows Media Player (*.avi or *.mov), shall be provided to the ENGINEER.

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section specifies administrative, verification and procedural requirements for project closeout, including but not limited to:

1. Final cleaning is included in Section 01710.

2. Project Record Documents is included in Section 01720.

4. Spare parts and maintenance materials, paint, lubricants, and special tools are included in applicable Sections in Divisions 2 through 16.

5. Record Shop Drawings included in Section 01300.

6. Warranties, guarantees, and bonds Section 01740 and applicable Sections in Technical Divisions 2 through 16.

7. Reconciliation of final accounting, final change order, final payment application included in General Conditions.

8. Permit close-outs including Certificate of Occupancy or Certificate of Completion.

1.02 RELATED WORK

A. Operation and Maintenance (O&M) data and manuals in applicable Sections in Technical Divisions.

B. Certified Surveyor documentation submittals in Section 01050.

1.03 CLOSEOUT PROCEDURES

A. Provide all deliverables as specified, prior to submitting the final payment application.

B. Provide submittals to ENGINEER that are required by governing or other authorities having applicable jurisdiction including but not limited to permit close out information, certificates of occupancy, etc.

C. Submit Application for Final Payment identifying total adjusted Contract Sum, previous payments and sum remaining due, following submittal and approval of Record Documents and Record Drawings.

D. Submit CONTRACTOR’s Final Release and Release of Liens with final payment application.

1.04 FINAL CLEANING

A. CONTRACTOR to complete final cleaning prior to submittal of the final application for payment.

B. CONTRACTOR to comply with requirements as specified in Section 01710.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01710

CLEANING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Execute cleaning, during progress of the work, and at completion of the WORK, as required by General Conditions.

1.02 DISPOSAL AND CLEANING

A. Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, permits, and anti-pollution laws.

PART 2 PRODUCTS

2.01 MATERIALS

A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.

B. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.

C. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 EXECUTION

3.01 DURING CONSTRUCTION

A. Execute periodic cleaning to keep the work, the site and adjacent properties free from accumulations of waste materials, rubbish and windblown debris, resulting from construction operations.

B. Provide on-site containers for the collection of waste materials, debris and rubbish.

C. Remove waste materials, debris and rubbish from the site periodically and dispose of at legal disposal areas away from the site.

3.02 FINAL CLEANING

A. Employ skilled workmen for final cleaning.

B. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.

C. Prior to final completion, conduct an inspection of all work areas, to verify that the entire WORK is clean.

END OF SECTION

SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 SCOPE

A. The CONTRACTOR shall keep and maintain, at the job site, a copy of contract documents, marked up to indicate all changes made during the course of a project, as specified herein.

1.02 REQUIREMENTS INCLUDED

A. CONTRACTOR shall maintain a record copy of the following documents, marked up to indicate all changes made during the course of a project:

1. Contract Drawings

2. Specifications

B. CONTRACTOR shall assemble copies of the following documents for turnover to the ENGINEER at the end of the project, as specified.

1. Field Orders, Change Orders, Design Modifications, and RFIs

2. Field Test records

3. Permits and permit close-outs (final approvals)

4. Certificate of Occupancy or Certificate of Completion, as applicable

5. Laboratory test reports

6. Certificates of Compliance for materials and equipment

7. Record Shop Drawings

8. Samples

C. RECORD DRAWINGS

1. The CONTRACTOR shall annotate (mark-up) the Contract Drawings to indicate all project conditions, locations, configurations, and any other changes or deviations that vary from the original Contract Drawings. This requirement includes, but is not limited to, buried or concealed construction, and utility features that are revealed during the course of construction. Special attention shall be given to recording the locations (horizontal and vertical) and material of all buried utilities that are encountered during construction – whether or not they were indicated on the Contract Drawings. The record information added to the drawings may be supplemented by detailed sketches, if necessary, clearly indicating, the WORK, as constructed.

2. These annotated Contract Drawings constitute The CONTRACTOR's Record Drawings and are actual representations of as-built conditions, including all revisions made necessary by change orders, design modifications, requests for information and field orders.

3. Record drawings shall be accessible to the OWNER and ENGINEER at all times during the construction period.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 MAINTENANCE OF RECORD DOCUMENTS AND SAMPLES

A. Store documents and samples in CONTRACTOR’s field office apart from documents used for construction.

1. Provide files and racks for storage of the record documents.

b. Record horizontal and vertical locations of underground structures, piping, utilities and appurtenances, referenced to permanent surface improvements.

c. Record actual installed pipe material, class, size, joint type, etc

3.03 RECORD INFORMATION COMPILATION

A. Do not conceal any work until the required information is acquired.

B. Items to be recorded include, but are not limited to:

1. Location of buried utilities and appurtenances – referenced to visible and accessible features.

2. Field changes of dimensions and/or details

C. Changes made by Field Order, Change Order, design modification, and RFI.

D. Details not indicated on the original Contract Drawings.

E. Specifications - legibly mark each Section to record:

1. Manufacturer, trade name, catalog number, and Supplier of each product and item of equipment actually installed.

2. Changes made by Field Order, Change Order, RFI, and approved shop drawing.

3.04 SUBMITTAL

A. If specified under the section for progress payments, monthly applications for payment will be contingent upon up-to-date Record Drawings. If requested by the ENGINEER or OWNER, CONTRACTOR shall provide a copy of the Record Drawings, or present them for review prior to processing monthly applications for payment.

B. Upon substantial completion of the WORK and prior to final acceptance, the CONTRACTOR shall finalize and deliver a complete set of Record Drawings to the ENGINEER conforming to the construction records of the CONTRACTOR. The set of drawings shall consist of corrected and annotated drawings showing the recorded location(s) of the WORK. Unless specified otherwise elsewhere, Record Drawings shall be in the form of a set of full-size drawings with annotations carefully and neatly superimposed on the drawings in red.

C. Upon substantial completion of the WORK and prior to final acceptance, the CONTRACTOR shall finalize and deliver a complete set of Record Documents to the ENGINEER conforming to the construction records of the CONTRACTOR. The set of documents shall consist of corrected and annotated documents showing the as-installed equipment and all other as-built conditions not indicated on the Record Drawings.

D. The information submitted by the CONTRACTOR into the Record Drawings and Record Documents will be assumed to be correct, and the CONTRACTOR shall be responsible for the

accuracy of such information, and shall bear the costs resulting from the correction of incorrect data.

E. Delivery of Record Drawings and Record Documents to the ENGINEER will be a prerequisite to Final payment.

F. The CONTRACTOR shall maintain a copy of all books, records, and documents pertinent to the performance under this Agreement for a period of five years following completion of the contract.

END OF SECTION

SECTION 01730

OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes procedural requirements for compiling and submitting operation and maintenance data required to complete the project.

1.02 RELATED WORK

A. Submittals are included in Section 01300.

B. Contract closeout is included in Section 01700.

C. Warranties and Bonds are included in Section 01740.

1.03 OPERATING MANUALS

A. Provide operation and maintenance instructions for all electrical, mechanical, and instrumentation & controls equipment furnished under various technical specifications Sections.

B. Separate manuals shall be provided for each type of equipment, or each Section number. Each manual shall contain the following:

1. Format and Materials

a. Binders:

1) Commercial quality three ring binders with durable and cleanable plastic covers

2) Maximum ring width capacity: 3 inches

3) When multiple binders are used, correlate the data into related consistent groupings/volumes.

b. Identification: Identify each volume on the cover and spine with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". Include the following:

1) Title of Project.

2) Identify the general subject matter covered in the manual

3) Identify structure(s) and/or location(s), as applicable

4) Specification Section number

c. 20 lb loose leaf paper, with hole reinforcement

d. Page size: 8-1/2 inch by 11 inch

e. Provide heavy-duty fly leafs (section separators), matching the table of contents, for each separate product, each piece of operating equipment, and organizational sections of the manual.

f. Provide reinforced punched binder tab; bind in with text.

g. Reduce larger drawings and fold to the size of text pages - but not larger than 11 inches x 17 inches - or provide a suitable clear plastic pocket (with drawing identification) for such folded drawings/diagrams.

2. Contents:

a. A table of contents/Index

b. Specific description of each system and components

c. Name, address, telephone number(s) and e-mail address(es) of vendor(s) and local service representative(s)

d. Specific on-site operating instructions (including starting and stopping procedures)

e. Safety considerations

f. Project specific operational procedures

g. Project specific maintenance procedures

h. Manufacturer's operating and maintenance instructions – specific to the project

i. Copy of each wiring diagram

j. Copy of approved shop drawing(s) and CONTRACTOR's coordination/layout drawing(s)

k. List of spare parts and recommended quantities

l. Product Data: Mark each sheet to clearly identify specific products and component parts and data applicable to installation. Delete inapplicable information.

m. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams

n. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified.

o. Warranties and Bonds, as specified in the General Conditions

3. Transmittals

   a. Prepare separate transmittal sheets for each manual. Each transmittal sheet shall include al least the following: the CONTRACTOR's name and address, OWNER's name, project name, project number, submittal number, description of submittal and number of copies submitted.

   b. Submittals shall be transmitted or delivered directly to the office of the ENGINEER, as indicated in the Contact Documents or otherwise directed by the ENGINEER.

   c. Provide copies of transmittals (only, i.e., without copies of the respective submittal) directly to the Resident Project Representative.

C. Manuals for Equipment and Systems - In addition to the requirements listed above, for each System, provide the following:

1. Overview of system and description of unit or system and component parts. Identify function, normal operating characteristics and limiting conditions. Include performance curves, with engineering data and tests and complete nomenclature and commercial number of replaceable parts.

2. Panelboard circuit directories including electrical service characteristics, controls and communications and color coded wiring diagrams as installed.

3. Operating procedures: include start-up, break-in and routine normal operating instructions and sequences; regulation, control, stopping, shut-down and emergency instructions; and summer, winter and any special operating instructions.

4. Maintenance Requirements

   a. Procedures and guides for trouble-shooting; disassembly, repair, and reassembly instructions

   b. Alignment, adjusting, balancing and checking instructions

   c. Servicing and lubrication schedule and list of recommended lubricants

   d. Manufacturer's printed operation and maintenance instructions

   e. Sequence of operation by instrumentation and controls manufacturer

   f. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance

5. Control diagrams by controls manufacturer as installed (as-built)

6. CONTRACTOR's coordination drawings, with color coded piping diagrams, as installed (as-built)

7. Charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams. Include equipment and instrument tag numbers on diagrams.

8. List of original manufacturer's spare parts and recommended quantities to be maintained in storage

9. Test and balancing reports, as required

10. Additional Requirements as specified in individual product specification

11. Design data for systems engineered by the CONTRACTOR or its Suppliers

D. Electronic Transmission of O&M Manuals

1. Unless otherwise approved by the ENGINEER, O&M manuals may not be transmitted by electronic means other than by CD-ROM. Electronic O&M manuals shall meet the following conditions:

   a. The above-specified transmittal form is included.

   b. All other requirements specified above have been met, including, but not limited to, coordination by the CONTRACTOR, review and approval by the CONTRACTOR.

   c. The submittal contains no pages or sheets large than 11 x 17 inches.

   d. With the exception of the transmittal sheet, the entire submittal is included in a single file.

   e. Files are Portable Document Format (PDF) – with the printing function enabled.

2. When electronic copies are provided, transmit two hard-copy (paper) originals to the ENGINEER with an electronic copy on CD-ROM.

3. The electronic copy of the O&M manual must be identical in organization, format and content to the hard copies of the manual.

1.04 SERVICES OF MANUFACTURERS' REPRESENTATIVE

A. All electrical, mechanical, and instrumentation & controls equipment furnished under various technical specifications Sections shall include the cost of a competent representative of the manufacturers of all equipment to supervise the installation, adjustment and testing of the equipment; and, to instruct the OWNER's operating personnel on operation and maintenance. This supervision may be divided into two or more time periods to suit the CONTRACTOR’s schedule and/or the OWNER’s personnel availability.

B. See the detailed specifications for additional requirements for furnishing the services of manufacturer's representatives.

C. The manufacturer’s representative shall certify that the installation of the equipment is satisfactory; that the unit has been satisfactorily tested; that the equipment is ready for operation;

and, that the operating personnel have been suitably instructed in the operation, maintenance, care, and safe operation of the equipment. The *Equipment Manufacturer's Certificate of Installation, Testing, and Instruction* attached to this Section shall be used for this certification.

D. For other materials furnished under other specification Sections, furnish the services of approved representative(s) of the manufacturer when, in the opinion of the ENGINEER, some evident product failure or malfunction makes such services necessary.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 SUBMITTAL SCHEDULE

A. Operation and maintenance manuals shall be delivered directly to the office of the ENGINEER, as follows:

1. Three preliminary copies of manuals shall be submitted to the office of the ENGINEER, no later than 30 days following approval of the respective shop drawings.

2. Provide six final copies of complete manuals prior to testing and start-up.

B. The ENGINEER will review Operation and Maintenance manuals submittals on operating equipment for conformance with the requirements of the applicable specification Section. The review will generally be based on the *O&M Manual Review Checklist* appended to this Section.

C. If during test and start-up of equipment, any changes were made to the equipment, provide copies (the number specified in paragraph 3.01.A.2) of as-built drawings or any other amendments for insertion in the final manuals. Submit the required number within 30 days of start-up and testing of the facility.

3.02 VENDOR TRAINING/INSTRUCTIONS (TO OWNER's PERSONNEL)

A. Before final initiation of operation, CONTRACTOR's vendors shall train/instruct OWNER's designated personnel in the operation, adjustment, and maintenance of products, equipment and systems at times convenient to the OWNER.

B. Unless specified otherwise under the respective equipment specification section, vendor training/instruction shall consist of eight hours of training for each type of equipment. Such training/instruction shall be scheduled and held at times to accommodate the work schedules of OWNER's personnel, including splitting the required training/instruction time into separate sessions and/or presented at reasonable times other than the CONTRACTOR's "normal working hours" or the OWNER's normal day shift.

C. Use operation and maintenance manuals as basis for instruction. Train/instruct the OWNER's personnel, in detail, based on the contents of manual explaining all aspects of operation and maintenance of the equipment. If the respective equipment is inter-related to the operation of other equipment, all interlock, constraints, and permissives shall be explained.

D. At least two weeks prior to the schedule for vendor training, a detailed lesson plan, representative of the material to be covered during instruction, shall be submitted to the ENGINEER for approval. Lesson plans shall consist of in-depth outlines of the training material, including a table of contents, resume of the instructor, materials to be covered, start-up procedures, maintenance requirements, safety considerations, and shut-down procedures.

E. Prepare and insert additional data in each Operation and Maintenance Manual when the need for such data becomes apparent during training/instruction.

F. Vendor's training/instruction will be considered acceptable based on the completed *OWNER's Acknowledgement of Manufacturer's Instruction* as indicated on the Equipment Manufacturer's Certification of Installation, Testing, and Instruction appended to this Section.

3.03 VIDEOGRAPHY OF VENDOR TRAINING/INSTRUCTION

A. Audio/video (A/V) record (in DVD format) training/instructions as they are being provided to the OWNER's personnel. Such recording shall include the entire training/instruction session(s) as well as all questions and answers. A/V recording shall be performed by a professional organization experienced in the production of such recordings. Self-recording by the CONTRACTOR may be considered, provided that CONTRACTOR can demonstrate, in advance, proficient examples of such recordings.

B. To avoid audio problems, training/instruction shall be held in a location sufficiently removed from construction activity, insulated from the noise of construction activity, or during a time when construction activity is not occurring in the vicinity.

C. The audio portion of the A/V recording should be done with a microphone (wired or wireless) attached to the trainer/instructor to maximize the quality of speech.

D. Each A/V recording should have "chapters" to segregate the distinct portions of the training/instruction, or have visual cues at the start of a change in subject.

E. Two copies of the A/V recordings shall be submitted to the ENGINEER on DVD disk(s). The DVDs will become the property of the OWNER.

END OF SECTION

EQUIPMENT MANUFACTURER'S CERTIFICATE OF INSTALLATION, TESTING AND INSTRUCTION

Owner: _____

Project: _____

Contract No. _____

CDM Smith Project No._____

EQUIPMENT SPECIFICATION SECTION_____

EQUIPMENT DESCRIPTION_____

I_____, Authorized representative of
(Print Name)

_____
(Print Manufacturer's Name)

hereby CERTIFY that_____
(Print equipment name and model with serial No.)

installed for the subject project [has] [have] been installed in a satisfactory manner, [has] [have] been satisfactorily tested, [is] [are] ready for operation, and that OWNER assigned operating personnel have been suitably instructed in the operation, lubrication, and care of the unit[s] on Date: _____ Time: _____.

CERTIFIED BY: _____ DATE: _____
(Signature of Manufacturer's Representative)

OWNER'S ACKNOWLEDGMENT OF MANUFACTURER'S INSTRUCTION

[I] [We] the undersigned, authorized representatives of the _____ and/or Plant Operating Personnel have received classroom and hands on instruction on the operation, lubrication, and maintenance of the subject equipment and [am] [are] prepared to assume normal operational responsibility for the equipment:

_____ DATE: _____

_____ DATE: _____

_____ DATE: _____

O&M Manual Review Checklist

Submittal No.: _____

Project No.: _____

Manufacturer: _____

Equipment Submitted: _____

Specification Section: _____

Date of Submittal: _____

General Data

_____ 1. Are the area representative's name, address, e-mail address and telephone number included?

_____ 2. Is the nameplate data for each component included?

_____ 3. Are all associated components related to the specific equipment included?

_____ 4. Is non-pertinent data crossed out or deleted?

_____ 5. Are drawings neatly folded and/or inserted into packets?

Operations and Maintenance Data

_____ 6. Is an overview description of the equipment and/or process included?

_____ 7. Does the description include the practical theory of operation?

_____ 8. Does each equipment component include specific details (design characteristics, operating parameters, control descriptions, and selector switch positions and functions)?

_____ 9. Are alarm and shutdown conditions clearly identified? Does it describe possible causes and recommended remedies?

_____ 10. Are step procedures for starting, stopping, and troubleshooting the equipment included?

_____ 11. Is a list of operational parameters to monitor and record for specific equipment included?

_____ 12. Is a proposed operating log sheet included?

_____ 13. Is a spare parts inventory list included for each component?

_____ 14. Is a lubrication schedule for each component included - or does it clearly state “No Lubrication Required"?

_____ 15. Is a maintenance schedule for each component included?

_____ 16. Is a copy of the warranty information included?

Review Comments

Is the submittal fully approved (yes/no)?

If not, see the following are the points of rejection that must be addressed and require resubmittal by the CONTRACTOR:

Item No.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14, _____
15. _____

Reviewed By: _____ Date: _____

Legend

1 = OK

2 = Not Adequate

3 = Not Included

Note: This submittal has been reviewed for compliance with the Contract Documents.

SECTION 01740

WARRANTIES AND BONDS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.

1.02 RELATED WORK

A. Specific requirements for warranties for the work and products and installations that are specified to be warranted are included in the individual Sections.

1.03 SUBMITTALS

A. Submit written warranties to the ENGINEER prior to the date fixed by the ENGINEER for Substantial Completion. If the Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the work, or a designated portion of the work, submit written warranties upon request of the ENGINEER.

B. When a designated portion of the work is completed and occupied or used by the OWNER, by separate agreement with the CONTRACTOR during the construction period, submit properly executed warranties to the ENGINEER within 15 days of completion of that designated portion of the WORK.

C. When a special warranty is required to be executed by the CONTRACTOR, or the CONTRACTOR and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the ENGINEER for approval prior to final execution.

D. Refer to individual Sections for specific content requirements, and particular requirements for submittal of special warranties.

E. At Final Completion compile two copies of each required warranty and bond properly executed by the CONTRACTOR, or by the CONTRACTOR, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1.04 WARRANTY REQUIREMENT

A. Related Damages and Losses: When correcting warranted work that has failed, remove and replace other work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted work.

B. Reinstatement of Warranty: When work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that work covered by a warranty has failed, replace or rebuild the work to an acceptable condition complying with requirements of Contract Documents. The CONTRACTOR is responsible for the cost of replacing or rebuilding defective work regardless of whether the OWNER has benefited from use of the work through a portion of its anticipated useful service life.

D. OWNER's Recourse: Written warranties made to the OWNER are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the OWNER can enforce such other duties, obligations, rights, or remedies.

E. Rejection of Warranties: The OWNER reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the contract Documents.

F. The OWNER reserves the right to refuse to accept work for the project where a special warranty, certification, or similar commitment is required on such work or part of the work, until evidence is presented that entities required to countersign such commitments are willing to do so.

G. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the CONTRACTOR of the warranty on the work that incorporates the products, nor does it relieve suppliers, manufacturers and subcontractors required to countersign special warranties with the CONTRACTOR.

1.05 MANUFACTURERS CERTIFICATIONS

A. Where required, the CONTRACTOR shall supply evidence, satisfactory to the ENGINEER, that the CONTRACTOR can obtain manufacturers' certifications as to the CONTRACTOR's installation of equipment.

1.06 DEFINITIONS

A. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the OWNER.

B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the OWNER.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

Division 2 Site Construction

SECTION 02100

SITE PREPARATION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials and equipment required and perform all site preparation, complete as shown on the Drawings and as specified herein.

B. Obtain all permits required for site preparation work prior to proceeding with the work, including clearing, and tree removal.

C. The areas to be cleared, grubbed and stripped within public rights-of-way and utility easements shall be minimized to the extent possible for the scope of pipeline work and in consideration of the actual means and methods of construction used. No unnecessary site preparation within these areas shall be performed.

1.02 RELATED WORK

A. Biological and Cultural Resources Environmental Controls is included in Section 01561.

B. Earthwork is included in Section 02200.

C. Revegetation is included in Section 02930.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, copies of all permits required prior to clearing, grubbing, and stripping work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 CLEARING

A. Cut and remove all timber, trees, stumps, brush, shrubs, roots, grass, weeds, rubbish and any other objectionable material resting on or protruding through the surface of the ground.

B. Preserve and protect trees and other vegetation larger than 3-inches in diameter at the base as directed by the ENGINEER to remain as specified below.

3.02 GRUBBING

A. Grub and remove all stumps, roots in excess of 1-1/2-in in diameter, matted roots, brush, timber, logs, concrete rubble and other debris encountered to a depth of 18-in below original grade or 18-in beneath the bottom of roadway subbase, whichever is deeper.

B. Refill all grubbing holes and depressions excavated below the original ground surface with suitable materials and compact to a density conforming to the surrounding ground surface in accordance with Section 02200.

3.03 STRIPPING

A. Strip topsoil from all areas to be excavated or filled.

B. Topsoil shall be free from brush, trash, large stones and other extraneous material. Avoid mixing topsoil with subsoil.

C. Stockpile and protect topsoil until it is used in landscaping, loaming and seeding operations. Dispose of surplus topsoil after all work is completed.

3.04 DISPOSAL

A. Cut tree trunks and limbs exceeding 4-in in diameter shall be cut into 4-ft lengths.

B. Dispose of material and debris from site preparation operations by hauling such materials and debris to an approved offsite disposal area. No rubbish or debris of any kind shall be buried on the site.

C. Burning of cleared and grubbed materials or other fires for any reason will not be permitted.

D. At the Broderson site, chip eucalyptus and stockpile to be used as mulch.

3.05 PROTECTION

A. Trees and other vegetation larger than 3-inches at the base as directed by the ENGINEER to remain, shall be protected from damage by all construction operations by erecting suitable barriers, guards and enclosures, or by other approved means. Conduct clearing operations in a manner to prevent falling trees from damaging trees and vegetation designated to remain and to the work being constructed and so as to provide for the safety of employees and others.

B. Maintain protection until all work in the vicinity of the work being protected has been completed.

C. Do not operate heavy equipment or stockpile materials within the branch spread of existing trees.

D. Immediately repair any damage to existing tree crowns, trunks, or root systems. Roots exposed and/or damaged during the work shall immediately be cut off cleanly inside the exposed or damaged area.

E. When work is completed, remove all dead and downed trees. Live trees shall be trimmed of all dead and diseased limbs and branches. All cuts shall be cleanly made at their juncture with the trunk or preceding branch without injury to the trunk or remaining branches.

F. Restrict construction activities to those areas within the limits of construction designated on the Drawings, within public rights-of-way, and within easements provided by the ENGINEER. Adjacent properties and improvements thereon, public or private, which become damaged by construction operations shall be promptly restored to their original condition, to the full satisfaction of the property owner.

END OF SECTION

SECTION 02140

DEWATERING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and remove and dispose of all surface water and ground water entering excavations.

B. The CONTRACTOR is hereby advised that the presence of sands and other permeable materials and extensive and shallow groundwater at the project sites present an appreciable construction challenge. The CONTRACTOR shall plan, include all costs in its bid and execute the project construction accordingly

1. Groundwater conditions are shallow in many areas of the project site. In some areas of the project site groundwater daylights on the surface resulting in areas of ponding, springs, and seeps. Certain project areas are prone to flooding.

2. Groundwater and surface conditions along the coastal areas of the project site (southern shore of Morro Bay) are likely influenced by tidal fluctuations. Groundwater level will also fluctuate seasonally and with variation in storm water runoff, irrigation schedules, rainfall, and other factors.

3. Although the soil conditions encountered generally consist of sandy materials, layers of moderately cemented, dense sand and clay were encountered in some of the geotechnical investigation explorations at depth. These types of conditions can perch groundwater and subsequently reduce the effectiveness of dewatering wells constructed at depth to drawdown the water table.

C. The CONTRACTOR shall obtain and abide by all permits necessary for dewatering including from the Regional Water Quality Control Board (RWQCB). See also Section 01060 – Regulatory Agency and Utility Requirements.

D. An NPDES Construction Authority Storm Water Permit has been obtained by the OWNER. The CONTRACTOR shall modify the permit prior to beginning construction activities (see SWPPP requirements in Section 01570). The CONTRACTOR's dewatering water disposal activities shall be in compliance with the requirements of the same.

E. The CONTRACTOR shall thoroughly review the project Geotechnical Report prior to developing the dewatering approach and plan.

F. The CONTRACTOR shall thoroughly review the Dewatering Plan Technical Memorandum provided as an attachment to these specifications prior to developing the dewatering approach and plan.

1.02 RELATED WORK

A. Storm Water Pollution Prevention Plan is included in Section 01570.

B. Earthwork is included in Section 02200.

1.03 SUBMITTALS

A. Submit for ENGINEER's review, in accordance with Section 01300, shop drawings showing details of dewatering system including proposed areas for drainage disposal. At the time of the first excavation, the CONTRACTOR shall be required to demonstrate the system proposed and to verify that adequate equipment, personnel, and materials are provided to dewater the excavations at all locations and times.

B. Submit copies of all permits obtained for or related to the disposal of water.

1.04 QUALITY CONTROL

A. The CONTRACTOR shall have the sole responsibility to control the rate and effect of the dewatering in such a manner as to avoid all objectionable settlement and subsidence.

B. All dewatering operations shall be adequate to assure the integrity of the finished project and shall be the responsibility of the CONTRACTOR.

C. Where critical structures or facilities exist immediately adjacent to areas of proposed dewatering, reference points shall be established and observed at frequent intervals to detect any settlement that may develop. The responsibility for conducting the dewatering operation in a manner that will protect adjacent structures and facilities rest solely with the CONTRACTOR. The cost of repairing structures and restoration of facilities shall be the responsibility of the CONTRACTOR.

PART 2 PRODUCTS

2.01 MATERIALS

A. Piping, pumping equipment, trucking transport, and all other materials required to provide dewatering of excavations shall be suitable for the intended purpose. Standby pumping units shall be maintained at the site to be used in case of failure of the normal pumping units.

B. The CONTRACTOR shall provide a dewatering system failure alarm with auto dialer or a person to monitor the system during working and non-working hours.

PART 3 EXECUTION

3.01 DEWATERING AND DRAINAGE SYSTEM

A. At all times during construction, provide and maintain proper equipment and facilities to remove all water entering excavations, and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fills, structures or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels.

B. Conduct dewatering in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation. Construct well or sump installation with proper sand filters to prevent drawing of finer grained soil from the surrounding ground.

C. Collect water entering the excavation from surface runoff in shallow ditches around the perimeter of the excavation, drain to sumps and pump from the excavation to maintain a bottom free from standing water.

D. Take all additional precautions to prevent uplift of any structure during construction. All such arrangements shall be subject to the approval of the ENGINEER.

E. Dispose of drainage so that flow or seepage back into the excavated area damage to adjacent property is to be prevented. Disposal area shall be approved by the ENGINEER. CONTRACTOR shall be responsible for obtaining any permits that may be necessary for disposal of water.

F. Prevent flotation by maintaining a positive and continuous operation of the dewatering system. If for any reason the dewatering system is found to be inadequate, make additions, changes and replacements, as necessary, to provide a satisfactory system at no additional cost to the OWNER. All damage resulting from failure to properly dewater excavations shall be repaired to the satisfaction of the ENGINEER at no additional cost to the OWNER.

G. Dewatering facilities shall be designed with filters such that sand and fine grained materials are not removed from the soil during dewatering. All dewatering water shall be desilted to discharge.

3.02 DISPOSAL OF DEWATERING WATER

A. The CONTRACTOR shall dispose of dewatering water removed from the WORK in a suitable manner without damage to adjacent property. The CONTRACTOR shall be responsible to obtain any permits that may be necessary to dispose of the water. The CONTRACTOR shall be responsible to furnish all temporary equipment, piping, valves, and appurtenances to accomplish the acceptable disposal of dewatering water.

B. The CONTRACTOR shall include a description of the dewatering water disposal approach with locations and methods of dewatering water collection, conveyance, and discharge in the dewatering plan submittal specified in Paragraph 1.03.A herein. The description shall also include a summary of the monitoring and reporting approach.

C. The CONTRACTOR may not utilize the collection system sewer mains for conveyance of dewatering water. The CONTRACTOR shall truck the dewatering water to the approved disposal sites subject to the following requirements:

1. The dewatering water shall be pretreated, if necessary, to remove any sediments and silts prior to discharge to the sewer mains. The water shall be settled or filtered to remove sand and fine-sized soil particles. The dewatering water discharge shall not exceed 3 ml/l of settleable solids.

2. Dewatering pumps shall be furnished by the CONTRACTOR. The use of wastewater pumps to be installed as part of the WORK shall not be used for conveyance of dewatering water.

3. The dewatering pumps shall be electric motor driven and served by the local electrical utility for normal operation. The CONTRACTOR may provide for portable engine-generator sets to provide standby electrical power in the event of a power outage. The engine-generator sets shall not operate when service from the electrical utility is available to minimize noise propagation to residential neighborhoods.

D. The CONTRACTOR is directed to plan and develop the methods of disposal for dewatering water in the following order of priority:

1. Dewatering water, when available, shall be used for auxiliary construction activities such as earthwork compaction and dust control to conserve the use of potable water and to minimize the disposal volume of dewatering water.

2. Dewatering water may be transported to the stormwater infiltration basin near the Mid-Town Pump Station. This new publically owned stormwater infiltration basin is located east of the Mid-Town Pump Station near the intersection of Los Osos Valley Road and Palisades Avenue.

3. Dewatering water may be transported to other publically owned stormwater retention basins. Existing publically owned stormwater retention basins are located south of the East Ysabel Pump Station near the intersection of South Bay Boulevard and Santa Ysabel Avenue and southeast of the intersection of Santa Ynez Avenue and Fairchild Way.

4. The CONTRACTOR may seek the use of privately owned retention basins and/or open lots to develop percolation or irrigation fields for disposal where feasible. If used, the CONTRACTOR shall furnish written confirmation from the property owner of the retention basin or field that such use is acceptable. Such use is subject to the approval of the ENGINEER pending a determination of whether the use of each proposed site is within the provisions of project environmental permits and agreements.

5. Use outfalls from stormwater drainage pump stations or stormwater channels are permissible, subject to water quality monitoring and treatment requirements. Possible existing stormwater drainage pump station outfalls or stormwater channel are listed as follows:

   a. The outfall of the stormwater drainage pump station located at the intersection of Don Avenue and Mitchell Drive.

   b. The outfall of the stormwater drainage pump station located at the intersection of 8th Street and El Moro Avenue.

   c. The Walker Ditch, a reinforced concrete channel located at the intersection of 18th Street and Paso Robles Avenue.

E. The discharge of dewatering water shall not be allowed during storm events and any subsequent runoff periods when stormwater flow is entering the stormwater drainage facilities.

F. If dewatering water is disposed of to any location that is tributary to surface waters, including existing outfalls from stormwater drainage pump stations or stormwater channels, the CONTRACTOR shall be required to monitor and report the status of each dewatering location and discharge location. Representative grab samples of dewatering water at each discharge location shall be obtained and analyzed for the parameters and at the frequency shown below. Samples will be required to meet the following water quality objectives:

Parameter	Sample Frequency	Water Quality Objective
Fecal Coliform	Weekly	14 MPN/100ml median; no more than 10% exceed 43 MPN/100ml

Parameter	Sample Frequency	Water Quality Objective
Settleable Solids	Weekly	250 NTU (NAL)/500 NTU (NEL)
Ammonia	Monthly	24 mg/L (as N)
pH	Monthly	6.5 to 8.5 (NAL)

The monthly report shall also include the locations and duration (date and time) of construction dewatering sources and the estimated volumes of construction dewatering water discharges. A description of any corrective actions shall be included with the report if noncompliance with any water quality objective occurs.

G. If disinfection is required to meet the water quality objectives, the CONTRACTOR shall provide suitable disinfection to meet the fecal coliform limitation. The disinfection facilities shall include liquid hypochlorite storage and feed equipment, disinfection tank with minimum 30-minute detention time at the dewatering flow rate, liquid sodium bisulfite dechlorination storage and feed equipment, and ancillary controls and instrumentation for automated operation, monitoring, and alarms. Liquid chemical facilities shall include suitable spill containment and safety devices. Alternative disinfection methods such as UV disinfection may be used, subject to the review and acceptance of the ENGINEER, except that the use of gaseous chlorine and/or sulfur dioxide shall not be allowed. The cost of disinfection shall be included in the lump sum price of the Dewatering bid item and no additional payment will be allowed therefor.

END OF SECTION

SECTION 02200

EARTHWORK

PART 1 GENERAL

1.00 STATUTORY REQUIREMENTS

A. All excavation, trenching, sheeting, bracing, etc shall comply with the requirements of OSHA excavation safety standards (29 CFR Part 1926.650 Subpart P), State and local requirements. Where conflict between OSHA, State and local regulations exists, the most stringent requirements shall apply.

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and perform all excavation work and grading; place and compact backfill and fill; and dispose of unsuitable, waste and surplus materials as shown on the Drawings and as specified herein.

B. Provide the services of a licensed professional engineer registered in the State of California, to prepare temporary excavation support system designs and submittals.

C. Furnish and install temporary excavation support systems, including sheeting, shoring and bracing, to insure the safety of personnel and protect adjacent structures, piping, etc, in accordance with Federal, State and local laws, regulations and requirements.

1.02 RELATED WORK

A. Site Preparation is included in Section 02100.

B. Dewatering is included in Section 02140.

C. Trenching, Backfilling and Compaction is included in Section 02221.

D. Revegetation are included in Section 02930.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, the proposed methods of construction, including excavation, excavation support systems designs, backfilling and filling and compaction for the various portions of the work. Excavation support system designs shall be prepared by a licensed professional engineer, registered in the State of California, having a minimum of 5 years of professional experience in the design and construction of excavation support systems. Review will be for information only. CONTRACTOR shall remain responsible for adequacy and safety of construction means, methods, and techniques.

B. The CONTRACTOR shall submit a copy of the excavation permit issued by the California Department of Industrial Safety.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM C33 – Standard Specification for Concrete Aggregates

2. ASTM D422 – Standard Test Method for Particle-Size Analysis of Soils

3. ASTM D806 - Standard Test Method for Cement Content of Hardened Soil-Cement Mixtures

4. ASTM D1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.

5. ASTM D1633 – Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

6. ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

7. ASTM D3786 - Standard Test Method for Bursting Strength of Textile Fabrics, Diaphragm Bursting Strength Tester Method

8. ASTM D4355 - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus

9. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity

10. ASTM D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles

11. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile

12. ASTM D5261 - Standard Test Method for Measuring Mass per Unit Area of Geotextiles

13. ASTM D5982 – Standard Test Method for Determining Cement Content of Fresh Soil-Cement (Heat of Neutralization Method)

B. California Test Methods (CTM)

1. CTM 216 – Method of Test for Relative Compaction of Untreated and Treated Soils

2. CTM 217 – Method of Test for Sand Equivalent

3. CTM 229 – Method of Test for Durability Index

4. CTM 231 – Method of Test for Relative Compaction of Untreated/Treated Soils and Aggregates

5. CTM 301 – Method of Test for Determining the Resistance "R" Value of Treated and Untreated Bases, Subbases and Basement Soils by the Stabilometer

6. CTM 422 – Method of Testing Soils and Waters for Chloride Content

7. CTM 643 – Method for Determining Field and Laboratory Resistivity and pH Measurements for Soil and Water

C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. Prior to and during the placement of backfill and fill coordinate with the soils testing laboratory to perform in-place soil density tests to verify that the backfill/fill material has been compacted in accordance with the compaction requirements specified elsewhere. The ENGINEER may designate areas to be tested.

1.06 DEFINITIONS

A. Where the phrase "in-the-dry" is used in this Section, it shall be defined to mean a soil condition such that the in-place moisture content of the soil at that time is no more than two percentage points above the optimum moisture content of that soil as determined by the laboratory test of the moisture-density relation appropriate to the specified level of compaction.

B. Where used in this Section "structures" refers to all buildings, wet wells, manholes and below grade vaults. Stormwater structures and duct banks are not considered structures in this context.

PART 2 PRODUCTS

2.01 SUITABLE FILL AND BACKFILL MATERIAL REQUIREMENTS

A. Fill, backfill, and embankment materials shall be selected or processed clean, fine earth, rock, or sand, free from grass, roots, brush, or other vegetation.

B. Fill and backfill materials to be placed within 6 inches of any structure or pipe shall be free of rocks or unbroken masses of earth materials having a maximum dimension larger than 3 inches.

C. Suitable Materials: Materials not defined as unsuitable below are defined as suitable materials and may be used in fills, backfilling, and embankment construction subject to the indicated limitations. In addition, when acceptable to the ENGINEER, some the material listed as unsuitable may be used when thoroughly mixed with suitable material to form a stable composite.

D. Suitable materials may be obtained from on-site excavations, may be processed on-site materials, or may be imported. If imported materials are required by this Section or to meet the quantity requirements of the project, the CONTRACTOR shall provide the imported materials at no additional expense to the OWNER.

E. The following types of suitable materials are defined.

1. Type A. (three-quarters inch minus granular backfill): Crushed rock or gravel, and sand with the gradation requirements below. The material shall have a minimum sand equivalent value of 28 and a minimum R-value of 78. If the sand equivalent value exceeds 35 the R-value requirement is waived.

Sieve Size	Percentage Passing
3/4-inch	100
No. 4	30 - 50
No. 200	0 - 12

2. Type B (Class 1 crushed stone): Manufactured angular, crushed stone, crushed rock, or crushed slag with the following gradation requirements. The materials shall have a minimum sand equivalent value of 75.

Sieve Size	Percentage Passing
3/4-inch	100
No. 4	30-50
No. 200	0-5

3. Type C (sand backfill): Sand with 100 percent passing a 3/8-inch sieve, at least 90 percent passing a Number 4 sieve, and a sand equivalent value not less than 30.

4. Type D (sand): Native sand or import, material having a sand equivalent of at least 30, free from clay or organic material, and complying with the grading requirements shown in the following table:

Sieve Size	Percentage Passing
No. 4	90 - 100
No. 200	0-5

5. Type E (free-draining backfill): Crushed rock or gravel with the following gradation requirement (Size Number 8 in ASTM C 33 – Concrete Aggregates):

Sieve Size	Percentage Passing
½”	100
3/8”	85 - 100
No. 4	10 - 30
No. 8	0 - 10
No. 16	0 - 5

6. Type F (coarse drainrock): Crushed rock or gravel comprised of hard, durable particles that are free of slaking or decomposition under the action of alternate wetting or drying cycles. Drainrock shall have a durability index of at least 40 when tested according to California Test Method 229. The material shall meet the following gradation requirements:

Sieve Size	Percentage Passing
2”	100
1 ½”	90 - 100
1”	30 - 70
¾”	0 - 15
No. 4	0 - 5

7. Type G (Class 2 aggregate base): Aggregate base material of such nature that it can be compacted readily by watering and rolling to form a firm, stable base for pavements. Aggregate may include material processed from reclaimed asphalt concrete, Portland cement concrete, lean concrete base, cement treated base, or a combination of any of these materials. The amount of reclaimed material shall not exceed 50 percent of the total volume of the aggregate used.

   At the option of the CONTRACTOR, the grading for either the 1-1/2-inch maximum size of ¾-inch maximum size gradation shall be used. The sand equivalent value shall not be less than 22, and the material shall meet the following gradation and quality requirements:

	Percentage Passing	
Sieve Size	1-1/2-inch Max. Gradation	3/4-inch Max Gradation
2-inch	100	-
1-1/2-inch	90 - 100	-
1-inch	-	100
¾-inch	50 - 85	90 – 100
No. 4	25 - 45	35 – 60
No. 30	10 - 25	10 – 30
No. 200	2 - 9	2 - 9

Quality Requirements

Test	Test Method	Minimum Value
Resistance (R-value)	Calif. 301	78
Sand Equivalent	Calif. 217	22
Durability Index	Calif. 229	35

8. Type H (graded drainrock): Drainrock shall be crushed rock or gravel, durable and free from slaking or decomposition under the action of alternative wetting or drying. Graded drainrock shall have a durability index of at least 40 when tested according to California Test Method 229. The material shall meet the following gradation requirements (Size Number 57 in ASTM C 33):

Sieve Size	Percentage Passing
1 ½"	100
1"	95 – 100
½"	25 – 60
No. 4	0 – 10
No. 8	0 – 5

The drainrock shall have a sand equivalent value not less than 75. The finish graded surface of the drainrock immediately beneath hydraulic structures shall be stabilized to provide a firm, smooth surface upon which to conduct reinforced concrete floor slabs.

9. Type I: Select Native Backfill, Retaining Wall Backfill, Embankment Fill, and General Fill. Suitable on-site or imported material that is free of organics, debris, oversized material greater than 3 inches, or other deleterious materials and meets the requirements of Paragraph 2.03.

10. Type K (topsoil): Stockpiled topsoil material which has been obtained at the site by removing soil to depth not exceeding 2 feet. Removal of the topsoil shall be done after the area has been stripped of vegetation and debris.

11. Type L (flowable fill): Flowable fill shall be in accordance with Section 02210 – Flowable Fill.

12. Type M (Aggregate Subbase): Aggregate subbase material that can be compacted readily by watering and rolling to form a firm stable base. Aggregate shall conform to the grading and quality requirements shown in the following tables:

Sieve Size	Percentage Passing
3"	100
2 ½"	90 to 100
No. 4 (4.75 mm)	35 to 70
No. 200 (0.075 mm)	0 to 20

Quality Requirements

Test	Method	Minimum Value
Sand Equivalent	Calif. 217	18
R-Value	Calif. 301	60

13. Type N (trench plug): Low permeable fill material, a non-dispersible clay material having a minimum plasticity index of 10. Alternatively, Flowable Fill may be used for trench plug construction.

14. Type O (bank-run gravel): Bank-run gravel shall consist of material obtained from a natural source that meets the following gradation requirements:

Sieve Size	Percentage Passing
2-inch	100
1-1/2-inch	90 - 100
¾-inch	50 - 85
No. 4	25 - 45
No. 30	10 - 25
No. 200	2 - 9

2.02 UNSUITABLE MATERIAL

A. Unsuitable materials include the materials listed below.

1. Soils which, when classified under ASTM D 2487 – Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System), fall in the classifications of PT, OH, CH, MH, or OL.

2. Soils which cannot be compacted sufficiently to achieve the density specified for the intended use. Also see Paragraph 2.02.A.6.

3. Materials that contain hazardous or designated waste materials including petroleum hydrocarbons, pesticides, heavy metals, and any material which may be classified as hazardous or toxic according to applicable regulations.

4. Soils that contain greater concentrations of chloride or sulfate ions, or have a soil resistively or pH less than the existing on-site soils.

5. Topsoil, except as allowed below.

6. Soils that cannot be compacted because they are at greater than optimum moisture content are not unsuitable. The CONTRACTOR shall blade, aerate and/or mix with dry material such that optimum moisture is achieved.

2.03 USE OF FILL, BACKFILL, AND EMBANKMENT MATERIAL TYPES

A. The CONTRACTOR shall use the types of materials as designated herein for all required fill, backfill, and embankment construction hereunder.

B. Where these Specifications conflict with the requirements of any local agency having jurisdiction or with the requirements of a pipe material manufacturer, the ENGINEER shall be immediately notified. In case of conflict between types of pipe embedment backfills, the CONTRACTOR shall use the agency-specified backfill material if that material provides a greater degree of structural support to the pipe, as determined by the ENGINEER. In case of conflict between types of trench or final backfill types, the CONTRACTOR shall use the agency-specified backfill material if that material provides the greater in-place density after compaction.

C. Fill and backfill types shall be used in accordance with the following provisions:

1. Embankment fills and General Fill shall be constructed of Type I material, as defined herein.

Fill materials to be placed within3 feet of finished grade in pavement areas shall have an R-value of at least 50 as determined by CTM 301.

Imported fill materials used in building areas shall have an Expansion Index of less than 20. Imported fill materials shall be reviewed by the ENGINEER prior to being brought to the site; however, imported fill material shall comply with all specifications for those materials as placed at the site.

2. Pipe zone backfill, as defined under "Pipe and Utility Trench Backfill" below, shall consist of the following materials.

   a. For dry trench conditions (i.e. non-groundwater areas) for pipelines up to 12 inches in diameter, the pipe zone material shall be Type D material obtained on-site. At the CONTRACTOR's option and cost imported materials may be used. Suitable imported materials are Types D, E, and G. If Type E is used, the CONTRACTOR shall wrap the bedding in geosynthetic filter fabric, also at its cost.

   b. For pipelines 12 inches and greater in diameter and for all pipelines in wet trench conditions (i.e. in groundwater areas with proper dewatering) the pipe zone from below the pipe to the pipe springline shall consist of Type E backfill wrapped in geosynthetic filter fabric..

3. Trench zone backfill for pipelines as defined under "Pipe and Utility Trench Backfill" shall be Type I backfill material. Trench zone backfill material shall have at least 85 percent of the material passing the No. 4 sieve. Type K material may be used for trench zone backfill in agricultural areas unless otherwise shown or specified.

4. Final backfill material for pipelines under paved areas, as defined under "Pipe and Utility Trench Backfill" shall be Type G backfill material. Final backfill under areas not paved shall be the same material as that used for trench backfill, except Type K material shall be used for the final backfill in agricultural areas unless otherwise indicated.

5. Trench backfill and final backfill for pipelines under structures shall be the same material as used in the pipe zone, except where concrete encasement is required by the Contract Documents.

6. Aggregate base materials under pavements shall Type G material constructed to the thickness indicated. Aggregate subbase shall be Type M material. Trench backfill materials placed within 3 feet of finished grade in pavement areas shall have an R-value of at least 50 as determined by Caltrans Test 301.

7. Backfill around structures shall be Type I material, except as shown.

8. Structural Fill shall be as follows:

   a. Drainrock materials under hydraulic structures or other water retaining structures with underdrain systems shall be Type H material.

   b. Under concrete hydraulic structures or other water retaining structures without underdrain systems, Types G or H materials shall be used.

c. Under structures where groundwater must be removed to allow placement of concrete, Type F material wrapped in geotextile shall be used.

d. For all other Structural Fill applications, Type G or H material shall be used.

9. Backfill for disposal system vertical well and horizontal French drain type systems shall be Type E gravel.

10. Gravel backfill for the retaining wall chimney and collection drains shall be a Type H material.

11. Retaining wall backfill material shall consist of a Type I native or imported material conforming to Caltrans Standard Specifications for Structural Backfill, Section 19-3.06, and having a sand equivalent (SE) of at least 30.

12. The top 6 inches of fill on reservoir roofs, embankment fills around hydraulic structures, and all other embankment fill shall consist of Type K material, topsoil.

13. Geosynthetics used for filter fabric must be permeable and nonwoven. Filter fabric must be manufactured from polyester, polypropylene, or a combination thereof. The properties of filter fabric must have the values shown in the following table:

Property	Test	Value		
		Class A	Class B	Class C
Grab breaking load, 1-inch grip, lb (min. in each direction)	ASTM D4632	157		
Apparent elongation, percent (min. in each direction)	ASTM D 4632	50		
Min. hydraulic bursting strength, psi	ASTM D 3786	210		
Ultraviolet resistance, percent min retained grab breaking load, 500 hours	ASTM D 4355	70		
Permittivity, sec^{-1} min	ASTM D 4491	0.5	0.2	0.1
Max. apparent opening size, average roll value, U.S. standard sieve size	ASTM D 4751	40	60	70

14. Geotextile for Subgrade Stabilization: Geotextile to be used for subgrade stabilization in building areas shall fabric must be a permeable, nonwoven, needle-punched geotextile. The fabric must be manufactured from polyester, polypropylene, or a combination thereof. Polymers must be either virgin compounds or clean reworked material. Do not subject virgin compounds to use or processing other than required for initial manufacture. Clean reworked material must be previously processed material from the processor's own production that has been reground, pelletized, or solvated. The fabric must not contain more than 20 percent of clean reworked material by weight. Do not use recycled materials from either post-consumer or post-industrial sources. The properties of the geotextile must have the values shown in the following table:

Property	Test	Value
Minimum mass, oz/sq yd	ASTM D 5261	7.5
Grab breaking load, lb, 1-inch grip (minimum in each direction)	ASTM D 4632	200
Apparent elongation, percent (minimum in each direction)	ASTM D 4632	50
Minimum permittivity, sec^{-1}	ASTM D 4491	1.0
Apparent opening size, U.S. Standard sieve size:	ASTM D 4751	70–100
Ultraviolet resistance, percent (minimum retained grab breaking load, 500 hours)	ASTM D 4355	70

2.04 MATERIALS TESTING

A. All soils testing of samples submitted by the CONTRACTOR will be done by a testing laboratory of the ENGINEER's choice and at the OWNER's expense. At its discretion, the ENGINEER may request that the CONTRACTOR supply samples for testing of any material used in the work. All materials shall comply with the specifications as-placed at the job site.

B. Particle size analysis of soils and aggregates will be performed using ASTM D 422 – Standard Test Method for Particle-Size Analysis of Soils.

C. Determination of sand equivalent value will be performed using CTM 217.

D. Unified Soil Classification System: References in the Section to soil classification types and standards shall have the meanings and definitions indicated in ASTM D 2487. The CONTRACTOR shall be bound by all applicable provisions of said ASTM D 2487 in the interpretation of soil classifications.

E. The testing for chloride, sulfate, resistively, and pH will be done in accordance with California Test Methods 417, 422, and 643 of the California Department of Transportation.

PART 3 EXECUTION

3.01 PREPARATION

A. Potholes

1. Perform exploratory excavation work (potholes) for the purpose of verifying the location of underground utilities and structures and to check for unknown utilities and structures, prior to commencing excavation work.

2. Potholes shall be backfilled as soon as the desired information has been obtained. Backfilled surfaces shall be stabilized in accordance with approved erosion and sedimentation control plans.

B. Dewatering and Drainage Systems

1. Temporary dewatering and drainage systems in accordance with Section 02140 shall be in place and operational prior to beginning excavation work.

3.02 EXCAVATION SUPPORT

A. Furnish, install, monitor and maintain excavation support (e.g., shoring, sheeting, bracing, trench boxes, etc) as required by Federal, State or local laws, ordinances, regulations and safety requirements. Support the sides of excavation, to prevent any movement which could in any way reduce the width of the excavation below that necessary for proper construction and protect adjacent structures from undermining, settlement or other damage. Take care to prevent the formation of voids outside of sheeting. If voids occur behind sheeting, immediately backfill and compact the voids with General Fill material. Voids in locations that cannot be properly compacted upon backfilling shall be filled with lean concrete.

B. Install excavation supports outside the neat lines of foundations. Supports shall be plumb and securely braced and tied in position. Excavation support shall be adequate to withstand all pressures to which the supports will be subjected. Any movement or bulging of supports shall be corrected to provide the necessary clearances, dimensions and structural integrity.

C. Excavation Supports Left in Place

1. The OWNER or ENGINEER may direct that certain excavation supports remain in place, or be cut off at any specific elevation. If the CONTRACTOR believes that such a directive increases CONTRACTOR's cost and would thereby entitle CONTRACTOR to a change in contract cost, CONTRACTOR shall notify the ENGINEER in accordance with the applicable article(s) in the General Conditions pertaining to changes in the work.

2. The right of the OWNER or ENGINEER to direct that certain excavation supports remain in place shall not be construed as creating any obligation on the OWNER or ENGINEER to give such direction, nor shall failure to give such direction relieve the CONTRACTOR from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the CONTRACTOR to leave in place sufficient excavation supports to prevent any movement of the ground or damage to adjacent structures.

D. Excavation supports shall be carefully removed in such manner so as not to endanger the WORK or other adjacent structures, utilities, or property. All voids left or caused by withdrawal of supports shall be immediately filled with sand and compacted.

3.03 STRUCTURAL EXCAVATION PROCEDURES

A. Excavations for structures shall be suitably wide for construction of the structures, including excavation supports, dewatering and drainage systems and working clearances.

B. Excavation shall be performed in-the-dry and shall be accomplished by methods which preserve the undisturbed state of subgrade soils. Drainage and dewatering systems shall be in place and operational prior to beginning excavation work. In no case shall the earth be plowed, scraped or excavated by any means so near to the finished subgrade that would disturb the finished subgrade. Hand excavation of the final 3 to 6-in may be required to obtain a satisfactory, undisturbed subgrade. Subgrade soils which become soft, loose, "quick", or otherwise unsatisfactory for support of structures as a result of inadequate excavation, dewatering, or other construction methods shall be removed and replaced with lean concrete or structural fill as

defined in paragraph 2.03.C.8, subject to prior approval by the ENGINEER, at no additional cost to the OWNER.

C. Subgrade Preparation

1. All structures unless otherwise shown on the Drawings or otherwise specified herein:

   a. Compact the top 12-in of subgrade to a minimum of 95 percent relative compaction (based on ASTM D1557 or CTM 216).

2. Where existing subgrade contains a significant amount of clay or cohesive soils, over-excavate sufficiently below the bottom of structure for placement of a lean concrete working mat. Prior to placing the lean concrete working mat, compact the top 12-in of existing subgrade to a minimum of 95 percent relative compaction (based on ASTM D1557 or CTM 216).

D. When excavations have reached the required subgrade, including any allowances for working mats or base materials, prior to the placement of working mats or base materials, notify the soils testing laboratory to verify the suitability of the existing subgrade soils for the anticipated foundation and structural loadings. If the existing subgrade soils are determined to be unsuitable, direction will be provided by the ENGINEER regarding removal and replacement with suitable materials. If CONTRACTOR believes that such direction would increase CONTRACTOR's cost and would thereby entitle CONTRACTOR to a change in Contract cost, CONTRACTOR shall notify the ENGINEER in accordance with the applicable article(s) in the General Conditions pertaining to changes in the work.

E. Over-excavation beyond the limits and depths required by the Contract Documents shall be replaced at no additional cost to the OWNER by lean concrete or other approved material subject to the prior approval of the ENGINEER.

3.04 GENERAL FILLING AND BACKFILLING PROCEDURES

A. Fill and backfill materials shall be placed in lifts to suit the specified compaction requirements to the lines and grades required, making allowances for settlement and placement of cover materials (i.e. topsoil, sod, etc). Soft spots or uncompacted areas shall be corrected.

B. Compaction in open areas may be accomplished by any of the following methods: compaction equipment, fully loaded ten-wheel trucks, tractor dozers weighing at least 30,000 lbs and operated at full speed, or heavy vibratory rollers. Compaction in confined areas (including areas within a 45 degree angle extending upward and outward from the base of a wall) and in areas where the use of large equipment is impractical, shall be accomplished by hand operated vibratory equipment or mechanical tampers. Lift thickness shall not exceed 6-in (measured before compaction) when hand operated equipment is used.

C. Fill and backfill shall not be placed and compacted when the in-place moisture content of the soil at that time is more than three percentage points above the optimum moisture content of that soil as determined by the laboratory test of the moisture-density relation appropriate to the specified level of compaction.

3.05 FILL AND BACKFILL PROCEDURES

A. Fill required beneath foundations or slabs on grade (except sidewalks) shall be structural fill as defined in paragraph 2.03.C.8. Place and compact structural fill in even lifts having a maximum thickness (measured before compaction) of 8-in.

B. Fill and backfill material placed immediately adjacent to and within 10-ft of all structures shall be Type I fill. All structure water-tightness tests and dampproofing/waterproofing shall be completed prior to placing fill or backfill around structures. Place and compact fill in even lifts having a maximum thickness (measured before compaction) of 8-in uniformly around the structure.

C. General fill may be used in areas beyond those designated for select fill unless shown or specified otherwise. General fill shall be placed in even lifts having a maximum thickness (measured before compaction) of 12-in.

3.06 EMBANKMENT FILL PROCEDURES

A. Prior to placing embankment fill materials, all organic materials (including peat and loam) and loose inorganic silt material (loess) shall be removed from areas beneath the embankments. If the subgrade slopes are excessive, the subgrade shall be stepped to produce a stable, horizontal surface for the placement of embankment materials. The existing subgrade shall then be scarified to a depth of at least 6-in.

B. Embankment fill shall consist of material meeting the specifications in paragraph 2.03.C.1. and be placed and compacted in even lifts (measured before compaction) of 12-in.

C. Rock may be used in embankment fill only with prior, written approval of the ENGINEER.

3.07 IMPERVIOUS FILL

A. Impervious fill shall consist of Type N material and be placed in controlled, even lifts having a maximum thickness (measured before compaction) of 6-in. Compaction shall be sufficient to attain a permeability of less than $1x10^{-7}$ cm/sec.

B. Moisture content of impervious fill to be compacted shall be maintained at or near its optimum moisture content (minus 2 to plus 3 percent).

3.08 COMPACTION REQUIREMENTS

A. Beneath foundations and slabs on grade (except sidewalks): Compact the top 12-in of existing subgrade (and each layer of fill if applicable) to a minimum of 95 percent modified proctor (ASTM D1557) at or near its optimum moisture content (minus 2 to plus 3 percent).

B. 10-ft around structures: Compact the top 12-in of existing subgrade and each layer of fill or backfill to a minimum of 95 percent modified proctor (ASTM D1557) at or near its optimum moisture content (minus 2 to plus 3 percent).

C. Embankments (except under roadways), lawn or unimproved areas: Compact the top 6-in of existing subgrade and each layer of fill or backfill to a minimum of 90 percent modified protector (ASTM D1557) at or near its optimum moisture content (minus 2 to plus 3 percent).

D. Roads, paved areas and roadway embankments: Compact the top 12-in of existing subgrade and each layer of fill or backfill to a minimum of 90 percent modified proctor (ASTM D1557) at or near its optimum moisture content (minus 1 to plus 4 percent). Compact fill in the upper 3 feet to a minimum of 95 percent modified proctor (ASTM D1557) at or near its optimum moisture content (minus 2 to plus 3 percent).

3.09 DISPOSAL OF UNSUITABLE, WASTE AND/OR SURPLUS EXCAVATED MATERIAL

A. Unsuitable, waste and surplus excavated material shall be removed and disposed of off-site. Materials may be temporarily stockpiled in an area within the limits of construction that does not disrupt construction activities, create any nuisances or safety hazards, or otherwise restrict access to the work site.

3.10 GRADING

A. Grading shall be performed to the lines and grades shown on the Drawings. All objectionable material encountered within the limits indicated shall be removed and disposed of. Subgrades shall be completely and continuously drained and dewatered throughout the grading process. Install temporary drains, drainage ditches, etc, to intercept or divert surface water which may affect the execution or condition of grading work.

B. If at the time of grading it is not possible to place any material in its proper section of the WORK, it shall be stockpiled in approved areas for later use. No extra payment will be made for the stockpiling or double handling of excavated material.

C. Stones or rock fragments larger than 4-in in their greatest dimensions will not be permitted within the top 6-in of the finished grade of fills and embankments.

D. In cut areas, all loose or protruding rocks in slopes shall be removed to line or finished grade of the slope. All cut and fill slopes shall be uniformly dressed to the slope, cross-section and alignment shown on the Drawings unless otherwise directed by the ENGINEER.

END OF SECTION

SECTION 02210

FLOWABLE FILL

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install all flowable fill complete as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Dewatering is included in Section 02140.

B. Earthwork is included in Section 02200.

C. Trenching, Backfill, and Compaction are included in 02221.

D. Cast-in-Place Concrete is included in Section 03300.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, shop drawings and product data. Submittals shall include the following:

1. Constituent quantities per cubic yard of the flowable fill mix including water content, cement factor, type and amount of fly ash and type and manufacturer of cement.

2. Technical data on all materials and components.

3. If the CONTRACTOR proposes to use native aggregate, submittals shall include a testing program that will be used to control the variability of the aggregates. The testing program shall be approved by the ENGINEER.

B. Test Reports

1. Sieve analysis of aggregate.

2. Laboratory test results of the compressive strength of the proposed mix.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM C33 - Standard Specification for Concrete Aggregates.

2. ASTM C94 - Standard Specification for Ready-Mixed Concrete.

3. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

4. ASTM C150 - Standard Specification for Portland Cement.

5. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

6. ASTM D4832 - Standard Test Method for Preparation and Testing of Controlled Low Strength Material Test Cylinders.

B. American Concrete Institute (ACI).

1. ACI 301 - Standard Specification for Structural Concrete.

C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. All testing and inspection services required, unless otherwise specified, shall be provided and paid for by the OWNER. Testing necessary to establish the mix shall be performed by and at the expense of the CONTRACTOR. Methods of testing shall comply with the latest applicable ASTM Methods except as specified herein.

1.06 DELIVERY, STORAGE AND HANDLING

A. Products shall be stored in conformity with the manufacturer's recommendations.

B. Fly ash, aggregate and cement shall be stored or stockpiled in conformity with the recommendations of ACI 301.

PART 2 PRODUCTS

2.01 GENERAL

A. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

B. Materials shall comply with this Section and any applicable State or local requirements.

2.02 MATERIALS

A. Cement shall be domestic portland cement conforming to ASTM C150, Type II.

B. Fly ash shall conform to ASTM C618, Class C or Class F.

C. Aggregate shall be inert natural native or imported sand conforming to the requirements of ASTM C33 or inert natural sand containing aggregate sizes not greater than 3/8-in and having given satisfactory flowability, strength and setting time when used in comparable flowable fill mixes. Aggregates shall not be expansive or reactive.

D. Water shall be clean and free from injurious amounts of oils, acids, alkalis, organic matter, or other deleterious substances. Chloride content shall be less than 50 ppm.

E. Admixtures manufactured specifically manufactured for use in flowable fills will be considered for approval. Admixtures shall be free of chlorides and alkalis (except for those attributable to water). Admixtures shall be compatible with the mix and shall be suitable for use in contact with potable water after curing. Admixtures causing retarded or accelerated setting of the mix shall not be used without written approval from the ENGINEER.

2.03 MIXES

A. Select proportions of ingredients to meet the minimum design strength of 100 psi and to produce a fill having proper placability, durability and strength. Proportion ingredients to produce a homogenous mixture which will readily work into corners and angles without permitting materials to segregate.

B. Compression Tests: Furnish testing of the proposed mix to demonstrate compliance with the compression strength requirements.

C. Slump of the mix, as measured by ASTM C143, shall be approximately 8-in.

2.04 MEASURING, BATCHING, MIXING AND TRANSPORTING

A. Measuring, batching, mixing and transporting shall conform to ASTM C94 and the requirements herein or as otherwise approved in writing by the ENGINEER.

B. Ready-mixed flowable fill, whether produced by a concrete supplier or the CONTRACTOR shall conform to the requirements above. No hand mixing will be permitted.

C. The flowable fill shall be mixed until there is uniform distribution of the materials and shall be discharged completely before the mixer is recharged. Fill which has been remixed or retempered shall be rejected.

PART 3 EXECUTION

3.01 INSPECTION AND COORDINATION

A. The batching, mixing, transporting and placing and of the flowable fill shall be subject to the inspection of the ENGINEER at all times. No placement shall be made without the inspection and acceptance of the preparations by the ENGINEER.

3.02 APPEARANCE

A. The flowable fill shall have a homogeneous structure which, when hardened, will have the required strength and durability.

3.03 PLACING

A. No flowable fill shall be placed until the condition of subgrade and method of placement have been approved by the ENGINEER. Before depositing flowable fill, all debris and foreign matter shall be removed from the excavation. Flowable fill shall not be placed in water or submerged within 24 hours after placing, nor shall running water be permitted to flow over the surface of fresh flowable fill.

B. Deposit the mix as near its final position as possible to avoid segregation due to rehandling or flowing. Pumping of the mix will be permitted when the approved design mix is based on pumping. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials.

3.04 CURING AND PROTECTION

A. Protect all flowable fill against injury from the elements and damage of any nature during construction operations.

B. Flowable fill placed during cold weather shall be protected against freezing. Salt, manure or other chemicals shall not be used for cold weather protection.

3.05 FIELD TESTS

A. Sets of 6-in by 12-in test cylinders will be taken of the work by the ENGINEER following the procedures given in ASTM D4832. The number of sets of test cylinders shall be at the discretion of the ENGINEER. The cylinders shall be capped with neoprene for testing. When the average compressive strength of the cylinders in any set falls below the required compressive strength; the ENGINEER may reject the fill represented by the set of cylinders or require modification of the proportions of the design mix to achieve the required strengths.

B. Cooperate in the making of tests by allowing free access to the work for the selection of samples, providing an insulated closed curing box for specimens, affording protection to the specimens against injury or loss through the operations and furnishing material and labor required for the purpose of taking test cylinder samples. All shipping of specimens will be paid for by the OWNER.

C. Slump tests will be made in the field by the construction manager in conformity with ASTM C143.

END OF SECTION

SECTION 02221

TRENCHING, BACKFILLING AND COMPACTION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and perform all trenching for pipelines and appurtenances, including drainage, filling, backfilling, disposal of surplus material and restoration of trench surfaces and easements.

B. Excavation shall extend to the width and depth shown on the Drawings or as specified herein and shall provide suitable room for installing pipe, structures and appurtenances.

C. Furnish and place all sheeting, bracing and supports and remove from the excavation all materials which the ENGINEER may deem unsuitable for backfilling. The bottom of the excavation shall be firm, dry and in all respects, acceptable. If conditions warrant, deposit gravel for pipe bedding, or gravel refill for excavation below grade, directly on the bottom of the trench immediately after excavation has reached the proper depth and before the bottom of the trench has become softened or disturbed by any cause whatever. The length of open trench shall be related closely to the rate of pipe laying. All excavation shall be made in open trenches.

D. All excavation, trenching and related sheeting, bracing, etc, shall comply with the requirements of OSHA excavation safety standards (29 CFR Part 1926.650 Subpart P) and State requirements. Where conflict between OSHA and State regulations exists, the more stringent requirements shall apply.

E. Wherever the requirement for 95 percent compaction is referred to herein it shall mean "at least 95 percent of maximum dry density as determined by ASTM D1557 or by CTM 216".

F. Prior to the start of work submit the proposed method of backfilling and compaction to the ENGINEER for review.

1.02 RELATED WORK

A. Dewatering is included in Section 02140.

B. Earthwork is included in Section 02200.

C. Flowable Fill is included in Section 02210.

D. Excavation Support and Protection is included in Section 02311.

E. Pavement repair and resurfacing is included in Section 02576.

F. Revegetation is included in Section 02930.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. Pipe bedding, pipe zone, and trench backfill materials shall be in accordance with Section 02200.

2.02 GEOTEXTILE FABRIC

A. The geotextile fabric shall comply with the requirements of Section 02200, paragraph 2.3.C.

B. Edges shall be salvaged or otherwise finished to prevent outer material form pulling away from geotextile.

2.03 BURIED WARNING AND IDENTIFICATION TAPE

A. Provide polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inches minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED RECYCLED WATER LINE BELOW", "CAUTION, BURIED SEWER LINE BELOW", or similar wording. Provide permanent color and printing, unaffected by moisture or soil

Warning Tape Color Codes

Purple: Reclaimed Water Systems
Green: Buried Sewer Systems

1. Warning Tape for Metallic Piping

Provide acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.003 inch and a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation

2.04 DETECTION WIRE FOR NON-METALLIC PIPING

A. Provide insulated single strand, solid copper detection wire with a minimum of 10 AWG for non-metallic piping as shown on the drawings.

PART 3 EXECUTION

3.01 TRENCH EXCAVATION

A. Trench excavation shall include material of every description and of whatever substance encountered. Pavement shall be cut with a saw, wheel or pneumatic chisel along straight lines or ground on the edges before excavating.

B. Strip and stockpile topsoil from grassed areas crossed by trenches. At the CONTRACTOR's option, topsoil may be otherwise disposed of and replaced, when required, with approved topsoil of equal quality.

C. While excavating and backfilling is in progress, traffic shall be maintained, and all utilities and other property protected as provided in the General Conditions and General Requirements.

D. Trenches shall be excavated to the depth indicated on the Drawings and in widths as defined on the Drawings. The bottom of the excavations shall be firm and dry and in all respects acceptable to the ENGINEER.

E. Excavation and dewatering shall be accomplished by methods which preserve the undisturbed state of subgrade soils. The trench may be excavated by machinery to, or just below the designated subgrade, provided that material remaining in the bottom of the trench is no more than slightly disturbed. Subgrade soils which become soft, loose, "quick", or otherwise unsatisfactory as a result of inadequate excavation, dewatering or other construction methods shall be removed and replaced by Type F, G, or H fill as noted in Section 02200, paragraph 2.3.C.8, as required by the ENGINEER at the CONTRACTOR's expense.

F. Clay and organic silt soils are particularly susceptible to disturbance due to construction operations. Care should be taken to avoid disturbing these soils.

G. Where pipe is to be laid in screened gravel bedding, the trench may be excavated by machinery to the normal depth of the pipe provided that the material remaining in the bottom of the trench is no more than slightly disturbed.

H. Where pipe is to be laid directly on the trench bottom, final excavation at the bottom of the trench shall provide a flat-bottom true to grade upon undisturbed material. Bell holes shall be made as required.

3.02 DISPOSAL OF MATERIALS

A. Excavated material shall be stacked without excessive surcharge on the trench bank or obstructing free access to hydrants and gate valves. Inconvenience to traffic and abutters shall be avoided as much as possible. Excavated material shall be segregated for use in backfilling as specified below.

B. It is expressly understood that no excavated material shall be removed from the site of the work or disposed of, except as directed by the ENGINEER. When removal of surplus materials has been approved by the ENGINEER, dispose of such surplus material in approved designated areas.

C. Should conditions make it impracticable or unsafe to stack material adjacent to the trench, the material shall be hauled and stored at a location provided. When required, it shall be re-handled and used in backfilling the trench.

3.03 POTHOLES

A. Excavation of potholes may be required for the purpose of locating underground utilities or structures as an aid in establishing the precise location of new work.

B. Potholes shall be backfilled as soon as the desired information has been obtained. The backfilled surface shall be maintained in a satisfactory condition for travel until resurfaced as specified.

3.04 EXCAVATION BELOW GRADE AND REFILL

A. Whatever the nature of unstable material encountered or the groundwater conditions, trench drainage shall be complete and effective.

B. If the CONTRACTOR excavates below grade through error or for the CONTRACTOR's own convenience, or through failure to properly dewater the trench, or disturbs the subgrade before dewatering is sufficiently complete, he may be directed by the ENGINEER to excavate below grade as set forth in the following paragraph, in which case the work of excavating below grade and furnishing and placing the refill shall be performed at his own expense.

C. If the material at the level of trench bottom consists of fine sand, sand and silt or soft earth, the subgrade material shall be removed to the extent directed and the excavation refilled with flowable fill.

3.05 BACKFILLING

A. As soon as practicable after the pipe has been laid and jointed, backfilling shall begin and thereafter be prosecuted expeditiously.

B. An impervious dam or bulkhead cutoff shall be constructed in the trench as shown on the drawings, to interrupt the unnatural flow of groundwater after construction is completed. The dam shall be effectively keyed into the trench bottom and sidewalls. Trench dams shall be trench plug material or flowable fill.

C. All backfill is to be placed and compacted per the requirements set forth in Section 02200, paragraphs 3.04 through 3.08.

D. Where a loam or gravel surface exists prior to cross-country excavations, it shall be removed, conserved and replaced to the full original depth as part of the work under the pipe items. In some areas it may be necessary to remove excess material during the clean-up process, so that the ground may be restored to its original level and condition.

E. To prevent longitudinal movement of the pipe, dumping backfill material into the trench and then spreading will not be permitted until selected material or screened gravel has been placed and compacted to a level 1-ft over the pipe.

F. Backfill shall be brought up evenly on all sides. Each layer of backfill material shall be thoroughly compacted by rolling, tamping, or vibrating with mechanical compacting equipment or hand tamping, to meet the compaction requirements of Section 02200. If rolling is employed, it shall be by use of a suitable roller or tractor, being careful to compact the fill throughout the full width of the trench.

G. Water jetting or puddling may be not used.

H. Where other methods are not practicable, compaction shall be by use of hand or pneumatic ramming with tools weighing at least 20 lbs and the material being spread and compacted in

layers not over 6-in thick. If necessary, sprinkling shall be employed in conjunction with rolling or ramming.

I. Bituminous paving shall not be placed in backfilling.

J. All road surfaces shall be broomed and hose-cleaned immediately after backfilling. Dust control measures shall be employed at all times.

3.06 GEOTEXTILE INSTALLATION

A. Geotextile fabric shall be installed as shown on the drawings and in accordance with the manufacture's recommendations.

B. Overlaps shall be a minimum of 12 inches.

C. Maintain geotextile smooth and as free as practicable of tension, folds, wrinkles, or creases.

D. Fabric sections should be overlapped in accordance with the manufacturer's recommendations to reduce the potential for soil migration through the backfill.

3.07 RESTORING TRENCH SURFACE

A. Where the trench occurs adjacent to paved streets, in shoulders, sidewalks, or in cross-country areas, thoroughly consolidate the backfill and maintain the surface as the work progresses. If settlement takes place, immediately deposit additional fill to restore the level of the ground.

B. In and adjacent to streets, the trench backfill within 12 inches of the pavement subgrade shall consist of the following for the specified jurisdictions:

1. San Luis Obispo County – Structural Fill or compacted native material, compacted to 95% relative compaction.

C. The surface of any driveway or any other area which is disturbed by the trench excavation and which is not a part of the paved road shall be restored to a condition at least equal to that existing before work began.

D. In sections where the pipeline passes through grassed areas, and at the CONTRACTOR's own expense, remove and replace the sod, or loam and seed the surface to the satisfaction of the ENGINEER.

END OF SECTION

SECTION 02270

EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and perform all installation, maintenance, removal and area cleanup related to erosion and sedimentation control work as shown on the Drawings and as specified herein. The work shall include, but not necessarily be limited to; installation of temporary access ways and staging areas, silt fences, stone filter boxes, stone filter berms, sediment removal and disposal, device maintenance, removal of temporary devices, temporary mulching, excelsior matting installation and final cleanup.

1.02 RELATED WORK

A. Dust control is included in Section 01562.

B. Storm Water Pollution Prevention Plan is included in Section 01570.

C. Earthwork is included in Section 02200.

D. Revegetation is included in Section 02930.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, within 10 days after award of Contract, technical product literature for all commercial products, including straw mulch tackifier, to be used for erosion and sedimentation control.

1.04 QUALITY ASSURANCE

A. Be responsible for the timely installation and maintenance of all sedimentation control devices necessary to prevent the movement of sediment from the construction site to off site areas or into the stream system via surface runoff or underground drainage systems. Measures in addition to those shown on the Drawings necessary to prevent the movement of sediment off site shall be installed, maintained, removed, and cleaned up at the expense of the CONTRACTOR. No additional charges to the OWNER will be considered.

PART 2 PRODUCTS

2.01 MATERIALS

A. Crushed stone for sediment filtration devices, access ways and staging areas shall conform to Caltrans Standard.

B. Berm structural stone shall be rip-rap as follows:

1. Rip-rap shall be sound, durable rock which is roughly rectangular shape and of suitable quality to insure permanence in the condition in which it is to be used. Rounded stones,

boulders, sandstone or similar soft stone will not be acceptable. Material shall be free from overburden, spoil, shale and organic material, meet the ENGINEER's approval and be well graded within the following limits:

Weight of Stone	Percent Finer by Weight
40 lb	100
12 lb	50
3 lb	0

C. Sediment Fence

1. Sediment fence shall be a prefabricated commercial product made of a woven, polypropylene, ultraviolet resistant material such as “Envirofence” by Mirafi Inc., Charlotte, NC or equal.

D. 1/4-in woven wire mesh for filter boxes shall be galvanized steel or hardware cloth.

E. Straw mulch shall be utilized on all newly graded areas to protect areas against washouts and erosion. Straw mulch shall be comprised of sterile rice straw that is free from noxious weeds, mold or other objectionable material. The straw mulch shall contain at least 50 percent by weight of material to be 10-in or longer. Straw shall be in an air-dry condition and suitable for placement with blower equipment.

F. Latex acrylic copolymer or organic tackifier shall be a commercial product specifically manufactured for use as straw mulch tackifier.

G. An asphalt tackifier shall only be used when temperatures are too low to allow the use of a latex acrylic copolymer and only with prior written approval from the ENGINEER.

H. Erosion control blanket shall be installed in all seeded drainage swales and ditches directed by the ENGINEER. Erosion control blanket shall be 100 percent agricultural straw matrix stitch bonded with degradable thread between two photodegradable polypropylene nettings, such as Model S150 Double Net Short-Term Blanket (10 months) by North American Green, Evansville, IN or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Sediment Fence Installation

1. Sediment fences shall be positioned as necessary to prevent off site movement of sediment produced by construction activities as directed by the ENGINEER.

2. Dig trench approximately 6-in wide and 6-in deep along proposed fence lines.

3. Drive stakes, 8-ft on center (maximum) at back edge of trenches. Stakes shall be driven 2-ft (minimum) into ground.

4. Hang filter fabric on posts carrying to bottom of trench with about 4-in of fabric laid across bottom of trench. Stretch fabric fairly taut along fence length and maintain secure both ways.

5. Backfill trench with excavated material and tamp.

6. Install pre-fabricated silt fence according to manufacturer's instructions.

B. Construct filter boxes as directed by the ENGINEER, from 1/4-in woven wire mesh or hardware cloth and wood. Fill with crushed stone and place over all drop inlets and manholes to storm drain system as each inlet is completed. This should be done prior to setting casting, if there is a delay between installation of inlet structures or drain manholes and setting of castings. An alternate method is to ring each inlet with a sediment fence.

C. Stone Filter Berm Installation

1. Place berm structural stone across channel just below lower sandbag wall at work area. Face upstream side of structural berm with crushed stone.

D. Staging areas and access ways shall be surfaced with a minimum depth of 4-in of crushed stone.

3.02 MAINTENANCE AND INSPECTIONS

A. Inspections

1. Make a visual inspection of all erosion and sedimentation control devices once per week and promptly after every rainstorm. If such inspection reveals that additional measures are needed to prevent movement of sediment to offsite areas, promptly install additional devices as needed. Sediment controls in need of maintenance shall be repaired promptly.

B. Device Maintenance

1. Sediment Fences

a. Remove accumulated sediment once it builds up to 1/2 of the height of the fabric.

b. Replace damaged fabric, or patch with a 2-ft minimum overlap.

c. Make other repairs as necessary to ensure that the fence is filtering all runoff directed to the fence.

2. Filter Boxes

a. Replace crushed stone when it becomes saturated with silt.

3. Stone Filter Berm

a. Muck out trapped silt from dewatering operations when it has built up to within 6-in of the top of the berm.

b. Replace crushed stone filter when saturated with silt.

4. Add crushed stone to access ways and staging area as necessary to maintain a firm surface free of ruts and mudholes.

3.03 TEMPORARY MULCHING

A. Apply temporary mulch to areas where rough grading has been completed but final grading is not anticipated to begin within 30 days of the completion of rough grading.

B. Straw mulch shall be applied at rate of 100 lbs/1000 sq ft and tackified with latex acrylic copolymer at a rate and diluted in a ratio per manufacturer's instructions.

3.04 EROSION CONTROL BLANKETS

A. Erosion control blankets shall be installed in all seeded drainage swales and ditches as shown on the Drawings and as directed by the ENGINEER in accordance with manufacturer's instructions. The area to be covered shall be properly prepared, fertilized and seeded with permanent vegetation before the blanket is applied. When the blanket is unrolled, the netting shall be on top and the fibers in contact with the soil over the entire area. The blankets shall be applied in the direction of water flow and stapled. Blankets shall be placed a minimum of three rows (of 4-ft) wide (total approx. 12-ft width) within the drainage swale/ditch and stapled together in accordance with manufacturer's instructions. Side overlaps shall be 4-in minimum. The staples shall be made of wire, .091-in in diameter or greater, "U" shaped with legs 10-in in length and a 1-1/2-in crown. Commercial biodegradable stakes may also be used with prior approval by the ENGINEER. The staples shall be driven vertically into the ground, spaced approximately two linear feet apart, on each side, and one row in the center alternately spaced between each size. Upper and lower ends of the matting shall be buried to a depth of 4-in in a trench. Erosion stops shall be created every 25-ft by making a fold in the fabric and carrying the fold into a silt trench across the full width of the blanket. The bottom of the fold shall be 4-in below the ground surface. Staple on both sides of fold. Where the matting must be cut or more than one roll length is required in the swale, turn down upper end of downstream roll into a slit trench to a depth of 4-in. Overlap lower end of upstream roll 4-in past edge of downstream roll and staple.

1. To ensure full contact with soil surface, roll matting with a roller weighing 100 lbs/ft of width perpendicular to flow direction after seeding, placing matting and stapling. Thoroughly inspect channel after completion. Correct any areas where matting does not present a smooth surface in full contact with the soil below.

3.05 REMOVAL AND FINAL CLEANUP

A. Once the site has been fully stabilized against erosion, remove sediment control devices and all accumulated silt. Dispose of silt and waste materials in proper manner. Regrade all areas disturbed during this process and stabilize against erosion with surfacing materials as indicated on the Drawings.

END OF SECTION

SECTION 02271

RIPRAP

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and place riprap and appurtenances as specified herein.

1.02 RELATED WORK

A. Trench excavation and backfill is included in Section 02221.

B. Earthwork is included in Section 02200.

PART 2 PRODUCTS

2.01 MATERIALS

A. Riprap used for channel and slope protection shall be hard, durable, angular in shape, resistant to weathering and may be naturally occurring particles or fragments of natural stone. Control of gradation shall be by visible inspection. Rounded stones, boulders, sandstone, or similar soft stone or relatively thin slabs will not be acceptable. Stone shall be free from overburden, spoil, shale and organic material. Each stone shall weigh not less than 50 lbs nor no more than 125 lbs and at least 75 percent of the volume shall consist of stones weighing not less than 75 lbs each. The remainder of the stones shall be so graded that when placed with the larger stones the entire mass will be compact.

B. A bank-run gravel (Type O) base shall be placed and graded to a depth of 12-in to obtain a continuous uninterrupted bed of the required thickness within the required limits. See Section 02200 for bank-run gravel material.

C. Riprap shall be placed and graded off in a manner to ensure that the larger rock fragments are uniformly distributed and that the smaller rock fragments serve to fill the spaces between the larger rock fragments in a manner that will result in a compact mass of stone of the specified thickness. Hand placing will be required only to the extent necessary to secure the results specified above.

D. Riprap shall have a minimum placed thickness of 12-in with individual pieces at the surface having a maximum deviation of plus or minus 2-in.

E. Placing of riprap in layers or by dumping into chutes or by similar methods to cause segregation will not be permitted.

PART 3 EXECUTION

3.01 INSTALLATION

A. The construction methods, compaction equipment, and appurtenances for bank-run gravel shall be in accordance with Section 02200.

B. Place riprap and bank-run gravel base to the limits and grades shown on the Drawings.

END OF SECTION

SECTION 02281

AUTOMATIC IRRIGATION SYSTEM

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and the Provisions of Bid and Contract Documents, including General and Supplementary Conditions and Division 1 Specification Sections, shall apply to the work specified in this Section.

B. Habitat Management Plan (HMP) for the Los Osos Wastewater Project, Los Osos, San Luis Obispo County, Dated November 2011. This document sets forth implementation procedures for required habitat mitigation for the project.

1.02 DESCRIPTION

A. All work shall conform to the provisions set forth within the approved HMP and these construction documents. Provisions made within these construction documents shall complement the HMP and provide additional direction for implementation. Any conflicts between these plans and the HMP shall be brought to the landscape architect's attention prior to construction.

B. Work Included: Provide all material, labor, equipment transportation, and services necessary for the furnishing and installation of the complete automatic sprinkler irrigation systems as shown on the drawings and as specified herein. The work includes, but is not limited to:

1. Trenching, stockpiling excavation materials and refilling trenches.

2. Providing a complete system including piping, valves, fittings, sprinkler heads, emitters, automatic controls and final adjustment of heads to ensure complete coverage.

3. Line voltage connections to all irrigation controllers; low voltage control wiring from controller to remote control valves.

4. Cleanup, inspection and approval.

5. Furnish and install items to be attached to, or embedded in, concrete work.

6. Automatic controller assembly and installation including electrical enclosure and panel, and concrete pad.

7. Submittals, tests, as-built and record drawings.

8. Erosion control and repair of damage due to overwatering and erosion.

9. Warranty replacement.

10. Water meter and water supply line installation.

B. Related Work:

Section 02900: Landscape Planting

1.03 QUALITY ASSURANCE AND REQUIREMENTS

A. Requirements of Regulatory Agencies: All work and materials shall be in full conformance with the latest rules and regulations of the Uniform Building Code.

B. Manufacturer's Directions: Manufacturer's directions and detailed drawings shall be followed in all cases where the manufacturers of articles used in this contract furnish directions covering points not shown in the drawings and specifications.

C. Underwriters Laboratories: Electrical wiring, controls, motors, and devices shall be UL listed, and so labeled.

1.04 SUBMITTALS

A. Product List: Complete product list shall be submitted prior to performing any work. Product list shall conform to the requirements of Section 01300 - Submittals.

B. Record Drawings:

1. Provide and keep up to date and complete "Record Drawings" of the work of this Section. "Record Drawings" shall conform to the requirements of Division 1 Specification Sections.

2. Dimension from two permanent points of reference, building corners, sidewalk, or road intersections, etc., the location of the following items:

a. Connection to existing water lines.

b. Connection to existing electrical power.

c. Backflow device

d. Gate valves.

e. Routing and/or directional turns of sprinkler pressure lines (dimension max. 100' along routing).

f. Sprinkler control valves.

g. Routing of control wiring.

h. Quick coupling valves.

i. Other related equipment as directed by the ENGINEER.

C. Detail Drawings: Submit detailed drawings for approval, for all assemblies not detailed on the drawings.

D. Controller Charts:

1. Record drawings will be accepted by the ENGINEER before controller charts are prepared. Provide one controller chart for each controller supplied. The chart shall show the area controlled by the automatic controller and shall be the maximum size that the controller door will allow.

2. The chart is to be a reduced drawing of the actual "as-built" system. However, in the event the controller sequence is not legible when the drawing is reduced, it shall be enlarged to a size that will be readable when reduced. The chart shall be a black line or blue line ozalid print and a different color shall be used to indicate the area of coverage for each station. When completed and approved, the chart shall be hermetically sealed between two pieces of plastic, each piece being a minimum of 10 mils. These charts shall be completed and approved by the ENGINEER prior to final observation of the irrigation system.

E. Operation and Maintenance Manuals:

1. Prepare and deliver to the ENGINEER, within 10 calendar days prior to completion of construction, two hardcover binders with three rings containing the following information:

a. Index sheet stating CONTRACTOR's address and telephone number, list of equipment with name and addresses of local manufacturer's representative.

b. Catalog and part sheets on every material and equipment installed under this contract.

c. Guarantee statement.

d. Complete operating and maintenance instruction on all major equipment.

2. In addition to the above-mentioned maintenance manuals, provide the OWNER's maintenance personnel with instructions for major equipment and show evidence in writing to the ENGINEER at the conclusion of the project that this service has been rendered.

F. Equipment to be furnished:

1. Supply as part of this contract the following tools:

a. Two keys for opening valve boxes.

b. One 36-inch soil probe, Oakfield Model B.

c. Two keys for each automatic controller.

d. One quick-coupler key and matching hose swivel and globe valve for every five, or fraction thereof, valves installed.

2. Before final observation the above-mentioned equipment shall be turned over to the ENGINEER.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Handling of PVC Pipe and Fittings: The CONTRACTOR is cautioned to exercise care in handling, loading, unloading, storing and installation of PVC pipe and fittings. All PVC pipe shall be transported in a vehicle that allows the length of pipe to lie flat so as not to subject it to undue bending or concentrated external load at any point. Any section of pipe that has been dented or damaged will be discarded and, if installed, shall be replaced with new piping.

1.06 JOB CONDITIONS

A. The CONTRACTOR shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in area dimensions exist that might not have been considered in engineering. Such obstructions or differences should be brought to the attention of the ENGINEER. In the event this notification is not performed, the Irrigation Contractor shall assume full responsibility for any revision necessary.

1.07 SUBSTITUTIONS

A. Procedure: Submit information in conformance with section 01630 Substitutions and Product Options.

B. Provide descriptive catalog literature, performance charts and flow charts for each item to be substituted.

1.08 WARRANTY

A. The warranty for the sprinkler irrigation system shall be made in accordance with Section 01740 and the following form.

B. A copy of the warranty form shall be included in the operations and maintenance manual.

C. The warranty form shall be retyped onto the CONTRACTOR’s letterhead and contain the following information:

WARRANTY FOR SPRINKLER IRRIGATION SYSTEM

We hereby warrant that the sprinkler irrigation system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specification. We agree to repair or replace any defects in material or workmanship that may develop during the period of one year from the date of acceptance, except those that may be caused by ordinary wear and tear, unusual abuse or neglect. We also agree to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the OWNER. We shall make such repairs or replacements within a reasonable time, as determined by the OWNER, after receipt of written notice. In the event of our failure to make such repairs or replacements within a reasonable time after receipt of written notice from OWNER, we authorize the OWNER to proceed to have said repairs or replacements made at our expense, and we will pay the costs and charges therefore upon demand.

PROJECT:_____

CONTRACTOR:_____ PHONE NO.:_____

ADDRESS:_____ BY:_____

_____

DATE OF ACCEPTANCE:_____ BY:_____

PART 2 PRODUCTS

2.01 MATERIALS

A. General: Use only new materials of brands and types noted on drawings, specified, or approved equals.

2.02 PIPE AND FITTINGS

A. Pressure Main Line Piping and Fittings: From meter to backflow prevention unit shall be PVC schedule 80 solvent weld type.

B. Pressure and Non-Pressure Main Line Piping and Fittings: Sizes 2 inches and smaller shall be Schedule 40 PVC.

C. Non-pressure lines (buried): Shall be PVC Schedule 40.

D. All pipe and fittings shall conform to specific requirements as follows:

1. PVC (Solvent Weld):

a. Pipe: Manufactured from virgin polyvinyl chloride compound in accordance with ASTM D1784 or ASTM D2241, cell classification 12454B, hydrostatic design stress rating not less than 2,000 psi.

b. Fittings (solvent weld or thread): Standard weight, schedule 40, side gated, injection molded PVC complying with ASTM D1784, cell classification 13454B, including threads when required.

c. Fittings (2" through 8") slip type may be used, but must be similar in all respects to those manufactured by Cal Am Manufacturing Company and installed in accordance with their recommendations.

2. PVC nipples shall be Schedule 80 with molded threads.

3. All PVC pipe must bear the following markings:

a. Manufacturer's name.

b. Nominal pipe size.

c. Schedule or class.

d. Pressure rating in AST (not required on drip tubing).

e. NSF (National Sanitation Foundation) approval (not required on drip tubing).

f. Date of extrusion.

4. Solvent cement and primer for PVC solvent-weld pipe and fittings shall be of type and installation method prescribed by the manufacturer.

5. Brass Pipe and Fittings:

a. Brass pipe shall be 85% red brass, American National Standard Institute (ANSI), Schedule 40 screwed pipe.

b. Fittings shall be medium brass, screwed 125-pound class.

2.03 ELECTRICAL (HIGH VOLTAGE)

A. All high voltage electrical service required for automatic controller and other equipment noted on drawing for irrigation system will be provided by others.

2.04 ELECTRICAL (LOW VOLTAGE)

A. Connections between controller and remote control valves shall be made with direct burial AWG-UH, 600-volt wire, insulation thickness 3/64 inch, utilizing low-density high molecular weight polyethylene insulation.

B. Splices, where permitted, shall be waterproofed using Rain Bird, Pen-Tite Connectors or fusible heat shrinking tubing, and housed in a box. Boxes for other irrigation use may be utilized for this purpose.

C. Wire sizing shall be minimum of #14 "UF" 600 volt underground wiring, unless a shielded cable is used in which case #18 wire may be used. The common wire shall be white in color with all valve wires separated out as different colors.

2.05 QUICK COUPLING VALVES

A. Two-piece type brass body, 150-pound class, with 1-inch female threads opening at base permitting operation with a special connecting device (coupler) designed for this purpose.

1. Coupler threads: Lug type.

2. Hinge cover: Provide with rubber-like vinyl cover.

2.06 CHECK VALVES

A. Swing check valve, 2 inches and smaller on non-pressure lines: Bronze or plastic construction, 100 pound swp, female ips.

B. Anti-drain Valve: Plastic construction, with soft composition disc, stainless steel internal parts. Spring tension adjustable from 4 psi to 15 psi. Valve may be an integral part of sprinkler head.

2.07 BACKFLOW PREVENTION UNITS

A. Backflow Preventer: Designed to operate on a "reduced pressure" principle; equipped with gate valves and field test cocks.

B. All equipment within the backflow assembly shall be housed in an aluminum grated enclosure with lockable hinged opening.

C. Wye strainers at backflow prevention units shall be 125# class cast brass with 40 mesh monel screen, unless otherwise noted on drawing.

2.08 AUTOMATIC CONTROLLER

A. Type: Fully automatic operation, capable of operating the number of stations and type indicated on drawings.

1. Wall-mount type in a housing with locking hinged cover.

2. Automatic controller enclosure shall be made of vandal-resistant 3/16-inch steel plate and 10-gauge metal, with hinged door. The enclosure shall be similar to the LeMeur Type "A" or acceptable equal, and shall be painted inside and outside with two coats of rust-resistant paint prior to the installation of the automatic controller. Color and type of paint shall be approved by the ENGINEER.

2.09 REMOTE CONTROL VALVES

A. Valve Type: Spring loaded, diaphragm activated, normally closed type, equipped with flow control and pressure regulation capabilities where noted.

B. Valve solenoid: 24 volt ac, 4.5 watt maximum, 500 milli-amp maximum surge, corrosion-proof, stainless steel construction, epoxy encapsulated to form a single integral unit.

C. Provide bleeder valve to permit operation in the field without power at the controller.

2.10 DRIP EQUIPMENT

A. Pipe: Thick walled flexible PVC tubing

B. Stakes: 6" galv. metal stakes

C. Emitters: Barbed type. As listed on drawings

D. Flush Valve and Air Relief Valve. Of plastic construction by same manufacturer as drip pipe to assure proper connection.

2.11 SMALL SHRUBBERY SPRINKLER HEADS

A. Sprinklers shall be similar in all respects to type noted on drawing.

B. Where noted, pop-up type body shall be used, with height as noted in legend on drawing.

C. When noted, body shall be equipped with a built-in check valve.

2.12 VALVE BOXES

A. Valve boxes for remote control valves shall be 12" x 18" of a concrete material with cast iron locking tops. Brooks No. HFL or approved equal.

B. Valve box for gate valves shall be 12 inches round of a concrete material with cast iron locking tops. Brooks #1-RT.

C. Valve box extensions shall be by the same manufacturer as the valve box.

PART 3 EXECUTION

3.01 GENERAL

A. The CONTRACTOR is responsible for providing an optimum water supply to all plants and trees by the irrigation system, including uniform coverage of all planting areas by the spray system. Report to the ENGINEER all conditions preventing compliance with these requirements, and obtain the ENGINEER's instructions prior to proceeding with the work affected. Failure to report to the ENGINEER constitutes acceptance of this requirement by the CONTRACTOR.

3.02 FIELD QUALITY CONTROL

A. CONTRACTOR shall be responsible for notifying the ENGINEER in advance for the following observation meetings, according to the time indicated:

1. Pre-job conference: 7 days.

2. Backflow assembly location: 48 hours.

3. Pressure supply line installation and testing: 48 hours.

4. Automatic controller location: 48 hours.

5. Control wire installation: 48 hours.

6. Lateral line and sprinkler installation: 48 hours.

7. Coverage test: 48 hours.

8. Final site review: 7 days.

B. When observations have been conducted by other than the ENGINEER, show evidence in writing of when and by whom these observations were made.

C. No site observations will commence without "As-Built" record prints.

D. Final Observation:

1. The CONTRACTOR shall operate each system in its entirety for the ENGINEER at time of final observation as noted in 3.01 Field Quality Control of Section 02900. Any items deemed not acceptable by the ENGINEER, or not in compliance with these specifications and drawings, shall be reworked to the complete satisfaction of the ENGINEER.

2. The CONTRACTOR shall show evidence to the ENGINEER that the OWNER has received all accessories, charts, record drawings, and equipment as required before final observation can occur.

3.03 WATER SUPPLY

A. Sprinkler irrigation system shall be connected to water supply points of connection as indicated on the drawings.

B. Connections shall be made at approximate locations as shown on drawings. CONTRACTOR is responsible for minor changes caused by actual site conditions.

3.04 LAYOUT

A. Drawings:

1. Drawings are generally diagrammatic and indicative of the work to be installed. Due to the scale of drawings, it is not possible to indicate all offsets, fittings, sleeves, etc., which may be required. The CONTRACTOR shall carefully investigate the structural and finished conditions affecting all of his work and plan accordingly, furnishing such fittings, etc., as may be required.

2. All scaled dimensions are approximate. The CONTRACTOR shall check and verify all size dimensions and receive ENGINEER's approval prior to proceeding with work under this section.

B. Coordination: Coordinate installation of irrigation system, including pipe, so there will be NO interference with utilities or other construction or difficulty in planting trees, shrubs, and ground covers. The CONTRACTOR shall carefully check all grades to satisfy themselves that they may safely proceed before starting work on the irrigation system.

C. All piping or equipment shown diagrammatically on drawings outside planting areas shall be installed inside planting areas whenever possible.

D. Prior to installation, the CONTRACTOR shall stake out all pressure supply lines, routing and location of sprinkler heads.

E. All layouts shall be approved by the ENGINEER prior to installation.

3.05 INSTALLATION

A. General:

1. All plastic pipe and fittings shall be installed in complete accord with manufacturer instructions for same.

2. Line Clearance: All lines shall have a minimum clearance of 6 inches from each other and from lines of other trades. Parallel lines shall not be installed directly over one another.

B. Trenching:

1. Excavate trenches to required depths. Follow approved layout for each system.

2. Trench bottom shall be flat to ensure piping is supported continuously on an even grade.

3. Where lines occur under paved areas, consider dimension to be below the subgrade.

4. Provide minimum coverage as follows:

a. Pressure supply lines (2-1/2 inches and smaller): 18 inches.

b. Non-pressure lines: 12 inches.

c. Control wire: 18 inches.

C. Backfilling:

1. Buried pipe in trenches shall be center loaded only until all required tests are performed. Trenches shall be carefully backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand or other approved materials, free from large clods of earth or stones. Backfill shall be mechanically compacted in landscaped areas to a dry density equal to adjacent undisturbed soil in planting areas.

Backfill will conform to adjacent grades without dips, sunken areas, humps or other surface irregularities.

2. A fine granular material backfill will be initially placed on all lines. No foreign matter larger than 1/2 inch in size will be permitted in the initial backfill.

3. Flooding of trenches will be permitted only with approval of the ENGINEER.

4. If settlement occurs and subsequent adjustments in pipe, valves, sprinkler heads, lawn or planting, or other construction are necessary, the CONTRACTOR shall make all required adjustments without cost to the OWNER.

D. Assemblies:

1. Routing of sprinkler irrigation lines as indicated on the drawings is diagrammatic. Install lines (and various assemblies) in such a manner as to conform with the details per plans.

2. Install NO multiple assemblies in plastic lines. Provide each assembly with its own outlet.

3. Install all assemblies specified herein in accordance with respective detail. In absence of detail drawings or specification pertaining to specific items required to complete work, perform such work in accordance with best standard practice, with prior approval from ENGINEER.

4. PVC pipe and fittings shall be thoroughly cleaned of dirt, dust and moisture before installation. Installation and solvent welding methods shall be as recommended by the pipe and fitting manufacturer.

5. On PVC to metal connections, the CONTRACTOR shall work the metal connections first. Teflon tape or approved equal shall be used on all threaded PVC to PVC, and on all threaded PVC to metal joints. Light wrench pressure is all that is required. Where threaded PVC connections are required, use threaded PVC adapters into which the pipe may be welded.

6. Quick Coupling Valves: Unless otherwise indicated, locate valves within 12 inches of hardscape.

7. Backflow Prevention Unit and Controllers: Verify exact location with the ENGINEER. Install at minimum height permitted by local code.

E. Electrical Supply:

1. Low voltage wiring shall be placed in the same ditch and taped on bottom side of main lines unless otherwise approved.

2. Wire is to be taped a maximum 12 feet on center.

3. Provide a 12-inch expansion loop at each connection and directional change.

4. Use a continuous wire between controller and remote control valves. Except as otherwise approved, do not splice wire at any point. All approved splices shall be enclosed in an acceptable box.

5. Each controller shall be provided with separate ground wire.

F. Automatic Controller:

1. Install as per manufacturer's instructions. Remote control valves shall be connected to controller in numerical sequence as shown on the drawings.

2. Controller shall be mounted inside lockable electrical panel box mounted on a wall.

G. Flushing of System:

1. After all new sprinkler pipe lines and risers are in place and connected, all necessary diversion work has been completed, and prior to installation of sprinkler heads, the control valves shall be opened and full head of water used to flush out the system.

2. Sprinkler heads shall be installed only after flushing of the system has been accomplished to the complete satisfaction of the ENGINEER.

H. Sprinkler Heads:

1. Install the sprinkler heads as designated on the drawings and in accordance with their respective detail.

2. Spacing of heads shall not exceed the maximum indicated on the drawings. In no case shall the spacing exceed the maximum recommended by the manufacturer.

I. Valve Boxes:

1. All buried valves and equipment shall be installed with a proper box as specified in PART 2 PRODUCTS.

2. Fill area under box with a minimum of 3 cubic feet of pea gravel before box is installed.

3. Identification tags shall be attached to each remote control valve, showing number that corresponds with controller sequence. Tags shall be manufactured of polyurethane Behr Desopaid, yellow in color with black letters 2-3/4 inches by 2-1/4 inches.

4. All boxes shall be permanently marked on top, designating type of equipment installed as noted in drawing.

3.06 TEMPORARY REPAIRS

A. The OWNER reserves the right to make temporary repairs as necessary to keep the sprinkler system equipment in operating condition. The exercise of this right by the OWNER shall not relieve the CONTRACTOR of his responsibilities under the terms of the warranty as herein specified.

3.07 SYSTEM ADJUSTMENT

A. The CONTRACTOR shall adjust all sprinkler heads and valves for optimum performance and to prevent as much as possible any overspray onto walks and roadways. No spray is permitted on buildings.

B. If it is determined that adjustments in the irrigation equipment will provide proper and more adequate coverage, the CONTRACTOR shall make such adjustments prior to planting. Adjustments may include changes in nozzle sizes or degrees of arc, as required.

C. All sprinkler heads shall be set perpendicular to finished grades unless otherwise designated on the plans and at height and distance from walks, buildings, etc., as noted.

3.08 SYSTEM TESTING

A. Test all pressure lines under hydrostatic pressure of 150 pounds per square inch, and prove watertight.

B. Testing of pressure main lines shall occur prior to installation of electrical control valves, quick couplers or any other equipment that might prevent a proper test from being performed.

C. All piping under paved areas shall be tested under hydrostatic pressure of 150 pounds per square inch, and proved watertight, prior to paving.

D. Sustain pressure in lines for not less than 2 hours. If leaks develop, replace joints and repeat test until entire system is proven watertight.

E. All hydrostatic tests shall be made only in the presence of the ENGINEER, or other duly authorized representative of the OWNER. No pipe shall be completely backfilled until it has been inspected, tested and approved in writing.

F. Furnish necessary force pump and all other test equipment.

G. When the sprinkler irrigation system is completed, perform a coverage test in the presence of the ENGINEER to determine if the water coverage for planting areas is complete and adequate. Furnish all materials and perform all work required to correct any inadequacies of coverage due to deviations from plans, or where the system has been willfully installed as indicated on the drawings when it is obviously inadequate, without bringing this to the attention of the ENGINEER. This test shall be accomplished before any ground cover is planted.

H. Upon completion of each phase of work, entire system shall be tested and adjusted to meet site requirements.

I. Low voltage wire under paving shall be tested for continuity, prior to paving.

3.09 MAINTENANCE

A. The entire sprinkler irrigation system shall be under full automatic operation for a period of seven days prior to any planting.

B. The ENGINEER reserves the right to waive or shorten the operation period.

3.10 CLEANUP

A. Cleanup shall be performed as each portion of the work progresses. Refuse and excess dirt shall be removed from the site, all walks and paving shall be broomed or washed down, and any damage sustained to the work of others shall be repaired and work returned to its original condition.

3.11 OPERATING INSTRUCTIONS

A. The CONTRACTOR shall be required to train OWNER's maintenance personnel in proper operation of all major equipment. Provide written evidence of the person or persons so trained to the ENGINEER.

END OF SECTION

SECTION 02311

EXCAVATION SUPPORT AND PROTECTION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The work specified in this Section includes requirements for excavation and support of temporary excavations, and trenches. The CONTRACTOR shall design, furnish, install, and maintain a system of supports, including all bracing and associated items, to retain excavations in a safe manner and to control ground movements. Upon completion of the required construction the system of supports shall be completely removed and the excavation and staging area sites restored as discussed herein.

B. The work shall include site grading; fencing and signing; construction staging areas; design and construction of excavation support systems; design and construction of thrust blocks; disposal of excavated material, surface water, and ground water; backfilling; and site restoration. Work shall include all labor, materials, and equipment required to complete excavation support.

C. Retain the services of a professional engineer registered in the State of California to prepare excavation support and protection system designs and submittals described herein.

D. Work shall include the design, equipment, materials, installation, protection, and monitoring of geotechnical instrumentation required to monitor the performance of the excavation support system as required herein.

E. All excavations and support systems shall conform to applicable OSHA excavation, trenching, and shoring standards which are contained in the U.S. Code of Federal Regulations 29 (C.F.R.) 1926.650-1926.653, other federal, state or local requirements. In the event of a conflict, comply with the more restrictive applicable requirements.

1.02 RELATED WORK

A. Submittals are included in Section 01300.

B. Site Preparation is included in Section 02100.

C. Dewatering is included in Section 02140.

D. Earthwork is included in Section 02200.

E. Trenching, Backfilling and Compaction is included in Section 02221.

F. Settlement Monitoring is included in Section 02445.

1.03 SUBMITTALS

A. Submit to the ENGINEER in accordance with Section 01300, Shop Drawings and design calculations for the CONTRACTOR-designed excavation support system stamped by a Professional Engineer in the State of California. Submittals shall indicate the following, as a minimum:

B. Shop Drawings shall include:

1. Provide overall plan layout of the system, indicating clearances, dimensions, material properties, member sizes, locations, spacing and penetrations depth of all members, locations of various types of lateral supports. Indicate existing and proposed utilities, structures or other obstruction, location and type of instrumentation and monitoring points within the area of influence of the excavation.

2. Provide wall elevations and locations of all bracing.

3. Show the overall sequence of installation and removal of bracing, indicating levels to which the work will be carried out before bracing is installed or removed.

4. Method of preloading bracing (if required) and the preload for each member, and the method of locking-off the preload. Include detailed drawings of the connections, jacking supports and method of shimming.

5. Details, layout, arrangement, equipment requirements, and method of construction of the proposed excavation support system.

6. Procedures for resolving difficulties arising from misalignment of members exposed during excavation, and criteria for implementing those procedures.

7. Pile driving report meeting the requirements of Section 01060 – Regulatory Agency and Utility Requirements, Coastal Development Permit Condition 80.

C. Design calculations shall include:

1. Loads on the excavation support system for all stages of excavation, bracing removal, and concrete placement, including material and equipment loads on adjacent ground during construction.

2. Design of wall and all bracing members including all details for all stages of construction.

3. Theoretical deflections of excavation support system and deformation of structures, pipelines, and other improvements located within the area of influence of the excavation.

4. Submit to the ENGINEER for review and acceptance, a plan of action to be implemented in the event any threshold value for deformation, as specified in Section 02445, is reached. The plan of actions shall be positive measures by the CONTRACTOR to limit further movement of the wall including but not limited to trenching for struts and wales, placement of granular earth berms against the wall, installation of additional struts, or combinations thereof. The details of the mitigating measures shall include a schedule of implementation, location and/or availability of materials, structural details for all connections to the wall and

support elements, and a detailed description of the method of implementation. The CONTRACTOR shall be prepared to work 24 hours per day to implement such measures. The remedial work/mitigating measures shall be at no additional cost to the OWNER.

D. Submit quality control measures as required to ensure that the performance of the excavation support system is consistent with the approved shop drawings and the requirements herein.

E. Submit welder qualifications and weld procedures in accordance with AWS D1.1.

F. Submit CONTRACTOR's and Design Engineer's qualifications as described herein.

G. At least one copy of the design shall be maintained at the job site during excavation that includes a plan indicating the sizes, types, and configurations of the materials to be used in the protective system, and the identity of the registered engineer who approved the design.

H. Do not proceed with any support of excavation or protection activities until the submittal has been accepted by the ENGINEER.

I. Design Engineer's documentation shall include:

1. On-site inspections of excavation support system as the systems are constructed.

2. Review of quality control measures and performance data.

3. Certification that the excavation support system is constructed per the applicable design following completion of each support system and following any modifications by CONTRACTOR during construction.

1.04 QUALITY ASSURANCE

A. Regulations: Perform all work in accordance with current applicable regulations and codes of all Federal, State and local agencies.

B. The CONTRACTOR shall have at least 5 years of experience with work compatible to the Work shown and specified, employing labor and supervisory personnel who are similarly experienced in this type of Work.

C. The CONTRACTOR's Design Engineer shall be a Registered Professional Engineer in the State of California with at least 5 years professional experience in the design and construction of support of excavation systems and shall have completed not less than 5 successful excavation support projects of equal type, size, and complexity to that required for the work.

1.05 DESIGN REQUIREMENTS

A. The design of temporary excavation support systems is the responsibility of the CONTRACTOR. The design calculations and drawings shall be prepared, stamped and signed by a Professional Engineer registered in the State of California, who is experienced in designing similar excavation support systems.

B. Design temporary excavation support systems in accordance with requirements of this Section. These criteria are the minimum acceptable standards. In the event of a conflict with federal, state, or local regulatory requirements, comply with the more restrictive applicable requirements.

C. All underground utility lines shall be identified, located, and protected from damage or displacement. Utility companies and other responsible authorities shall be contacted to locate and mark the locations and, if they so desire, direct or assist with protecting the underground installation. When required, the CONTRACTOR shall obtain an excavation permit from the local authority having jurisdiction prior to the initiation of any excavation work.

D. Design excavation support systems in accordance with all OSHA requirements and other local and agency requirements.

E. Design the support system to minimize horizontal and vertical movements and to protect adjacent structures and utilities from damage.

F. Excavations below the level of the base of any adjacent foundation or retaining wall shall not be permitted unless the design of the excavation and bracing includes an analysis of the stability of the structure supported by the foundation and as necessary, incorporates required bracing/underpinning of the foundation.

G. For support systems in which bracing is installed between opposite sides of the excavation, design the excavation support of both sides to be nearly the same as feasible.

H. Where necessary to resist point loads, pipe piles used as soldier piles shall be filled with concrete with a compressive strength not less than 3,000 psi. The strength of the concrete shall not be considered in design of the pipe pile for bending stress.

I. Design, install, operate, and maintain ground water control system to control ground water inflows, prevent piping or loss of ground, and maintain stability of the excavation. Refer to the requirements of Section 02140.

J. Design review and field monitoring activities by the OWNER or by the ENGINEER shall not relieve the CONTRACTOR of his/her responsibilities for the work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Soldier piles and structural steel members shall conform to ASTM A572 or ASTM A242 unless approved otherwise. No members with permanent deformations are to be provided. Members shall not be spliced unless approved by the ENGINEER.

B. Steel sheet piling shall conform to ASTM A328 or ASTM A572 or ASTM A690, unless approved otherwise.

C. Liner plates shall be fabricated from structural quality hot-rolled carbon steel sheets or plates conforming to ASTM A1101 with the following minimum properties before cold forming:

1. Tensile Strength: 42,000 psi

2. Yield strength: 28,000 psi

Plates shall be of either the two- or four-flange type, punched for bolting on all sides. Bolt spacing shall be in accordance with the manufacturer's standard spacing and shall be multiples of the plate length so that the plates having the same curvature shall be interchangeable. Bolt numbers and pattern shall be determined by the liner supplier.

D. Concrete shall conform to ASTM C33 and ASTM C150 unless otherwise approved.

E. All timber shall be structural grade with a minimum allowable flexural strength of 1100 psi. Timber lagging shall be at least 3 inches thick and free of large or loose knots.

PART 3 EXECUTION

3.01 GENERAL

A. Commence installation of support system and excavations only after shop drawings have been reviewed and accepted by the ENGINEER.

B. All instrumentation required per Section 02445 shall be installed and initialized prior to the start of work.

C. Methods of construction for excavations shall be such as to ensure the safety of the Work, CONTRACTOR's employees, ENGINEER, and OWNER's employees and inspectors, the public and adjacent property and improvements, whether public or private.

D. Before beginning construction at any location of this project, adequately protect existing structures, utilities, trees, shrubs, and other existing facilities. The repair of or compensation for damage to existing facilities shall be at no additional cost to the OWNER.

E. As a minimum, place fencing, gates, lights, and signs as necessary around the excavations and staging areas to provide for public safety.

F. Install excavation support systems in accordance with the approved shop drawings and applicable permits.

G. All voids between excavation support system and earth shall be filled with materials acceptable to the ENGINEER.

H. If unstable material is encountered during excavation, all necessary measures shall be taken immediately to contain it in place and prevent ground displacement.

I. If settlement or deflections of supports indicate that support system requires modification to prevent excessive movements, redesign and resubmit revised shop drawings and calculations to the ENGINEER at no additional cost to the OWNER.

J. Sufficient quantity of material shall be maintained on site for protection of work and for use in case of accident or emergency.

K. All welding shall conform to the applicable provisions of ANSI/AWS D1.1.

3.02 PORTABLE TRENCH BOXES

A. Portable trench boxes or sliding trench shields may be used for the protection of workers only.

B. Trench boxes shall not be used as tunnel launch and exit shafts.

C. Additional excavation, backfilling, and surface restoration required as the result of trench box use shall be at no additional cost to the OWNER.

D. Trench boxes or shields shall be designed, constructed, and maintained to meet acceptable engineering and industry standards.

E. Shields shall be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.

F. A copy of the trench box manufacturer's specifications, recommendations, and limitations shall be in written form and maintained at the job site during all excavation work.

3.03 SOLDIER PILES

A. Install soldier piles with the minimum embedment depths as shown on approved shop drawings.

B. Soldier piles shall be installed using an impact hammer or within pre-drilled holes.

C. Driven piles shall be installed with driving shoes where hard driving is anticipated.

D. For soldier piles installed in predrilled holes, provide casing or other methods of support as necessary to prevent caving of holes and loss of ground.

E. Predrilled holes for soldier piles shall be backfilled with concrete from the pile tip elevation to the elevation of the bottom of the excavation. The remainder of the predrilled hole shall be backfilled with lean concrete or sand. Concrete strength shall be in accordance with the approved shop drawings.

F. The predrilled hole diameter shall be sufficient to allow for proper alignment and concrete backfilling of the pile.

G. Driven soldier piles shall be advanced without the aid of a water jet unless otherwise authorized.

H. Provide timber lagging of sufficient thickness to withstand earth pressures and in accordance with the approved shop drawings.

I. Install lagging such that ground loss does not occur between adjacent or below the lowest board. As excavation proceeds, the maximum height of unlagged face of excavation shall not exceed 4 feet. The unlagged face shall not exceed 2-ft if water seeps or flows from the face of the excavation or if the face of the excavation becomes unstable.

J. As installation progresses, backfill the voids between the excavation face and the lagging. Pack with materials such as hay, burlap, or geotextile filter fabric where necessary to allow drainage of ground water without loss of ground.

3.04 STEEL SHEET PILING

A. Install steel sheet piling with the minimum embedment depths as shown on the approved shop drawings.

B. Drive sheeting in plumb position with each sheet pile interlocked with adjoining piles for its entire length so as to form a continuous diaphragm throughout the length of each run of wall, bearing tightly against original ground. Exercise care in driving so that interlocking members can be extracted without damaging adjacent structures or utilities. The methods of driving, cutting, and splicing shall conform to the approved shop drawings.

C. Use templates or other temporary alignment facilities to maintain piling line.

D. Prior to installation, the sheet piles shall be thoroughly cleaned and inspected for defects and for proper interlock dimensions. The CONTRACTOR shall provide a tool for checking the interlock dimensions.

E. Each sheet pile shall have sufficient clearance in the interlocks to slide, under its own weight, into the interlock of the sheet pile previously placed.

F. Excavation shall not be carried in advance of steel sheet piling installation.

G. Obstructions encountered before the specified embedment for piles shall be removed. Where obstructions cannot be removed, the sheet pile system shall be re-evaluated by the CONTRACTOR's Design Engineer for the resulted reduced embedment and additional toe stability measure implemented, as required or for realignment of the sheet pile wall. A submittal of the proposed measures shall be provided.

H. Damaged piling or piling with faulty alignment shall be withdrawn and new piling driven properly in its place. The cost of such additional work shall be considered as part of the pile driving and shall be borne by the CONTRACTOR.

3.05 LINER PLATES

A. Liner plates shall be installed as soon as excavation has progressed sufficiently for the next ring of plates to be installed. A complete circumferential ring of liner plates shall be installed prior to continuing the excavation. Installing more than one incomplete ring of liner plates at any time is not acceptable. Plates shall be staggered in the vertical direction to facilitate shaft strength and leakage resistance.

B. Liner plates shall be grouted in accordance with the approved shop drawings.

3.06 INTERNAL BRACING

A. Provide internal bracing to carry maximum design load without distortion or buckling.

B. Include web stiffeners, plates, or angles as needed to prevent rotation, crippling, or buckling of connections and points of bearing between structural steel members. Allow for eccentricities caused by field fabrication and assembly.

C. Install and maintain all bracing support members in tight contact with each other and with the surface being supported. Wood shims shall not be used.

D. Coordinate excavation work with installation of bracing. Excavation shall extend no more than 2 feet below any brace level prior to installation of the bracing.

E. Use procedures that produce uniform loading of bracing member without eccentricities or overstressing and distortion of members of system.

3.07 REMOVAL OF EXCAVATION SUPPORT

A. Do not remove internal bracing and transfer loads to the permanent structure without prior acceptance of the ENGINEER.

B. Removal shall begin at and progress from the bottom of the excavation. Members shall be released slowly as to note any indication of possible failure of the remaining members or possible cave-in of the sides of the excavation.

C. Backfilling shall progress together with the removal of support systems from excavations.

D. Unless otherwise indicated, remove all portions of excavation support.

E. Do not remove vertical support members that were installed within the zone of influence of new or existing structures. The zone of influence is defined as a zone extending down and away from the outer edge of the structure at 1 horizontal to 1 vertical. Support members installed within this zone shall be cut off at 5 ft below finished grade and abandoned in place.

F. No untreated wood shall remain as part of the abandoned portion of the work.

G. When removing the excavation support system, do not disturb or damage adjacent buildings, structures, waterproofing material, or utilities. Fill voids immediately with lean concrete or well-graded cohesionless sand, as indicated or as directed by the ENGINEER.

H. Remove material of the excavation support system from the site immediately.

END OF SECTION

SECTION 02576

PAVEMENT REPAIR AND RESURFACING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, material, equipment and incidentals required and replace all pavement shown in the Drawings, pavement removed over trenches, or otherwise disturbed by the CONTRACTOR's operations.

B. New pavement in streets shall consist of temporary pavement or all weather surface over trenches and final hot mix asphalt (HMA) pavement placed either over trenches or over the entire paved traveled way as shown in the Drawings.

C. Streets, driveways, parking areas or sidewalk pavements damaged or disturbed by the CONTRACTOR's operations shall be repaired, replaced or restored in accordance with the requirements specified herein and as directed for the respective type of pavement replacement and in a manner satisfactory to the ENGINEER.

D. Furnish all labor, material, equipment and incidentals required to cold plane where directed by the ENGINEER.

1.02 RELATED WORK

A. Trimming edges of existing pavement is included in Section 02221.

B. Flowable Fill is included in Section 02210.

C. Hot Mix Asphalt (HMA) is included in Section 02577.

1.03 REFERENCE STANDARDS

A. Except as otherwise specified herein, the 2010 State Standard Plans and Specifications, issued by the California Department of Transportation (CalTrans), shall apply to materials and workmanship required for the work of this Section.

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.04 MAINTENANCE

A. All pavement placed shall be maintained for a period of 1 year. During this period all areas which have settled or are unsatisfactory for traffic shall be refilled and replaced.

PART 2 PRODUCTS

2.01 MATERIALS

A. Pavement shall be as specified in 02577.

PART 3 EXECUTION

3.01 GENERAL

A. Materials for pavement shall be mixed, delivered, placed and compacted in accordance with Section 02577.

3.02 INSTALLATION

A. Temporary pavement or all weather surface shall be placed wherever existing pavement has been removed or disturbed at the end of each day, before traffic is released to roadway.

1. A temporary all-weather roadway surface of aggregate base, per Section 02200, cement treated materials, per Section 02210, or other suitable material, as determined by the ENGINEER, may be used on minor streets prior to final pavement repair during the non-rainy season (April 15 to October 15).

2. Temporary pavement (cold mix asphalt) or cement treated materials, per Section 02210, shall be used for the temporary roadway surface on arterial and collector roads, and on all roads during the rainy season (October 15 to April 15).

B. Final pavement over trenches shall be constructed as specified in Section 02577 and as shown on the Drawings.

C. Final pavement over the entire paved traveled way shall be constructed as follows:

1. Repair all soft and broken areas in temporary and existing pavement. Remove all cold patch that has been placed. Clean all surfaces to be paved of all foreign matter and loose material. All surfaces shall be dry before priming.

2. Where required, level depressions in the temporary pavement or all weather surface with HMA pavement approved by the ENGINEER.

3. Repair any defects in curbing caused by the CONTRACTOR's operations.

4. Place and compact HMA pavement in accordance with Section 02577.

5. Clean all pavement penetrations and remove all loose aggregate from the site.

6. Raise all manhole, drop inlet and catch basin frames, gate valve and curb stop boxes, gas drips and valves and any other pavement penetrations to finished elevation of the new pavement. All raised appurtenances shall be grouted with concrete or otherwise as approved by the ENGINEER to firmly support them flush with the surface of the new pavement.

D. Cold planing shall be performed as follows:

1. In areas directed by the ENGINEER, remove up to 12-in of HMA using a cold planer. The planing machine shall be specifically designed and built for planing flexible pavements and have the ability to plane concrete patches when encountered in bituminous pavement.

2. The planing machine shall be self-propelled and have the means for planing without tearing or gouging the underlaying surface and blading the cutting into a window. The machine shall be capable or being operated at speeds from 10 to 40 fpm and designed such that the operator can at all times observe the planing operation without leaving the control area. A cut to predetermined grade or any specified lesser depth up to the thickness specified in Paragraph 3.02D1 above may be required. The machine shall be adjustable as to crown and depth.

3. All manhole/catch basin covers and grates and other items at the roadway surfaces shall be lowered to a sufficient depth prior to cold planing. All damaged covers, grates and utility boxes shall be replaced with new covers, grates or utility boxes by the CONTRACTOR, at his/her expense.

4. The equipment furnished shall be maintained so as to produce a clean cut in the pavement at all times.

5. The planed surface shall conform generally to the grade and cross slope required and be free from being torn, gouged, shaved, broken or excessively grooved.

6. Surface texture shall be as specified by the ENGINEER and in any case be acceptable to traffic in the event resurfacing is delayed. The planing shall be squared off for the full width of the traveled way at the end of each work day.

7. No cutting shall remain on the project at the end of each work day. Dispose of all waste materials as specified in Section 01046 at no additional compensation.

8. The planed surface shall be free of imperfections of workmanship that will prevent the surface from being resurfaced with new pavement following this operation.

3.03 PAVEMENT MARKINGS

A. Reline all streets with pavement markings equal in type and location where existing prior to paving.

END OF SECTION

SECTION 02577

HOT MIX ASPHALT (HMA) PAVING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Section Includes:

1. Hot mix asphalt (HMA) pavement for roadways, parking areas, ramps, grade adjustments and walkways on prepared aggregate base course or subgrade as shown in the Drawings or required as part of the Work.

2. Removal, preparation and replacement of existing pavement required for the construction of buried utilities, new structures, or potholing that is part of the Work.

3. Removal, preparation, and replacement or repair of existing pavement that is damaged by CONTRACTOR's operations during the construction of the Work.

4. Temporary HMA pavements until the permanent pavements can be constructed.

1.02 RELATED WORK

A. Earthwork is included in Section 02200.

B. Painted Traffic Lines and Markings are included in Section 02762.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, the following:

1. Product information for aggregate materials, HMA mix design, and prime and tack coats. Minimum information shall include source of aggregates and asphalt, gradation, unit weight of mix design, gradation, air void content, and other test results needed for compliance with the 2010 CalTrans Standard Specifications and field testing by ENGINEER.

1.04 REFERENCE STANDARDS

A. State of California Department of Transportation (CalTrans):

1. Standard Specifications, 2010.

PART 2 PRODUCTS

2.01 HOT MIX ASPHALT (TYPE A):

Hot mix asphalt (HMA) shall be Type A, using the standard process for overlays, and shall conform to the provisions in Section 39, "Hot Mix Asphalt," of the 2010 State Standard Specifications and these Specifications.

A. The grade of asphalt binder to be mixed with aggregate for HMA Type A shall be Performance Grade PG 70-10 for dikes and dike overlays and PG 64-10 for all other HMA and shall conform to the provisions in Section 92, "Asphalts," of the 2010 State Standard Specifications.

B. The aggregate for HMA Type A shall be 3/8-inch grading for dikes and dike overlays and ½-inch grading for overlays and leveling courses.

C. All Job Mix Formulas in accordance with Section 39-1.03, "Hot Mix Asphalt Mix Design Requirements," of the 2010 State Standard Specifications shall be submitted within 10 calendar days, not including Saturdays, Sundays, and legal holidays, of the CONTRACTOR's receipt of the fully executed contract, in accordance with Section 4-1.03, "Submittals," of these Specifications.

D. The first paragraph of Section 39-1.07, "Production Start-up Evaluation," of the 2010 State Standard Specifications is modified to read: "The ENGINEER evaluates HMA production and placement at start-up or at any location agreed upon at least 3 business days in advance.

E. In addition to the requirements of Section 39-2.02B, "Quality Control Testing," of the 2010 State Standard Specifications the CONTRACTOR shall submit QC test reports to the ENGINEER on Caltrans Form CEM 3501 within 2 days of production. Testing and inspection frequency shall conform this section or as directed by the ENGINEER.

F. In addition to the requirements of Section 6-1.04, "Defective Materials," 39-2.03A, and 39-3.02A, "Testing," of the 2010 State Standard Specifications, a credit to the OWNER of $5 per ton, at the discretion of the ENGINEER, will be taken for each ton of HMA represented by acceptance tests that do not comply with these provisions.

G. Item 1 of the third paragraph of Sections 39-2.03A and 39-3.02A, "Testing," of the 2010 State Standard Specifications is hereby modified to read: "Stop production if directed by the ENGINEER."

PART 3 EXECUTION

3.01 EXISTING PAVEMENT REMOVAL

A. Existing pavements to be removed shall be cut or ground by a wheel cutter, clay spade, or other device capable of making a neat, and reasonably straight cut with minimal damage to adjacent pavement that is not to be removed.

B. If saw cut, the existing pavement shall be cut and trimmed after placement of required base course material and just prior to placement of HMA for pavement replacement, and the trimmed edges shall be painted with a coating of prime coat immediately prior to constructing the new abutting HMA pavements. No extra payment shall be provided for these items, and all costs incurred in performing this work shall be incidental to underground utility construction or pavement replacement.

C. All removed pavement material is the property and disposal responsibility of the CONTRACTOR.

3.02 PAVEMENT INSTALLATION

A. The construction of HMA pavements shall conform to the requirements of these Specifications and upon completion the pavement shall be true to grade and cross.

B. The CONTRACTOR shall not pass equipment over any pipe, drain, utility line, duct or structure before it is protected by ample fill material, properly compacted. Any damage to such facilities shall be promptly repaired by the CONTRACTOR at its own expense.

C. The subgrade shall be brought to the required grades and cross sections by excavating, filling, blading and compacting as specified.

D. Base and subbase materials shall be bladed to a smooth surface and shall be compacted to 95 percent relative compaction as determined by ASTM D1557. Subgrade for pavement shall not vary more than 0.05 feet (1.5 cm) from the specified road grade.

E. When HMA is to be applied over existing pavement, existing surfaces adjoining gutters and other permanent features shall be ground to create smooth transitions and to maintain surface water flow lines.

F. Potholes and depressed areas in existing pavements to be overlaid with new HMA shall be completely removed, subgrade and aggregate base course prepared, and patched with new HMA before the installation of new pavement overlays.

G. At terminations of new surface course, the HMA shall be feathered into the existing surface over such a distance as may be required to produce a smooth riding transition. Existing pavements to be over-laid shall be ground or removed as required to avoid feather edges less than 1-in in depth.

H. Grind all edges with concrete swales and gutters to provide minimum 1-in depth at transition and to maintain original drainage flow lines between new and existing surfacing unless otherwise noted.

I. The top of pavement shall match utility surface features such as valve boxes, corrosion protection test station boxes, electrical and telephone pull boxes, utility vaults, etc. Wherever possible drainage should be directed away from such utility structures, except drainage structures such as curb inlets and drop inlets.

J. Vertical Joints: Before opening the lane to public traffic, pave shoulders and median borders adjacent to a lane being paved.

    1. Longitudinal vertical joints are not allowed on the traveled way open to traffic, regardless of thickness. Place HMA on adjacent traveled way lanes so that at the end of each work shift, the distance between the ends of HMA layers on adjacent lanes is between 5 feet and 10 feet. Place additional HMA along the transverse edge at each lane's end and along the exposed longitudinal edges between adjacent lanes. Hand rake and compact the additional HMA to form temporary conforms. Kraft paper or another approved bond breaker may be placed under the conform tapers to facilitate the taper removal when paving operations resume.

    2. Place shoulder conform tapers concurrently with adjacent lane's paving.

3. At the end of each work shift a vertical joint between driveways and adjacent lanes shall not be more than 0.15 foot.

K. Smoothness: The first paragraph 39-1.12A, "General," of the 2010 State Standard Specifications is hereby modified to read: "Determine HMA smoothness with a straightedge."

1. Section 30-1.12C, "Profilograph," of the 2010 State Standard Specifications shall not apply.

2. The fourth paragraph of Section 39-1.12D, "Smoothness Correction," is hereby modified to read: "After grinding, measure the ground HMA pavement surface with a 12-foot straightedge until the pavement is within specified tolerances. If straightedged pavement cannot be ground to within specified tolerances, remove and replace the pavement.

L. Compaction Testing: Relative density of HMA placed in overlay layers (excludes leveling) of 0.15 foot or more, and in widths 5 feet or more will be determined by nuclear gage in backscatter mode in accordance with California Test 375.

1. Section 39-1.04F, "Cores," of the Standard Specification is hereby deleted.

2. The first paragraph of Section 39-1.07, "Production Start-up Evaluation," of the 2010 State Standard Specifications is hereby modified to read: "The ENGINEER evaluates HMA production and placement at start-up or at any location agreed upon at least 3 business days in advance."

3. The sixth paragraph of Section 39-1.07, "Production Start-up Evaluation," of the 2010 State Standard Specifications is hereby modified to read: "For Standard projects, perform a test strip in accordance with California Test 375 to calibrate nuclear gages. The ENGINEER will take density measurements with a nuclear from random locations selected per California Test 375. Take two 4-inch or 6-inch diameter cores of HMA from the locations of each test site. Take cores in the ENGINEER's presence, and backfill and compact holes with HMA. Before submitting a core to the ENGINEER, mark it with the core's location and place it in a protective container. Do not start production paving until the ENGINEER has correlated the nuclear gage with the core densities and has developed a gage conversion factor; this is assumed to require two business days after the completion of the test strip. A new test strip is required if the mix design is changed, if the lift thickness is changed, material source changes, or if the gage used is changed or recalibrated."

4. The fourth and fifth paragraphs of Section 39-2.03A, "Testing," are hereby modified to read: "The ENGINEER determines the percent of maximum theoretical density of the HMA in 500 ton lots, using a calibrated nuclear gauge, with a minimum of ten tests per lot. The ENGINEER will provide the CONTRACTOR the final results of the nuclear gauge tests based on the maximum theoretical density of that day's production within 24 hours. The CONTRACTOR may proceed with the work at the CONTRACTOR's own risk before the final results are available. If the maximum theoretical density results for any day's production are not available by the end of shift, the ENGINEER will provide the CONTRACTOR preliminary results based on the maximum theoretical density of a previous day's material.

5. If the relative compaction of any lot, based on the calibrated nuclear gauge, is less than 89%, or greater than 99%, the CONTRACTOR shall take two cores from each 500 ton lot at random locations designated by the ENGINEER, in accordance with the procedures specified above. The ENGINEER determines the percent of maximum theoretical density for each core by determining the core's density and dividing by the maximum theoretical density. The average percent of maximum theoretical density of the two cores will be considered final for determining removal and replacement requirements."

M. Hot Mix Asphalt Paving: In addition to the requirements of Section 39-1.09, "Subgrade, Tack Coat, and Geosynthetic Pavement Interlayer," of the 2010 State Standard Specifications, the CONTRACTOR shall remove any permanent pavement markers, temporary pavement delineation and temporary construction tapers prior to the HMA overlay operation and dispose of materials as provided in Section 7-1.13, "Disposal of Materials Outside the Highway Right of Way", of the 2010 State Standard Specifications.

1. The CONTRACTOR shall mark or otherwise provide line for the paving operation longitudinal joints shall correspond with the existing traffic stripes.

2. At locations where the new overlay width is not as wide as the existing roadway surfacing, the outer one foot shall be tapered and compacted so the outer edge of new pavement is a maximum one-half inch thick.

3. Additional HMA surfacing material shall be placed along the edge of road connections, private drives, and other highway facilities, hand raked, if necessary, and compacted to form smooth, tapered conforms an shown on "Asphalt Concrete Blanket Details" of these Specifications. Full compensation for furnishing all labor and tools and for doing all the work necessary to hand rake these conforms shall be considered as included in the contract prices paid per ton for the various items of HMA surfacing involved and no additional compensation will be allowed therefor.

N. Hot Mix Asphalt (Miscellaneous Areas): This work includes producing hot mix asphalt (HMA) and placing it on miscellaneous areas and shall conform to the provisions in Section 39, "Hot Mix Asphalt," of the 2010 State Standard Specifications and these Specifications.

1. Miscellaneous areas include, but are not limited to, Overside Drains (OSD), Driveways and Intersection Flares, swales, ditches, and non-standard berms.

O. Place Hot Mix Asphalt Dike Overlay: Dikes shall be overlaid, shaped, and compacted with an extrusion machine to the required cross sections at the locations and shaped designated on the Plans and shall conform to the provisions in Section 39, "Hot Mix Asphalt," of the 2010 State Standard Specifications and these Specifications.

3.03 ROADWAY SURFACE REMOVAL

A. All pavement cuts shall be neat and straight to provide an unfractured and level pavement joint for bonding existing surfacing with pavement replacement. Pavement cuts shall be parallel or at right angles to the road or area centerlines. All cut edges shall provide clean, solid, vertical faces free from all loose material.

B. All existing crushed aggregate and pavement removed, and any excess new material shall be hauled away from the project site and legally disposed of by the CONTRACTOR.

3.04 RESURFACING

A. In all existing pavement areas where the surface is removed, broken or damaged by CONTRACTOR's equipment or in which the ground has caved in or settled because of the installation of the improvements, or areas designated to be repaved, resurfaced, or modified, the surface shall be restored to the original grade by the CONTRACTOR. Prior to resurfacing, the existing surfacing shall be removed as provided above. All broken and jagged edges of the pavement edge shall be straight. Areas to be cut shall be indicated until these edges have been sawed. If during the initial removal of the existing pavement a method of removal was used that disturbed the adjoining pavement, or if during general construction operations the adjacent pavement was disturbed, then this adjoining pavement must also be removed and replaced. Where irregular surfaces are to be surfaced, existing pavement shall be cut parallel to the alignment of the pipe or to the centerline of the roadway. Pavement shall be saw cut or ground to a minimum depth of 2-in at a point not less than 6-in outside the limits of excavation or the previous pavement cut (made by pneumatic tools), whichever limits are the greater. The additional surfacing so cut shall be removed and disposed of by the CONTRACTOR prior to resurfacing.

B. Restoration of pavement shall be to the same section as the existing roadway/paved area or a minimum thickness of 3-in, whichever is greater.

3.05 PAVEMENT MARKING REPAIR

A. All traffic markings and signs painted on areas which are covered with new or repair pavement shall be replaced in kind. See Section 02762.

3.06 SPECIAL REQUIREMENTS

A. The restoration of all surfaces, as described herein, disturbed by the installation or repair to underground facilities shall be completed as soon as is reasonable and practical, but in no case greater than the time allowed in Section 01571.

3.07 CLEAN-UP

A. After all installation, repair and restoration of paving has been completed, all excess asphalt, dirt, rock and other debris shall be removed from the roadways. Adjoining curbs, gutters, structures, and other surfaces over-sprayed or splattered shall be cleaned of all HMA products.

3.08 REPAIR OF PAVEMENT SURFACE

A. Following Final Completion, the CONTRACTOR shall repair settled pavement over trenches, excavation, or backfill placed as part of this Work during the period of the warranty of the Work.

B. All materials and labor required for the repair of paving shall be supplied by the CONTRACTOR and the work shall be done in a manner satisfactory to the ENGINEER.

END OF SECTION

SECTION 02616

DUCTILE IRON PIPE AND FITTINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required, install, disinfect and test ductile iron fittings for piping as shown on the Drawings and as specified herein.

B. Fittings shall be located substantially as shown on the Drawings. The ENGINEER reserves the right to make such modifications in locations as may be found desirable to avoid interference between pipes or for other reasons. Pipe fitting notation is for the CONTRACTOR's convenience and does not relieve him/her from installing and jointing different or additional items where required to achieve a complete piping system.

C. Where the word "pipe" is used it shall refer to pipe, fittings, or appurtenances unless otherwise noted.

1.02 RELATED WORK

A. Submittal Requirements are included in Section 01300.

B. Pipeline testing and cleaning is included in Section 01445.

C. Warranties and bonds are included in Section 01740.

D. Jacking is included in Section 02151.

E. Trenching, Backfilling and Compaction is included in Section 02221.

F. Earthwork is included in Section 02200.

G. Sedimentation and Erosion Control is included in Section 02270.

H. Pavement Repair and Resurfacing is included in Section 02576.

I. Valves and Appurtenances are included in Division 15.

1.03 SUBMITTALS

A. Submit shop drawings and product data, including piping layouts, design calculations, warranty information, test reports, in accordance with Section 01300 and the referenced standards.

B. Submit design calculations in accordance with Paragraph 2.02 below signed by a Professional ENGINEER, as noted in Section 01300.

C. Submit the name of the pipe and fitting suppliers and a list of materials to be furnished.

D. Prior to shipment of pipe, certified copies of mill tests confirming the type of materials used in the pipe, and shop testing of pipe to show compliance with the requirements of the applicable standards, along with a sworn affidavit of compliance that the pipe complies with the referenced standards, shall be submitted.

E. Submit copies of all shop tests, including hydrostatic tests.

F. Submit information on all warranties per Section 01740.

G. Submit shop drawings with a tabulated laying schedule which references stations and invert elevations as shown on the Drawings as well as all fittings, bends, outlets, restrained joints, tees, special deflection bells, adapters, solid sleeves and specials, along with the manufacturer's drawings and specifications providing complete details of all items. The laying schedule shall show pipe class, class coding, station limits and transition stations for various pipe classes. The above shall be submitted to the ENGINEER for approval before manufacture and shipment. The location of all pipes shall conform to the locations indicated on the Drawings. Full length pipe may be supplied from inventory provided that all specification requirements are met. Shop drawings shall include but not be limited to:

    1. Complete and dimensional working drawings of all pipe layouts, including pipe stationing, invert elevation at changes in grade or horizontal alignment, all elements of curves and bends both in horizontal alignment and vertical position.

    2. The grade of material; size, wall thickness, of the pipe and fittings and appurtenances, type and location of fittings, specials, and valves; and the type and limits of the lining, lining reinforcing and coating systems of the pipe and fittings. Methods and procedures recommended by the coating manufacturer will be documented.

    3. Joint details; methods and locations of supports,; and complete information concerning type, size and location of all welds. Shop welds (no field welding will be allowed) will be clearly differentiated and welds will be clearly detailed with preparation procedures for all pipe and parent material comprising each weld. Critical welding procedures will be identified along with methods for controlling welding stresses and distortions. Locations and proposed joint details will also be clearly identified.

    4. Method of manufacture of pipe fittings; and any specials.

    5. All other pertinent information for all items to be furnished; product data to show compliance of all couplings, supports, fittings, coatings and related items.

H. Submit anticipated production and delivery schedule.

I. Prior to shipment of pipe, submit a certified affidavit of compliance from the manufacturer stating that the pipe, fittings, gaskets, linings and exterior coatings for this project have been manufactured and tested in accordance with AWWA and ASTM standards and requirements specified herein.

J. Submit handling procedures for all phases from finished fabrication through delivery including storage, transportation, loading, and unloading. This will include storage at the project site and required protection following installation prior to startup.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and other special Purpose Applications.

2. ASTM A194 - Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service.

3. ASTM A242 – Standard Specification for High-Strength Low-Allow Structural Steel

4. ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

5. ASTM C150 - Standard Specification for Portland Cement.

B. American Water Works Association (AWWA)

1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.

2. AWWA C105 – American National Standard for Polyethylene Encasement for Ductile Iron Pipe Systems

3. AWWA C110 - Ductile-Iron and Gray-Iron Fittings, 3-in through 48-in (75mm Through 1219mm) for Water.

4. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

5. AWWA C115 – Flanged Ductile Iron Pipe with Ductile Iron or Gray Iron Threaded Flanges.

6. AWWA C116 – Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior surfaces of Ductile Iron and Grey Iron Fittings for Water Supply Service.

7. AWWA C150 – Thickness design of Ductile Iron Pipe

8. AWWA C151 – Ductile Iron Pipe, Centrifugally Cast

9. AWWA C153 - Ductile- Iron Compact Fittings, 3-in through 24-in and 54-in through 64-in, for Water.

10. AWWA C550 – Protective Interior Coatings for Valves and Hydrants

11. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

12. AWWA C606 – Grooved and Shouldered Joints

13. AWWA C651 - Disinfecting Water Mains.

14. AWWA M41 – Ductile Iron Pipe and Fittings Manual of Water Supply Practices

C. American National Standards Institute (ANSI)
   1. ANSI B16.1 – Cast Iron Pipe Flanges and Flanged Fittings

D. National Sanitation Foundation (NSF)

   1. NSF 61 – Drinking Water System Components Health Effects.

E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. It is a requirement of these Contract Documents to have all of the ductile iron pipe under thus section designed and supplied by a single manufacturer rather than have selection and supply of these items by a number of different manufacturers. Similarly. It is a requirement of these Contract Documents to have all of the ductile iron fittings under this section designed and supplied by a single manufacturer rather than have selection and supply of these items by a number of different manufacturers. All connections between the fittings shall be compatible, as detailed in Section 1.06.

B. All ductile-iron fittings to be installed under this project shall be inspected and tested at the foundry as required by the standard specifications to which the material is manufactured. Furnish in duplicate to the ENGINEER sworn certificates of such tests and their results at least 5 days prior to the shipment of the goods.

C. Inspection of the fittings will also be made by the ENGINEER or representative of the OWNER after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the Specification requirements even though pipe may have been accepted as satisfactory at the place of manufacture. Fittings rejected after delivery (including defects from manufacturing or delivery/transport) shall be marked for identification and shall immediately be removed from the job at the CONTRACTOR’s expense.

D. All pipe and fittings to be installed under this Contract may be inspected at the plant for compliance with this Section by an independent testing laboratory selected by the ENGINEER at the OWNER's expense.

E. A manufacturer's representative shall be made available to the ENGINEER during the manufacturing furnishing, transporting, and unloading of the pipe during installation and testing of the pipe to assist in insuring that the pipe is properly fabricated, transported, unloaded, stored in the field, joined and tested. Manufacturer's responsibilities relate only to the proper care and treatment of the pipe during these procedures and not the techniques or procedures used during installation and testing.

   1. The designated factory representative shall be made available at any time the ENGINEER may request. The field or site representative shall be made available a minimum of 10 working days (time on site) during the project when requested by the ENGINEER.

   2. The cost for the services of the factory representative, including expenses, shall be considered incidental to the project and will not be paid separately.

F. The manufacturer shall meet the following criteria and furnish the necessary project information , which demonstrates the required experience:

1. Experience shall include the successful fabrication of at least 50 fittings in compliance with AWWA C110 or C153 of the largest specified diameter or larger with similar lining/coatings within the past 5 years.

G. All fittings shall be marked in accordance with all applicable AWWA standards. Legibly and permanently mark all fittings, specials and appurtenances to be consistent with the laying schedule and marking drawings (if required) with the following information:

1. Manufacturer, date.

2. Size, type, class, or wall thickness.

3. AWWA Standard(s) produced to.

4. Special fittings, bends, and appurtenances requiring specific orientation will be appropriately marked with the words "TOP" in the correct position and in a consistent location.

1.06 DESCRIPTION OF SYSTEMS

A. Fittings shall be supplied by one of the named pipe manufacturers or ENGINEER approved equal. Fittings shall be as supplied by the American Cast Iron Pipe Co., U.S. Pipe and Foundry, Griffin Pipe Products, all pipe divisions of the McWane Company or an approved equal who is a member of the Ductile Iron Pipe Research Association (DIPRA). All ductile iron fittings shall be supplied by a single manufacturer. The fittings supplier shall certify in writing that their fittings are compatible with the supplied brand of pipe.

B. Pipe is to be installed in those locations shown on the Drawings, and only where specifically indicated.

C. CONTRACTOR is responsible for compatibility between joints of all items they supply.

D. In the case of conflict between information on the Drawings and this section especially concerning pressures, coatings, linings minimum thickness etc. the information given in this section shall govern.

1.07 DELIVERY, STORAGE AND HANDLING

A. Care shall be taken in loading, transporting, and unloading to prevent injury to the fittings. See AWWA C600 and the referenced AWWA Standards for Shipping, handling and storage procedures. All fittings shall be examined as noted in Division 1. Any damage to linings or coatings discovered during the examination shall be repaired to the satisfaction of the ENGINEER at the cost of the CONTRACTOR, before proceeding with the work.

B. Under no circumstances shall the fittings be dropped or skidded against each other. Care shall be taken to preventing marring the pipe coating. Padded wooden pipe cradles, or chocks suitable for the protection of coatings shall be used between finished pipes and beneath them when pipes are placed upon rough surfaces.

C. Materials, if stored, shall be kept safe from damage. The interior of all fittings and other appurtenances shall be kept free from dirt, excessive corrosion or foreign matter at all times.

D. No metal tools or heavy objects shall be permitted to come in contact unnecessarily with the finished coating. Workers will be permitted to walk upon the coated pipe only when necessary, in which case they shall wear footwear with rubber or composition soles and heels that are sufficiently free of dirt and mud that coating remains undamaged.

1.08 WARRANTIES

A. Provide warranties as required in Section 01740.

PART 2 PRODUCTS

2.01 MATERIALS

A. Ductile iron pipe shall conform to AWWA C151. Pipe shall be supplied in standard lengths as much as possible.

B. Thickness design shall be per AWWA C150. The pipe supplier shall perform thickness analysis as referenced in Paragraph 2.02. All ductile iron pipe supplied shall meet the minimum wall thickness and pressure class indicated on the drawings.

2.02 DUCTILE IRON PIPE DESIGN

A. Ductile iron pipe shall have a minimum tensile strength of 60,000 psi with minimum yield strength of 42,000 psi (per AWWA M-41). Design shall be done for external and internal pressures separately using the larger of the two for the net design thickness. Additional allowances shall be made for service allowance and casting tolerance per AWWA C150. The pipe classes determined for various sizes and conditions shall provide the total calculated thickness at a minimum or conform to minimum pipe class specified in Paragraph 2.01A2 above, or as shown on the Drawings, whichever is greater.

B. Design for the net thickness for external loading shall be taken as the greater of the following conditions:

1. 2-1/2-ft of cover with AASHTO H-20 wheel loads, with an impact factor of 1.5.

2. Depth from existing ground level of future proposed grade (whichever is greater) to top of pipe as shown on the Drawings, with truck load.

3. Soil Density: 125 lbs/cu ft

4. Laying Conditions; AWWA C150, Type 2.

C. Design for the net thickness shall be based upon the following internal pressure conditions:

1. Design pressure: 150 psi

2. Surge allowance: 100 psi

3. Safety factor: 2

4. Total internal pressure design: 2 ([150] + [100]) = [500] psi

5. E': 300 psi

D. Copies of design calculations showing that the pipe meets all of the requirements specified herein shall be furnished to the ENGINEER for approval during shop drawing review in accordance with Section 01300. A yield strength of 42,000 psi shall be used during design calculations.

2.03 END TREATMENTS/JOINTS

A. Ductile iron pipe/fitting joints shall be push-on rubber gasket type or rubber-gasket mechanical joint. All joints for pipe and fittings shall be restrained. All gasket materials shall comply with Table 5-1 of AWWA M-41. Rubber-gasket joints shall conform to AWWA C111. Gasket shall be of styrene butadiene rubber (SBR).

B. Restraint for push on joint pipe shall be positive locking "Locked-type" joints manufactured by the pipe and fitting manufacturer that utilize restraint independent of the joint gasket. All restrained joints shall be suitable for the specified 200 psig test pressure. Joints shall be fabricated of heavy section ductile iron casting. Bolts and nuts shall be low carbon steel conforming to ASTM A193, Grade B7. Restraint for mechanical joint pipe shall use retainer glands for restraining joint. Restrained push on joints shall be by one of the following or an approved equal:

- "TR Flex" by US Pipe and Foundary Company
- "Superlok" by Clow Water Systems Company

1. The minimum number of restrained joints required for resisting forces at fittings and changes in direction of the pipe shall be determined from the length of restrained pipe on each side of the fittings and changes in direction necessary to develop adequate resisting friction with the soil. The required lengths of restrained joints shall be as shown on the Drawings.

2. Restrained pipe joints that achieve restraint by incorporating cut out sections in the wall of the pipe shall have a minimum wall thickness at the point of the cut out that corresponds with the minimum specified wall thickness for the rest of the pipe.

C. Threaded ductile iron flanges for ductile iron pipe shall be fabricated per AWWA C115 and sealed during installation with a special high pressure, full face gasket per AWWA C111. At the pipe manufacturer's option, the use of 250 lb pattern flanges, which are faced and drilled in accordance with ANSI B16.1 may be substituted in order to match valves or other equipment and/or to meet the required working pressure requirements. All flanges shall be rated for the same pressure as the adjacent pipe in all cases. Compatibility of the flanges with the 250 lb class and higher special class AWWA valves will the responsibility of the CONTRACTOR.

1. Flanges shall be pre drilled and then faced after being screwed onto the pipe, with flanges true to 90 degrees of the pipe axis and shall be flush with the end of the pipe.

2. Gaskets shall be full face rubber, 1/8" thick SBR material. Such as American Torseal Gasket, or approved equal. Special material ring gaskets such as those by Garlock or equal may be required for pressures exceeding 250 for ANSI rated and custom flanges.

3. Flanged joints shall be supplied with bolts and nuts on one end, bolt studs with a nut at each end, or studs with nuts on one end where the flange is tapped. The number and size of bolts shall comply with the same standard as the flange. Bolts and nuts shall, except as otherwise specified or noted in the Specifications or on the Drawings, comply with ASTM A193, grade B7.

4. Blind flanges shall mate with regular flanges.

D. Couplings and Adapters

1. Sleeve type couplings shall be Dresser Style 38, 138 or equal.

a. Buried sleeve-type couplings shall have a protective wrapping of "Denso" material by DENSO Inc. of Texas or equal. Where "Denso" material is used, the joint shall be packed up with "Densyl mastic" to give an even contour for wrapping with "Densopol" tape. A 1.5 mm thick coating of "Denso" paste shall be applied following by 100 mm or more wide "Densopol" tape wound spirally round the joint with at least 50 percent overlap.

2. Split Sleeve type flexible couplings shall be Victaulic Depend-O-Lok Style E x E (unrestrained) or F x F (self-restrained) or equal.

3. Grooved flexible joints for ductile iron pipe sizes 36-in and smaller must be in accordance with AWWA C606 and shall be Victaulic Style 31 or equal.

4. Shouldered flexible joints for ductile iron pipe larger than 36-in shall be Victaulic Style 44 or equal.

2.04 FITTINGS

A. Pipe fittings shall be ductile iron with pressure rating of 350 psi for 24-in and smaller piping. Fittings shall meet the requirements of AWWA C110 or AWWA C153 as applicable. Fittings shall have the same pressure rating, as a minimum, of the connecting pipe.

B. Weld-on Outlets

1. As an alternative to ductile iron cast fittings, weld-on outlets may be used. Welded-on outlets shall be limited to branch outlets having a nominal diameter not greater than 30 percent of the nominal diameter of the main pipe, or 14-inches diameter, whichever is smaller. Welded-on outlets may be provided as radial tee outlet, tangential outlet, or lateral outlet fabricated at a specific angle to the main pipe (in 1 degree increments between 45 and 90 degrees from the axis of the main pipe). Welded-on outlets shall be welded onto the pipe under the supervision of a qualified welder at the same facility where the pipe is manufactured.. The ductile iron pipe manufacturer shall have a minimum of 5 years experience in the fabrication and testing of outlets of similar size and configuration. In no case shall field welding on of outlets be allowed.

2. The joints on welded-on outlets shall be compatible with the connecting pipe and meet where applicable, the requirements of ANSI/AWWA C111/A21.11 and/or ANSI/AWWA C115/A21.15.

3. Welding procedures for welded-on outlets shall be as determined by the pipe manufacturer.

   a. Parent pipe and branch outlet candidate pipe shall be centrifugally cast ductile iron pipe designed in accordance with ANSI/AWWA C150/A21.50 and manufactured in accordance with ANSI/AWWA C151/A21.51. Minimum class shall be: for sizes 4-inch through 54-inch, special thickness class 53.

   b. All welded-on outlets shall be rated for the working pressure indicated on the Drawings and the connecting pipe. Prior to the application of any coating or lining in the outlet area, all weldments for branch outlets to be supplied for this project shall be subjected to an air pressure test of at least 15 psi. Air leakage is not acceptable. A hydrostatic test of 500 psi for 2 hours should also be allowed as an alternative. No leakage is allowed on the hydrostatic test. The hydrostatic test shall be done prior to cutting out the parent pipe. The rating, safety factor and testing must be certified and contained in the manufacturer's submittal package.

2.05 INTERIOR LINING

A. Ductile iron fittings shall have the same type of lining as specified herein.

B. Ductile iron pipe and fittings shall have a cement mortar lining double the minimum thickness required by AWWA C104. The cement shall be per ASTM C150.

C. At the option of the supplier, fittings may be lined in accordance with AWWA C550. Lining shall be NSF 61 certified.

2.06 EXTERIOR COATING

A. Buried fittings shall be installed with a bituminous coating in accordance with AWWA C151 and C110 respectively.

B. Buried pipe and fittings shall be installed with polyethylene encasement. Polyethylene encasement shall have a minimum thickness of 8 mils and meet or exceed the minimum standards established by AWWA C105, current edition. Acceptable manufacturers include Northtown or approved equal.

1. Polyethylene encasement shall meet minimum size requirements per TABLE 3 of section 2.15 of DIPRA's Installation Guide For Ductile Iron Pipe.

2. Test results from an independent testing agency certifying that the polyethylene encasement meets all criteria established by AWWA C105, current edition, shall be submitted to the ENGINEER prior to approval of the polyethylene encasement for use. In general, samples shall be submitted and include test results in accordance with the AWWA standard associated with tensile strength, elongation, dielectric strength, impact resistance, and propagation tear resistance.

3. A 2-inch wide plastic adhesive tape, such as Calpico Vinyl, Polyken 900, or approved equal, shall be used for sealing seams, cuts, or tears in polyethylene encasement. Duct tape shall not be allowed.

PART 3 EXECUTION

3.01 GENERAL

A. Care shall be taken in loading, transporting and unloading to prevent injury to the fittings, lining or coatings. Fittings shall not be dropped or skidded against each other. All fittings shall be examined before laying and no piece shall be installed which is found to be defective. Any damage to the fittings, lining or coatings shall be repaired per manufacturer's recommendations. Handling and laying of fittings shall be in accordance with manufacturer's instruction and as specified herein.

If any defective fittings are discovered after it has been laid, it shall be removed and replaced with a sound fitting in a satisfactory manner. All fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work and when installed or laid, shall conform to the lines and grades required.

B. Materials, if stored, shall be kept safe from damage. The interior of all fittings and other appurtenances shall be kept free from dirt, excessive corrosion or foreign matter at all times.

C. Gaskets for mechanical and push-on joints to be stored shall be placed in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.

3.02 INSTALLING DUCTILE IRON FITTINGS

A. Ductile iron fittings shall be installed in accordance with requirements of AWWA C600, except as otherwise specified herein. A firm, even bearing throughout the length of the pipe shall be provided by digging bell holes at each joint and by tamping backfill materials at the side of the pipe to the springline per details shown on the Drawings. Blocking will not be permitted. If any defective fitting is discovered after it has been laid, it shall be removed and replaced with a sound fitting in a satisfactory manner by the CONTRACTOR, at his/her own expense.

All fittings shall be kept clean until they are used in the work and shall be sound and thoroughly cleaned before laying. When laid, the fittings shall perform to the lines and grades required. Sufficient backfill shall be placed to prevent flotation.

All ductile iron fittings laid underground shall have a minimum of 4 of feet of cover unless otherwise shown on the Drawings or as specified herein.

Fittings, in addition to those shown on the Drawings shall be provided, where required, in crossing utilities which may be encountered upon opening the trench. Solid sleeve closures shall be installed at locations approved by the ENGINEER. The first pipe section connecting to fittings shall be a full length section of pipe.

3.03 PIPE JACKING

A. Pipe jacking is specified in Section 02151.

3.04 CLEANING

A. At the conclusion of the work, thoroughly clean all of the fittings by flushing with water or other means to remove all dirt, stones, pieces of wood, or other material which may have entered during the construction period. All debris shall be removed from the pipeline. The lowest segment outlet shall be flushed last to assure debris removal.

B. After the fitting has been cleaned and if the groundwater level is above the pipe or water in the pipe trench is above the pipe following a heavy rain, the ENGINEER will examine the pipe for leaks. If defective fittings or joints are discovered at this time, they shall be repaired or replaced by the CONTRACTOR.

3.05 DISINFECTION

A. Ductile iron fittings used for recycled water service shall be disinfected after cleaning. Provide all necessary equipment and labor for the disinfection.

B. Disinfection shall be in accordance with AWWA C651 standard.

C. Discharge of chlorinated water shall comply with all Federal, State and local standards. Provide sodium bisulfite for dechlorination prior to discharge.

3.06 TESTING

A. After installation, the pipe shall be tested for compliance in accordance with Section 01445 and as specified herein. Furnish all necessary equipment and labor for the hydrostatic pressure test on the pipelines.

B. Submit detailed test procedures and method for ENGINEER's review. In general, testing shall be conducted in accordance with AWWA C605. The method and procedures for performing the hydrostatic pressure test shall be approved by the ENGINEER. Submit the plan for testing to the ENGINEER at least 10 days before starting a test.

C. Pressure pipelines shall be subjected to a hydrostatic pressure in accordance with paragraph 1.06-D. This test pressure shall be maintained for a minimum of 2 hours. The hydrostatic testing allowances shall not exceed those indicated in AWWA C605. Provide suitable restrained bulkheads as required to complete the hydrostatic testing specified.

D. CONTRACTOR shall make any taps and furnish all necessary caps, plugs etc, as may be required in conjunction with performing the testing.

E. Gravity pipelines shall be subjected to hydrostatic pressure test as specified in AWWA C605.

F. All valves and valve boxes shall be properly located and installed and operable prior to testing. Bulkheads shall be provided with a sufficient number of outlets for filling and draining the line and for venting air.

G. Hydrostatic pressure tests shall conform to Section 7.3 of AWWA C605. Furnish gauges, meters, pressure pumps and other equipment needed to fill the line slowly and perform the required hydrostatic pressure tests.

H. The line shall be slowly filled with water and the specified test pressure shall be maintained in the pipe for the entire test period by means of a pump furnished by the CONTRACTOR. Provide accurate means for measuring the quantity of makeup water required to maintain this pressure.

I. Duration of pressure test shall not be less than 2 hours. All leaks evident at the surface shall be repaired and leakage eliminated regardless of the total leakage as shown by test. Lines which fail to meet tests shall be repaired and retested as necessary until test requirements are complied with. Defective materials, pipes, valves and accessories shall be removed and replaced.

END OF SECTION

SECTION 02621

POLYVINYL CHLORIDE (PVC) GRAVITY PIPE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install and test polyvinyl chloride (PVC) sewer pipe and fittings as specified herein.

B. Pipe or piping refers to all pipe, fittings, material and appurtenances required to construct PVC sewer pipe complete, in place.

1.02 RELATED WORK

A. Pipeline Testing and Cleaning is included in Section 01445.

B. Trenching, backfilling and compacting is included in Section 02221.

C. Earthwork is included in Section 02200.

D. Pavement repair and resurfacing are included in Section 02576.

E. Precast Concrete Structures are included in Section 02605.

F. PVC Pressure Pipe is included in Section 02622.

G. Hydroseeding is included in Section 02920.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, and within 30 days of the Effective Date of the Agreement, the name of the pipe and fitting manufacturers and a list of materials to be furnished by each manufacturer. Also, include information on local representative for each manufacturer, if product is sold through a distributor.

B. Shop Drawings including piping layouts and schedules shall include dimensioning, fittings, types and locations of valves and appurtenances, joint details, methods and location of supports, anchorage, gasket material, grade of material and all other pertinent technical information for all items to be furnished.

C. Prior to each shipment of pipe, certified test reports that the pipe for this Contract was manufactured and tested in accordance with the ASTM Standards specified herein shall be submitted.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

2. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

3. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

4. ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

5. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

B. National Sanitation Foundation (NSF)

1. Standard No. 14 - Plastic Piping Components and Related Materials.

C. Uni-Bell PVC Pipe Association (Uni-Bell)

1. Uni-Bell Handbook for PVC Pipe Design and Construction.

2. UNI-B-6 – Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe.

D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. All PVC sewer pipe and fittings of a similar type (e.g. solid wall or profile wall) shall be from a single manufacturer. The supplier shall be responsible for the provisions of all test requirements specified in ASTM D3034 as applicable. In addition, all PVC pipe to be installed under this Contract may be inspected at the plant for compliance with this Section by an independent testing laboratory provided by the ENGINEER. The CONTRACTOR shall require the manufacturer's cooperation in these inspections. The cost of plant inspection of all pipe approved for this Contract, plus the cost of inspection of a reasonable amount of disapproved pipe, will be borne by the OWNER. Final payment will be reduced by excessive costs of plant inspection of pipe, CONTRACTOR shall have no claim thereto. Excessive inspection costs are defined as the costs of inspection of that amount of pipe which exceeds 125 percent of the aggregate length of each type installed.

B. Inspections of the pipe may also be made by the ENGINEER after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the requirements specified herein, even though sample pipes may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall be removed from the job at once.

1.06 SYSTEM DESCRIPTION

A. The equipment and materials specified herein are intended to be of standard types for use in transporting sewage.

B. Note information in this Section, especially concerning pressures, minimum thickness, etc.

C. CONTRACTOR is responsible for compatibility between pipe materials, fittings and appurtenances.

D. Unless otherwise noted, PVC pipe systems shall be designed for the following condition(s).

1. Class: SDR 35

2. Pressure:

a. Operating: 50

b. Testing: 75

E. Pressure pipes, as specified in Section 02622, shall be used in high groundwater areas for gravity sewer service, as shown in the Table below, and shall use PVC fittings.

Start Stationing	End Stationing	Street	Drawing No.	Pipe Diameter
7+79.94	10+50	3rd Street	A-PP-100	18
10+88.75	7+57.75	El Moro Avenue	A-PP-101	18
7+57.75	4+24.75	El Moro Avenue	A-PP-101	18
14+11.75	10+88.75	El Moro Avenue	A-PP-102	18
27+33.02	24+10.02	El Moro Avenue	A-PP-102	10
24+10.02	20+76.02	El Moro Avenue	A-PP-102	12
20+76.02	17+44.75	El Moro Avenue	A-PP-102	16
17+44.75	14+11.75	El Moro Avenue	A-PP-102	16
30+67.02	27+33.02	El Moro Avenue	A-PP-103	10
25+12	28+18.16	5th Street	A-PP-107	8
32+50	28+18.16	5th Street	A-PP-108	8
29+50	33+40	6th Street	A-PP-110	8
33+40	34+95.23	6th Street	A-PP-110	8
39+00	34+95.23	6th Street	A-PP-111	8
43+00	39+00	6th Street	A-PP-111	8
39+72	41+75.61	7th Street	A-PP-113	8
37+76	39+72	7th Street	A-PP-114	8
45+75	41+75.61	7th Street	A-PP-115	8
45+75	48+56.04	8th Street	A-PP-118	8
41+74.99	45+75	8th Street	A-PP-119	8
52+50	48+56.04	8th Street	A-PP-120	8
52+00	54+99.46	9th Street	A-PP-124	8
48+20.02	52+00	9th Street	A-PP-125	8

Start Stationing	End Stationing	Street	Drawing No.	Pipe Diameter
59+00	54+99.46	9th Street	A-PP-126	8
51+93	56+07.62	10th Street	A-PP-131	8
47+92.93	51+93	10th Street	A-PP-132	8
44+65	48+54.51	11th Street	A-PP-133	8
47+16.36	50+37.86	Paso robles Avenue	A-PP-158	8
50+37.86	53+76.76	Paso robles Avenue	A-PP-158	8
43+79.05	47+16.36	Paso robles Avenue	A-PP-159	8
6+60	10+30	18th Street	A-PP-161	8
18+42	14+50	18th Street	A-PP-163	8
42+00	45+71	17th Street	A-PP-165	8
45+71	49+65.98	17th Street	A-PP-165	8
53+50	49+65.98	17th Street	A-PP-167	8
14+94	18+30	16th Street	A-PP-168	8
18+30	21+29.49	16th Street	A-PP-168	8
24+00	21+29.49	16th Street	A-PP-169	8
26+00	24+00	16th Street	A-PP-169	8
10+50.01	7+74.59	2nd Street	A-PP-175	8
7+74.59	3+17.40	2nd Street	A-PP-175	12
9+22.86	10+50.01	2nd Street	A-PP-175	8
0+98.43	5+34.78	Santa Maria Avenue	A-PP-184	10
5+34.78	7+21.31	Santa Maria Avenue	A-PP-184	10
7+21.31	10+56.31	Santa Maria Avenue	A-PP-184	10
5+25	7+74.69	1st Street	A-PP-187	8
14+58.70	11+49.67	1st Street	A-PP-187	8
11+49.67	7+74.69	1st Street	A-PP-187	8
5+95	3+50	Baywood	A-PP-189	8
3+50	0+98.31	Baywood	A-PP-189	8
17+14.10	13+81.33	Santa Maria Avenue	A-PP-191	8
13+81.33	10+56.33	Santa Maria Avenue	A-PP-191	8
22+04	25+00	4th Street	A-PP-192	8
25+00	28+14.46	4th Street	A-PP-192	8
17+13	21+34.11	3rd Street	A-PP-194	8
15+60	17+13	3rd Street	A-PP-194	8
23+50	21+34.11	3rd Street	A-PP-195	8
0+95.31	03+06.2	Lupine Street	B-PP-101	18
22+17.04	24+31.24	Doris Avenue	B-PP-102	16
24+31.24	26+62.57	Doris Avenue	B-PP-102	18
10+62.44	12+94.02	Binscarth Road	B-PP-103	16
8+33.20	10+62.44	Binscarth Road	B-PP-104	16
5+74.42	8+33.20	Binscarth Road	B-PP-104	16
1+06.06	5+74.42	Binscarth Road	B-PP-104	16
19+75.06	22+14.71	Pecho Road	B-PP-105	16
17+23	19+75.06	Pecho Road	B-PP-105	16
14+74.47	17+23	Pecho Road	B-PP-105	12
3+12.19	2+77.19	Lupine Street	B-PP-107	10

Start Stationing	End Stationing	Street	Drawing No.	Pipe Diameter
5+40.59	3+12.19	Lupine Street	B-PP-107	10
3+19.04	1+05.94	Bay Street	B-PP-108	10
6+62.19	3+19.04	Bay Street	B-PP-108	10
3+60	0+94	Ramona Avenue	B-PP-109	8
6+15.58	3+60	Ramona Avenue	B-PP-109	8
7+50	6+15.58	Ramona Avenue	B-PP-109	8
12+00	13+13.71	Donna Avenue	B-PP-110	8
11+20	15+10.65	Fearn Avenue	B-PP-111	8
15+67.55	15+10.65	Fearn Avenue	B-PP-111	10
16+03.64	13+38.30	Mitchell Drive	B-PP-112	8
17+60	16+03.64	Mitchell Drive	B-PP-112	8
11+90	13+38.30	Mitchell Avenue	B-PP-112	8
6+66.83	9+41.72	Don Avenue	B-PP-113	8
20+62.32	23+08.37	Pine Avenue	B-PP-115	8
25+34.98	23+09.12	Broderson Avenue	B-PP-117	8
28+25.73	26+58.75	Doris Avenue	B-PP-118	8
29+49.59	28+25.73	Doris Avenue	B-PP-118	8
30+35.24	29+49.59	Doris Avenue	B-PP-118	8
15+45.88	12+94.02	Binscarth Road	B-PP-120	8
17+73.62	15+45.88	Binscarth Road	B-PP-120	8
20+25.78	17+73.62	Binscarth Road	B-PP-120	8
8+29.31	10+73.32	Donna Avenue	B-PP-125	8
5+81.73	8+29.31	Donna Avenue	B-PP-125	8
8+25.16	10+70.99	Fearn Avenue	B-PP-128	8
5+79.28	8+25.16	Fearn Avenue	B-PP-128	8
3+55	5+85.95	don Avenue	B-PP-132	8
19+09.72	22+17.04	Doris Avenue	B-PP-140	8
17+07.46	19+09.72	Doris Avenue	B-PP-140	8
3+30	0+74.53	Garden Street	B-PP-141	8
13+08.95	10+68.94	Nancy Avenue	B-PP-142	8
0+92.97	5+00.61	Sunny Hill Road	B-PP-144	8
6+69.99	8+45.94	Henrietta Avenue	B-PP-145	8
1+03.90	4+94.15	Maple Avenue	B-PP-146	8
6+58.37	10+68.94	Nancy Avenue	B-PP-148	8
4+27.34	6+58.37	Nancy Avenue	B-PP-148	8
3+15	1+05.97	Grove Street	B-PP-151	8
5+30	3+15	Grove Street	B-PP-151	8
3+33.90	1+05.93	Henrietta Avenue	B-PP-152	8
5+07.24	3+33.90	Henrietta Avenue	B-PP-152	8
4+30.48	7+20.66	Solano Street	B-PP-155	8
7+83.78	7+20.66	Solano Street	B-PP-155	8
0+92.68	3+56.83	Nevada Court	B-PP-158	8
9+55.54	10+43.37	Butte Drive	B-PP-159	8
6+01.06	9+55.54	Butte Drive	B-PP-159	8
2+45.45	6+01.06	Butte Drive	B-PP-159	8

Start Stationing	End Stationing	Street	Drawing No.	Pipe Diameter
76+89.07	74+75.63	Los Osos Valley Road	C-PP-103	16
80+08	76+89.07	Los Osos Valley Road	C-PP-104	16
80+97.37	80+08	Los Osos Valley Road	C-PP-104	16
83+31.78	80+97.37	Los Osos Valley Road	C-PP-104	12
84+20	83+31.78	Los Osos Valley Road	C-PP-104	12
85+98	84+20	Los Osos Valley Road	C-PP-104	12
86+94	85+98	Los Osos Valley Road	C-PP-104	10
90+04.35	86+94	Los Osos Valley Road	C-PP-104	10
91+25	90+04.35	Los Osos Valley Road	C-PP-105	10
93+42	91+25	Los Osos Valley Road	C-PP-105	8
95+53	93+42	Los Osos Valley Road	C-PP-105	8
96+97	95+53	Los Osos Valley Road	C-PP-105	8
97+11	96+97	Los Osos Valley Road	C-PP-105	8
98+56	97+11	Los Osos Valley Road	C-PP-105	8
101+18	98+56	Los Osos Valley Road	C-PP-105	8
103+95.18	101+18	Los Osos Valley Road	C-PP-106	8
104+34.73	103+95.18	Los Osos Valley Road	C-PP-106	8
108+15.11	104+34.73	Los Osos Valley Road	C-PP-106	8
1+55	1+11.9	Bush Drive	C-PP-129	8
4+45	1+55	Bush Drive	C-PP-129	8
3+92	3+61.78	Ferrel Avenue	C-PP-130	8
6+31	3+92	Ferrel Avenue	C-PP-130	8
1+00	0+47.44	9th Street	C-PP-131	8
3+06	1+00	9th Street	C-PP-131	8
6+49	3+06	9th Street	C-PP-131	8
11+83.69	12+23.69	Bayview Heights Drive	C-PP-132	8
10+52	11+83.69	Bayview Heights Drive	C-PP-132	8
6+97.2	10+52	Bayview Heights Drive	C-PP-132	8
11+71	10+10.61	Bay Oaks Drive	C-PP-133	8
12+56.95	11+71	Bay Oaks Drive	C-PP-133	8
1+65	0+90.83	10th Street	C-PP-139	8
4+06	1+65	10th Street	C-PP-139	8
6+40	6+89.92	Sunset Drive	C-PP-140	8
3+90	6+40	Sunset Drive	C-PP-140	8
1+89	3+90	Sunset Drive	C-PP-140	8
4+29.88	7+79.38	3rd Street	D-PP-101	18
1+68.51	4+29.88	3rd Street	D-PP-101	18
4+28.81	1+93.33	Pismo Avenue	D-PP-102	18
1+93.33	1+68.51	Pismo Avenue	D-PP-102	18
4+68.72	4+28.81	4th Street	D-PP-103	14
7+52.67	10+52.67	11th Street	D-PP-110	12
4+52.67	7+52.67	11th Street	D-PP-110	12
1+10.35	4+52.67	11th Street	D-PP-111	12
10+59.55	1+10.35	Los Olivos Avenue	D-PP-112	10
12+55.99	10+59.55	Los Olivos Avenue	D-PP-112	10

Start Stationing	End Stationing	Street	Drawing No.	Pipe Diameter
7+64.46	4+28.81	Pismo Avenue	D-PP-114	14
15+26.2	18+33.47	10th Street	D-PP-134	8
11+89.22	15+26.2	10th Street	D-PP-135	8
9+25.94	11+89.22	10th Street	D-PP-135	8
5+68.81	8+43	Fairchild Way	D-PP-139	8
8+43	9+84.46	Fairchild Way	D-PP-139	8
10+18.25	7+91.22	4th Street	D-PP-144	8
26+11.11	28+11.68	11th Street	D-PP-158	8
9+45.58	10+94.16	Santa Ynez Avenue	D-PP-172A	8
1+20.07	5+19.12	12th Street	D-PP-174	8
21+13.03	1+20.07	Santa Ynez Avenue	D-PP-175	8
24+03.04	21+13.03	Santa Ynez Avenue	D-PP-175	8
15+42.68	24+03.04	Fairchild Way	D-PP-176	8
13+81.7	15+42.68	Fairchild Way	D-PP-176	8
7+14.56	8+52.10	Mountain View Avenue	D-PP-180	8
8+52.10	11+86.27	Mountain View Avenue	D-PP-180	8
5+17.99	7+14.56	Mountain View Avenue	D-PP-181	8
2+21.84	5+17.99	Mountain View Avenue	D-PP-181	8
27+70.72	29+81.92	Santa Ynez Avenue	D-PP-182	8
25+70.86	17+70.02	Santa Ynez Avenue	D-PP-182	8
29+81.92	30+69.45	Santa Ynez Avenue	D-PP-182	8
30+69.45	31+32.77	Santa Ynez Avenue	D-PP-182	8
31+32.77	17+22.27	Santa Ynez Avenue	D-PP-182	8
24+41.06	27+56.97	Los Olivos Avenue	D-PP-183	8

1.07 DELIVERY, STORAGE AND HANDLING

A. All items shall be bundled or packaged in such a manner as to provide adequate protection of the ends during transportation to the site. Any pipe damaged in shipment shall be replaced as directed by the ENGINEER.

B. PVC items deteriorate in sunlight and are slightly brittle, especially at lower temperatures, so care shall be taken in loading, transporting and unloading items to prevent injury to the items. All items shall be examined before installation and no piece shall be installed which is found to be defective. Handling and installation of pipe and fittings shall be in accordance with the manufacturer's instructions, referenced standards and as specified herein.

C. Any pipe or fitting showing a crack or which has received a blow that may have caused an incident fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work.

D. While stored, pipe shall be adequately supported from below at not more than 3-ft intervals to prevent deformation. The pipe shall be stored in stacks no higher than that given in the following table:

Pipe Diameter (inches)	Max. No. of Rows Stacked
8 or less	5
12 to 21	4
24 to 30	3
33 to 48	2
54 and larger	1

E. Pipe and fittings shall be stored in a manner which will keep them at ambient outdoor temperatures and out of the sunlight [or delivered to the site so that no pipe is exposed to sunlight for more than [60] days]. Temporary shading as required to meet this requirement shall be provided. Simple covering of the pipe and fittings which allows temperature buildup or direct or indirect sunlight will not be permitted.

F. If any defective item is discovered after it has been installed, it shall be removed and replaced with an exact replacement item in a satisfactory manner by the CONTRACTOR, at the CONTRACTOR's own expense. All pipe and fittings shall be thoroughly cleaned before installation and the interior shall be kept clean until testing.

G. In handling the items, use special devices and methods as required to achieve the results specified herein. No uncushioned devices shall be used in handling the item.

PART 2 PRODUCTS

2.01 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

A. PVC solid wall gravity pipe and fittings shall be Type PSM, PVC SDR 35 with full diameter dimensions and shall conform to ASTM D3034, for sizes 4 through 15-in and shall conform to ASTM F679 for sizes 18 through 27-in. Straight pipe shall be furnished in lengths according to ASTM D3034 and wyes shall be furnished in lengths of not more than 3-ft. Saddle wyes will not be allowed.

B. PVC pipe and fittings shall have bell and spigot push-on joints. The bell shall consist of an integral wall section with a solid cross-section elastomeric gasket securely locked in place to prevent displacement during assembly. Installation of elastomeric gasketed joints and performance of the joint shall conform to ASTM F477, ASTM D3139 or ASTM D3212.

C. All fittings and accessories for sewers shall have bell and/or spigot configurations compatible with the pipe.

D. Sewer lines shall be green in color.

PART 3 EXECUTION

3.01 INSTALLATION OF PVC PIPE AND FITTINGS

A. No single piece of pipe shall be laid unless it is straight. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than 1/16-in per foot of length. If a piece of pipe fails to meet this requirement check for straightness, it shall be rejected and removed from the site. Laying instructions of the manufacturer shall be explicitly followed.

B. If any defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional cost to the OWNER. All pipe and fittings shall be thoroughly cleaned before installation, shall be kept clean until they are used in the work and when laid, shall conform to the lines and grades required. PVC pipe and fittings shall be installed in accordance with requirements of the manufacturer, ASTM D2321, or as otherwise provided herein.

C. As soon as the excavation is complete to normal grade of the bottom of the trench, bedding shall be placed, compacted and graded to provide firm, uniform and continuous support for the pipe. Bell holes shall be excavated so that only the barrel of the pipe bears upon the bedding. The pipe shall be laid accurately to the lines and grades indicated on the Drawings. Blocking under the pipe will not be permitted. Bedding shall be placed evenly on each side of the pipe to mid-diameter and hand tools shall be used to force the bedding under the haunches of the pipe and into the bell holes to give firm continuous support for the pipe. Bedding shall then be placed to 12-in above the top of the pipe. The initial 3-ft of backfill above the bedding shall be placed in 1-ft layers and carefully compacted. Generally the compaction shall be done evenly on each side of the pipe and compaction equipment shall not be operated directly over the pipe until sufficient backfill has been placed to ensure that such compaction equipment will not have a damaging effect on the pipe. Equipment used in compacting the initial 3-ft of backfill shall be approved by the pipe manufacturer's representative prior to use.

D. All piping shall be sound and clean before installation. When installation is not in progress, including lunchtime, the open ends of the pipe shall be closed by watertight plug or other approved means. Good alignment shall be preserved during installation. The deflection at joints shall not exceed that recommended by manufacturer. Fittings, in addition to those shown on the Drawings, shall be provided, if required, in crossing utilities which may be encountered upon opening the trench.

E. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a bell shall be beveled to conform to the manufactured spigot end.

F. The ENGINEER may examine each bell and spigot end to determine whether any preformed joint has been damaged prior to installation. Any pipe having defective joint surfaces shall be rejected, marked as such and immediately removed from the job site.

G. Each length of the pipe shall have the assembly mark aligned with the pipe previously laid and held securely until enough backfill has been placed to hold the pipe in place. Joints shall not be "pulled" or "cramped".

H. Before any joint is made, the pipe shall be checked to assure that a close joint with the next adjoining pipe has been maintained and that the inverts are matched and conform to the required grade. The pipe shall not be driven down to grade by striking it.

I. Precautions shall be taken to prevent flotation of the pipe in the trench.

J. When moveable trench bracing such as trench boxes, moveable sheeting, shoring or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and the backfill. Trench boxes, moveable sheeting, shoring or plates shall not be allowed to extend

below top of the pipe. As trench boxes, moveable sheeting, shoring or plates are moved, pipe bedding shall be placed to fill any voids created and the backfill shall be recompacted to provide uniform side support for the pipe.

3.02 JOINTING PVC PIPE (Push-on type)

A. Joints shall be made in strict accordance with the manufacturer's instructions. Pipe shall be laid with bell ends looking ahead. A rubber gasket shall be inserted in the groove of the bell end of the pipe and the joint surfaces cleaned and lubricated. The plain end of the pipe to be entered shall then be inserted in alignment with the bell of the pipe to which it is to be joined and pushed home with a come-along or by other means. Check that the reference mark on the spigot end is flush with the end of the bell.

3.03 JOINTING POLYVINYL CHLORIDE (PVC) SEWER PIPE AND FITTINGS

A. PVC sewer pipe and fittings shall be jointed in accordance with the recommendations of the latest ASTM Standards and detailed instructions of the manufacturer. The pipe manufacturer shall furnish information and supervise the installation of at least the first five joints.

B. All manhole connections shall be as shown on the Drawings and as specified in Section 02605. All concrete and mortared connections shall be equipped with an integral O-ring, or other sealant, such that a positive watertight seal is established.

3.04 WYE BRANCHES, CHIMNEYS AND STUBS

A. All fittings shall be furnished by the same manufacturer that furnishes the pipe.

B. Wye branches shall be furnished and installed and capped as shown on the Drawings or in locations directed by the ENGINEER. Each wye branch shall be provided with a PVC end cap and shall be backed with a piece of wood (2-in by 4-in) that extends to a point 3-ft below the finished ground surface.

C. PVC chimneys shall be installed according to the detail on the Drawings at locations to be determined by the ENGINEER. Concrete shall be as specified in Division 3. No backfill shall be placed over concrete within 16 hours of placing.

D. Ample time shall be given to the ENGINEER to obtain the exact location of each wye branch and chimney before it is covered. Wye branches and chimneys, which are covered before the ENGINEER has had time to obtain their location, shall be exposed at no additional cost so that location measurements can be taken.

E. PVC manhole drops shall be installed as shown on the Drawings. Concrete for encasements shall be 3500 psi as specified. No backfill shall be placed over this concrete within 16 hours of placing.

F. Pipe stubs for manhole connections shall not exceed 3.25-ft in length unless directed otherwise by the ENGINEER. Install caps where required.

3.05 SERVICE CONNECTIONS

A. Service connections shall be installed at a minimum slope of 2 percent at the locations and to the limits determined by the ENGINEER in the field. In each case, the end shall be capped and backed with a 2-in by 4-in wood post extending to 3-ft below the finished ground surface.

B. Service connections shall be 6-in diameter unless otherwise shown on the Drawings.

3.06 TESTING (GRAVITY PIPELINES)

A. Testing and cleaning of pipe, except where specified herein, shall be as specified in Section 01445. Submit a testing plan including detailed procedures and methods and equipment that will be used for pipeline testing at least 10 days before starting the testing for ENGINEER's review. The methods and procedures shall be approved by the ENGINEER. All tests shall be conducted in the presence of the ENGINEER. Furnish all necessary equipment and labor for carrying out the specified tests.

B. Exfiltration Testing.

1. Conduct exfiltration tests on all gravity PVC pipelines by plugging the pipe at each end of the designated test section and filling the pipe within the test section with water such that the water level is at least 2 feet above the top of the pipe at the upper end of the test section or 2 feet above the groundwater level, whichever is greater, but not more than 25 feet above the top of the pipe at the lower end of the test section.

2. After allowing sufficient time for absorption and trapped air to escape, initiate the test by measuring the water level inside the pipe test section relative to a stable reference point. Conduct the test by measuring the amount of water required to maintain a constant water level within the test section for a period of at least two hours. The amount of water added shall not be greater than 25 gallons per inch of internal pipe diameter per mile of pipe per day.

3. Should the amount of added water exceed the amount permitted, locate and repair leaks and retest until the above acceptance criteria are met. All repairs and retests shall be at no additional cost to the OWNER.

C. Infiltration Testing

1. Infiltration will be acceptable method for leakage testing when the ground water level is 2 feet above the top of the pipe throughout the length of the section being tested. Infiltration shall not exceed 25 gallons per inch of internal pipe diameter per mile of pipe per day.

2. If at any time prior to acceptance, the observed infiltration between any two manholes is observed to exceed 25 gallons, per inch of internal pipe diameter, per mile of pipe per day, locate and repair leaks at no additional cost to the OWNER. All visible leaks shall be repaired.

D. Low-Pressure Air Testing

1. Low-pressure air testing may be used in lieu if exfiltration tests (except for manholes) where approved by the ENGINEER.

2. All low-pressure air testing with air shall be performed in accordance with ASTM F1417.

3. Allowable leakage using the low- pressure air method shall not exceed 0.0015 cubic feet per minute per square foot of pipe.

4. Should the low-pressure air test yield a result that exceeds the amount permitted, locate and repair leaks and retest until the above acceptance criteria are met. All repairs and retests shall be at no additional cost to the OWNER.

E. Allowable Deflection Test

1. Pipe deflection measured not less than 90 days after the backfill has been completed as specified shall not exceed 5 percent. Deflection shall be computed by multiplying the amount of deflection (nominal diameter less minimum diameter when measured) by 100 and dividing by the nominal diameter of the pipe.

2. Deflection shall be measured with a rigid mandrel (Go/No Go) device cylindrical in shape and constructed with a minimum of nine evenly spaced arms or prongs. Drawings of the mandrel with complete dimensions shall be submitted to the ENGINEER for each diameter of pipe to be tested. The mandrel shall be hand pulled through all sewer lines.

3. Any section of sewer not passing the mandrel shall be uncovered at no additional cost to the OWNER and the bedding and backfill replaced to prevent excessive deflection. Repaired pipe shall be retested at no additional cost to the OWNER. Retested pipe shall not deflect more than 4 percent.

F. Television testing as specified in Section 01658 shall be performed for all gravity sewers 6-inch diameter or greater.

END OF SECTION

SECTION 02622

POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install and test polyvinyl chloride (PVC) recycled water and sewer pipe and fittings, complete as specified herein.

B. Pipe or piping refers to all pipe, fittings, material and appurtenances required to construct PVC recycled water pipe or sewer pipe complete, in place.

1.02 RELATED WORK

A. Pipeline Testing and Cleaning is included in Section 01445.

B. Trenching, backfilling and compacting is included in Section 02221.

C. Earthwork is included in Section 02200.

D. Pavement repair and resurfacing are included in Section 02576.

E. Precast concrete structures are included in Section 02605.

F. Ductile Iron Pipe and Fittings are included in Section 02616.

G. Valves and appurtenances are included in Division 15.

H. Revegetation is included in Section 02930.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, and within 30 days of the Effective Date of the Agreement, the name of the pipe and fitting manufacturers and a list of materials to be furnished by each manufacturer. Also, include information on local representative for each manufacturer, if product is sold through a distributor.

B. Shop Drawings including piping layouts and schedules shall include dimensioning, fittings, types and locations of valves and appurtenances, joint details, methods and location of supports, anchorage, gasket material, grade of material and all other pertinent technical information for all items to be furnished.

C. Prior to each shipment of pipe, certified test reports that the pipe for this Contract was manufactured and tested in accordance with the ASTM and AWWA Standards specified herein shall be submitted.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

2. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

3. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

4. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

B. American Water Works Association (AWWA)

1. AWWA C110 - Ductile-Iron and Gray-Iron Fittings, 3-in Through 48-in (75mm Through 1219mm) for Water.

2. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

3. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

4. AWWA C-605 – Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.

5. AWWA C651 - Disinfecting Water Mains.

6. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-in through 12-in for Water Distribution.

7. AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings 14-in through 48-in for Water Transmission and Distribution.

8. AWWA M-23 – Manual of Water Supply Practices PVC Pipe, Design and Installation.

C. National Sanitation Foundation (NSF)

1. Standard No. 14 - Plastic Piping Components and Related Materials.

2. Standard No. 61 - Drinking Water System Components - Health Effects.

D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. All PVC recycled water pipe shall be from a single manufacturer. The supplier shall be responsible for the provisions of all test requirements specified in ASTM D3034 and NSF

Standard No. 14 as applicable. In addition, all PVC pipe to be installed under this Contract may be inspected at the plant for compliance with this Section by an independent testing laboratory provided by the ENGINEER. The CONTRACTOR shall require the manufacturer's cooperation in these inspections. The cost of plant inspection of all pipe approved for this Contract, plus the cost of inspection of a reasonable amount of disapproved pipe, will be borne by the OWNER.

B. Inspections of the pipe may also be made by the ENGINEER or other representatives of the OWNER after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the requirements specified herein, even though sample pipes may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall be removed from the job at once.

1.06 SYSTEM DESCRIPTION

A. The equipment and materials specified herein are intended to be of standard types for use in transporting sewage and recycled water.

B. Note information in pipe schedule on Drawings, if any and in this Section, especially concerning pressures, minimum thickness, etc. In case of a conflict, information given in the pipe schedule shall govern.

C. CONTRACTOR is responsible for compatibility between pipe materials, fittings and appurtenances.

D. Unless otherwise noted, PVC pipe systems shall be designed for the following condition(s).

1. Class: 150 (DR 25)

2. System: AWWA C900/905

3. Pressure:

a. Operating: 150

b. Testing: 225

1.07 DELIVERY, STORAGE AND HANDLING

A. All items shall be bundled or packaged in such a manner as to provide adequate protection of the ends during transportation to the site. Any pipe damaged in shipment shall be replaced as directed by the ENGINEER.

B. PVC items deteriorate in sunlight and are slightly brittle, especially at lower temperatures, so care shall be taken in loading, transporting and unloading items to prevent injury to the items. All items shall be examined before installation and no piece shall be installed which is found to be defective. Handling and installation of pipe and fittings shall be in accordance with the manufacturer's instructions, referenced standards and as specified herein.

C. Any pipe or fitting showing a crack or which has received a blow that may have caused an incident fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work.

D. Any gouges or scratches that extend 10 percent or more into the pipe wall shall be cause for rejection of that pipe. The undamaged portion may be cut off and used. Rejected materials shall be clearly marked as rejected, segregated and removed from the site.

E. While stored, pipe shall be adequately supported from below at not more than 3-ft intervals to prevent deformation. The pipe shall be stored in stacks no higher than that given in the following table:

Pipe Diameter (inches)	Max. No. of Rows Stacked
8 or less	5
12 to 21	4
24 to 30	3
33 to 48	2

F. Pipe and fittings shall be stored in a manner which will keep them at ambient outdoor temperatures and out of the sunlight. Temporary shading as required to meet this requirement shall be provided. Simple covering of the pipe and fittings which allows temperature buildup or direct or indirect sunlight will not be permitted.

G. If any defective item is discovered after it has been installed, it shall be removed and replaced with an exact replacement item in a satisfactory manner by the CONTRACTOR, at the CONTRACTOR's own expense. All pipe and fittings shall be thoroughly cleaned before installation and the interior shall be kept clean until testing

H. In handling the items, use special devices and methods as required to achieve the results specified herein. No uncushioned devices shall be used in handling the item.

PART 2 PRODUCTS

2.01 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

A. PVC pressure pipe sized 4 through 12-in shall conform to the requirements of AWWA C900. All piping shall be Class 150 with a Dimension Ratio of 25. The pipe shall be PVC 1120 made from PVC compounds Class 12454-A or 12454-B as defined in ASTM D1784. Each pipe length shall be marked with the manufacturer's name or trademark, size, material code, pressure class, AWWA designation number and seal of test agency that verified pipe material for potable-water service.

B. PVC pressure pipe sizes 14 through 48-in shall conform to the requirements of AWWA C905. The pipe shall be made from PVC compounds Class 12454-A or 12454-B as defined in ASTM D1784. Each pipe length shall be marked with the manufacturer's name or trademark, size, material code, pressure class, AWWA reference and seal of test agency that verified pipe material for potable-water service.

C. All fittings for pressure mains shall be cast or ductile iron conforming to AWWA C110 for mechanical joints. All adaptors, fittings and transition gaskets necessary to connect cast or ductile iron fittings to PVC shall be furnished.

D. Sewer lines shall be green in color.

E. Recycled water lines shall be purple in color.

2.02 FUSIBLE POLYVINYL CHLORIDE (FPVC)

A. Piping and Fittings: Pipe, AWWA C905. Fittings shall be the same as specified for PVC pipe. Fusible polyvinyl chloride pipe for non-potable water not conforming to AWWA C905 dimensionality shall conform to AWWA C900, ASTM D2241 or ASTM D1785 for standard dimensionality, as applicable. Testing shall be in accordance with the referenced AWWA standards. Unless otherwise specified, fusible polyvinyl chloride pipe lengths shall be assembled in the field with butt-fused joints. The fusion technician shall follow the pipe supplier's guidelines for this procedure. All fusion joints shall be completed as described in this specification. Fusible polyvinyl chloride pipe shall be green for sewer applications and purple in color for recycled water applications. Use of FPVC is not permitted for gravity sewer applications.

PART 3 EXECUTION

3.01 INSTALLATION OF PVC PIPE AND FITTINGS

A. No single piece of pipe shall be laid unless it is straight. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than 1/16-in per foot of length. If a piece of pipe fails to meet this requirement, check for straightness, it shall be rejected and removed from the site. Laying instructions of the manufacturer shall be explicitly followed.

B. If any defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional cost to the OWNER. All pipe and fittings shall be thoroughly cleaned before installation, shall be kept clean until they are used in the work and when laid, shall conform to the lines and grades required. PVC pipe and fittings shall be installed in accordance with requirements of the manufacturer, ASTM D2321 and AWWA C605 or as otherwise provided herein.

C. As soon as the excavation is complete to normal grade of the bottom of the trench, bedding shall be placed, compacted and graded to provide firm, uniform and continuous support for the pipe. Bell holes shall be excavated so that only the barrel of the pipe bears upon the bedding. The pipe shall be laid accurately to the lines and grades indicated on the Drawings. Blocking under the pipe will not be permitted. Bedding shall be placed evenly on each side of the pipe to mid-diameter and hand tools shall be used to force the bedding under the haunches of the pipe and into the bell holes to give firm continuous support for the pipe. Bedding shall then be placed to 12-in above the top of the pipe. The initial 3-ft of backfill above the bedding shall be placed in 8-inch layers and carefully compacted. Generally the compaction shall be done evenly on each side of the pipe and compaction equipment shall not be operated directly over the pipe until sufficient backfill has been placed to ensure that such compaction equipment will not have a damaging effect on the pipe. Equipment used in compacting the initial 3-ft of backfill shall be approved by the pipe manufacturer's representative prior to use.

D. All piping shall be sound and clean before installation. When installation is not in progress, including lunchtime, the open ends of the pipe shall be closed by watertight plug or other approved means. Good alignment shall be preserved during installation. The deflection at joints shall not exceed that recommended by manufacturer. Fittings, in addition to those shown on the

Drawings, shall be provided, if required, in crossing utilities that may be encountered upon opening the trench.

E. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a bell shall be beveled to conform to the manufactured spigot end and a reference mark made at the same distance from the pipe end as measured from a factory marked end from the same manufacturer.

F. The ENGINEER may examine each bell and spigot end to determine whether any preformed joint has been damaged prior to installation. Any pipe having defective joint surfaces shall be rejected, marked as such and immediately removed from the job site.

G. Each length of the pipe shall have the assembly mark aligned with the pipe previously laid and held securely until enough backfill has been placed to hold the pipe in place. Joints shall not be "pulled" or "cramped".

H. Before any joint is made, the pipe shall be checked to assure that a close joint with the next adjoining pipe has been maintained and that the inverts are matched and conform to the required grade. The pipe shall not be driven down to grade by striking it.

I. Precautions shall be taken to prevent flotation of the pipe in the trench.

J. When moveable trench bracing such as trench boxes, moveable sheeting, shoring or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and the backfill. Trench boxes, moveable sheeting, shoring or plates shall not be allowed to extend below top of the pipe. As trench boxes, moveable sheeting, shoring or plates are moved, pipe bedding shall be placed to fill any voids created and the backfill shall be recompacted to provide uniform side support for the pipe.

K. Restrained joints shall be installed for all joints at fittings and in restrained joint areas as shown on the drawings. Where a pipe connects to a fitting, the first segment of pipe on both sides of the fitting shall be a full stick of pipe. Provide restrained joints at all pipeline angle points and deflections and as shown. Joint restraints shall be as follows:

1. Fully restrain all bell joints using Romac Industries Inc. “GripRing”, CertainTeed “Certa-Loc C-900/RJ”, or equal.

2. Fully restrain all mechanical joints using JCM “Model 610 Sur-Grip Fitting Restrainer”, EBBA Iron “Series 2000 PV” or approved equal.

3.02 JOINTING PVC PIPE (Push-on type)

A. Joints shall be made in strict accordance with the manufacturer's instructions. Pipe shall be laid with bell ends looking ahead. A rubber gasket shall be inserted in the groove of the bell end of the pipe and the joint surfaces cleaned and an approved lubricant applied in accordance with the manufacturer’s recommendations. The plain end of the pipe to be installed shall then be inserted into the bell of the pipe to which it is to be joined and when in alignment pushed home with a come-along or by other means. Check that the reference mark on the spigot end is flush with the end of the bell.

3.03 JOINTING MECHANICAL JOINT FITTINGS

A. Mechanical joints at valves, fittings and where designated shall be in accordance with the AWWA C111 and the instructions of the manufacturer. Suitable PVC to cast iron adaptors shall be installed prior to installing fittings. PVC beveled spigot shall be cut flush prior to insertion in mechanical joint pipe. To assemble the joints in the field, thoroughly clean the joint surfaces and rubber gasket with soapy water before tightening the bolts. Bolts shall be tight to the specified torques. Under no condition shall extension wrenches or pipe over handle of ordinary ratchet wrench be used to secure greater leverage.

3.04 INSTALLATION OF FUSIBLE POLYVINYLCHLORIDE (FPVC) PRESSURE PIPING

A. Installation guidelines from the pipe supplier shall be followed for all installations. Fusible polyvinylchloride pipe will be handled in a safe and non-destructive manner before, during, and after the fusion process and in accordance with this specification and pipe supplier's guidelines. The fusible polyvinylchloride pipe will be installed in a manner so as not to exceed the recommended bending radius guidelines. Where fusible polyvinylchloride pipe is installed by pulling in tension, the recommended maximum safe pulling force, established by the pipe supplier, shall not be exceeded. The general best practices of the industry per AWWA M23 shall also be observed.

B. Fusible polyvinylchloride pipe will be fused by qualified fusion technicians holding current qualification credentials for the pipe size being fused, as documented by the pipe supplier. Pipe supplier’s procedures shall be followed at all times during fusion operations. Each fusion joint shall be recorded and logged by an approved electronic monitoring device (data logger) connected to the fusion machine, which utilizes a current version of the pipe supplier’s recommended and compatible software. Only appropriately sized and outfitted fusion machines that have been approved by the pipe supplier shall be used for the fusion process. This includes requirements for safety, maintenance, and operation with modifications made for PVC.

C. Maximum offset in alignment between adjacent pipe joints shall be as recommended by the manufacturer and approved by the ENGINEER, but shall not exceed 5 degrees.

D. Fused joints are restrained joints. Fusible PVC may be used in areas where restrained fittings are indicated without additional restraint at fused joints.

E. Install fittings in accordance with AWWA C605.

3.05 FILLING AND TESTING

A. After installation, the pipe shall be tested for compliance as specified herein. Furnish all necessary equipment and labor for the hydrostatic pressure test on the pipelines.

B. Submit detailed test procedures and method for ENGINEER's review. In general, testing shall be conducted in accordance with AWWA C605. The method and procedures for performing the hydrostatic pressure test shall be approved by the ENGINEER. Submit the plan for testing to the ENGINEER at least 10 days before starting a test.

C. Pressure pipelines shall be subjected to a hydrostatic pressure in accordance with paragraph 1.06-D. This test pressure shall be maintained for a minimum of 2 hours. The hydrostatic testing allowances shall not exceed those indicated in AWWA C605. Provide suitable restrained bulkheads as required to complete the hydrostatic testing specified.

D. CONTRACTOR shall make any taps and furnish all necessary caps, plugs etc, as may be required in conjunction with performing the testing.

E. Gravity sewer pipelines shall be tested in accordance with the provisions in Section 02621 – Polyvinyl Chloride (PVC) Gravity Pipe.

F. All valves and valve boxes shall be properly located and installed and operable prior to testing. Bulkheads shall be provided with a sufficient number of outlets for filling and draining the line and for venting air.

G. Hydrostatic pressure tests shall conform to Section 7.3 of AWWA C605. Furnish gauges, meters, pressure pumps and other equipment needed to fill the line slowly and perform the required hydrostatic pressure tests.

H. The line shall be slowly filled with water and the specified test pressure shall be maintained in the pipe for the entire test period by means of a pump furnished by the CONTRACTOR. Provide accurate means for measuring the quantity of makeup water required to maintain this pressure.

I. Duration of pressure test shall not be less than 2 hours. All leaks evident at the surface shall be repaired and leakage eliminated regardless of the total leakage as shown by test. Lines which fail to meet tests shall be repaired and retested as necessary until test requirements are complied with. Defective materials, pipes, valves and accessories shall be removed and replaced.

J. Television testing as specified in Section 01658 shall be performed for all gravity sewers 6-inch diameter or greater.

END OF SECTION

SECTION 02624

SMALL DIAMETER PVC PRESSURE PIPE

PART 1 GENERAL

1.01 THE REQUIREMENT

A. The CONTRACTOR shall provide polyvinyl chloride (PVC) pressure pipe, complete and in place, in accordance with the Contract Documents.

B. This Section includes PVC pressure pipe with solvent-welded, flanged, or screwed joints. PVC pipe with bell and spigot joints is included in Section 02622 – PVC Pressure Pipe.

1.02 RELATED WORK

A. CONTRACTOR Submittals are included in Section 01300

B. Pipeline testing and cleaning water lines is included in Section 01445.

C. Trenching, backfilling and compacting is included in Section 02221.

D. Earthwork is included in Section 02200.

E. Pavement repair and resurfacing are included in Section 02576.

F. Precast concrete structures are included in Section 02605.

G. Ductile iron fittings are included in Section 02616.

H. Valves and appurtenances are included in Division 15.

I. Revegetation is included in Section 02930.

1.03 SUBMITTALS

A. All Submittals shall be in accordance with Section 01300 – CONTRACTOR Submittals

B. Submit within 30 days of the Effective Date of the Agreement, the name of the pipe and fitting manufacturers and a list of materials to be furnished by each manufacturer. Also, include information on local representative for each manufacturer, if product is sold through a distributor.

C. Submit Shop Drawings including piping layouts and schedules shall include dimensioning, fittings, types and locations of valves and appurtenances, joint details, methods and location of supports, anchorage, gasket material, grade of material and all other pertinent technical information for all items to be furnished.

D. Prior to each shipment of pipe, submit certified test reports that the pipe for this Contract was manufactured and tested in accordance with the ASTM and AWWA Standards specified herein shall be submitted.

E. Submit complete description of method of pipe installation.

F. Submit the manufacturer's recommendations for handling, storing and installing the pipe and fittings.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

2. ASTM D1785 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120

3. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

4. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

5 ASTM F 1498 – Standard Specification for Taper Pipe Threads 60 Degrees for Thermoplastic Pipe and Fittings

6. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

B. American Water Works Association (AWWA)

1. AWWA M-23 – Manual of Water Supply Practices PVC Pipe, Design and Installation.

C. National Sanitation Foundation (NSF)

1. Standard No. 14 - Plastic Piping Components and Related Materials.

D. American National Standards Institute

1. ANSI/ASME B 16.5 – Pipe Flanges and Flanged Fittings, Class 150

E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. All small diameter PVC pipe shall be from a single manufacturer. The supplier shall be responsible for the provisions of all test requirements specified in ASTM D3034 and NSF Standard No. 14 as applicable. In addition, all PVC pipe to be installed under this Contract may

be inspected at the plant for compliance with this Section by an independent testing laboratory provided by the ENGINEER. The CONTRACTOR shall require the manufacturer's cooperation in these inspections. The cost of plant inspection of all pipe approved for this Contract, plus the cost of inspection of a reasonable amount of disapproved pipe, will be borne by the OWNER.

B. Inspections of the pipe may also be made by the ENGINEER or other representatives of the OWNER after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the requirements specified herein, even though sample pipes may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall be removed from the job at once.

1.06 DELIVERY, STORAGE AND HANDLING

A. All items shall be bundled or packaged in such a manner as to provide adequate protection of the ends during transportation to the site. Any pipe damaged in shipment shall be replaced as directed by the ENGINEER.

B. PVC items deteriorate in sunlight and are slightly brittle, especially at lower temperatures, so care shall be taken in loading, transporting and unloading items to prevent injury to the items. All items shall be examined before installation and no piece shall be installed which is found to be defective. Handling and installation of pipe and fittings shall be in accordance with the manufacturer's instructions, referenced standards and as specified herein.

C. Any pipe or fitting showing a crack or which has received a blow that may have caused an incident fracture, even though no such fracture can be seen, shall be marked as rejected and removed immediately from the job.

D. Any gouges or scratches that extend 10 percent or more into the pipe wall shall be cause for rejection of that pipe. The undamaged portion may be cut off and used. Rejected materials shall be clearly marked as rejected, segregated and removed from the site.

E. While stored, pipe shall be adequately supported from below at not more than 3-ft intervals to prevent deformation. The pipe shall be stored in stacks no higher than 5 rows.

F. Pipe and fittings shall be stored in a manner which will keep them at ambient outdoor temperatures and out of the sunlight. Temporary shading as required to meet this requirement shall be provided. Simple covering of the pipe and fittings which allows temperature buildup or direct or indirect sunlight will not be permitted.

G. If any defective item is discovered after it has been installed, it shall be removed and replaced with an exact replacement item in a satisfactory manner by the CONTRACTOR, at the CONTRACTOR's own expense. All pipe and fittings shall be thoroughly cleaned before installation and the interior shall be kept clean until testing

H. In handling the items, use special devices and methods as required to achieve the results specified herein. No uncushioned devices shall be used in handling the item.

PART 2 PRODUCTS

2.01 PIPE MATERIAL

A. PVC pipe shall be made from all new rigid unplasticized polyvinyl chloride and shall be normal impact Type 1, Grade 1, class 12454, Schedule 80, listed as compliant with NSF Standard 61, unless otherwise indicated, in accordance with ASTM D 1785-Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

2.02 PIPE JOINTS

A. Pipe joints shall be solvent-welded type with solvent cement and primer as recommended by the pipe manufacturer for the chemical in the pipe and in accordance with ASTM D2564 – Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.

B. Screwed joints that are necessary to match up to threaded valves or fittings shall be made up with appropriate thread sealant, either paste or tape.

C. Flanged joints shall be made with solvent-welded PVC flanges, drilled to ANSI/ASME B 16.5 – Pipe Flanges and Flanged Fittings, Class 150, unless otherwise indicated. Gaskets shall be ANSI 150 lb. full face, 1/8-inch thick Neoprene for water or wastewater service. Gasket material for chemicals shall be suitable for the chemical service.

2.03 FITTINGS

A. Solvent Welded and Threaded Fittings: Solvent-welded and threaded fittings shall be Schedule 80 PVC fittings in accordance with ASTM D 2467 – Standard Specifications for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

B. Flanged Fittings: Flanged fittings shall be Schedule 80 fabricated PVC fittings with 150 lb. flanges to ANSI/ASME B 16.5.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: PVC pipe shall be installed in a neat and workmanlike manner, properly aligned, and cut from measurements taken at the Site to avoid interferences with structural members, architectural features, openings, and equipment. Exposed pipe shall afford maximum headroom and access to equipment, and where necessary, piping shall be installed with sufficient slopes for venting or drainage of liquids and condensate to low points. It is recommended that the CONTRACTOR obtain the assistance of the pipe manufacturer's field representative to instruct the pipefitters in the correct installation and support of PVC piping.

B. Supports and anchors: Piping shall be firmly supported with fabricated or commercial hangers or supports in accordance with Section 15140 – Pipe Hangers and Supports. Where necessary to avoid stress on equipment or structural members, the pipe shall be anchored or harnessed. Expansion joints and guides shall compensate for pipe expansion due to temperature changes.

C. Valve and Unions: Unless otherwise indicated, connections to fixtures, groups of fixtures, and equipment shall be provided with a shutoff valve and union, unless the valve has flanged ends.

Unions shall be provided at threaded valves, equipment, and other devices requiring occasional removal or disconnection. Valves and flanges attached to PVC pipe shall be provided with adequate supports.

3.02 PIPE PREPARATION

A. Prior to installation, each pipe length shall be carefully inspected, flushed clean of any debris or dust, and be straightened, if not true. Ends of threaded pipes shall be reamed and filed smooth. Pipe fittings shall be equally cleaned before assembly.

3.03 PIPE JOINTS

A. Threaded Joints: Pipe threads shall conform to ASTM F 1498 – Standard Specification for Taper Pipe Threads 60 Degrees for Thermoplastic Pipe and Fittings, and shall be full and cleanly cut with sharp dies or molded. Joints shall be made with Teflon tape or thread sealant.

B. Solvent-Welded Joints: Solvent-welded joints shall be made with fresh primer and solvent cement on clean, dry pipe ends. The primer and cement cans shall be kept closed at all times and the joints shall be made up at the recommended ambient temperatures, to the pipe or cement manufacturer's written recommendations. Pipe ends shall be inserted to the full depth of the socket.

C. Flange Joints: Flanged joints shall be made with gaskets and Type 316 stainless steel bolts and nuts. Care shall be taken not to over-torque the bolts, in accordance with the manufacturer's written recommendations.

3.04 INSPECTION AND FIELD TESTING

A. Inspection: Finished installations shall be carefully inspected for proper joints and sufficient supports, anchoring, interferences, and damage to pipe, fittings, and coating. Damage shall be repaired to the satisfaction of the ENGINEER.

B. Field Testing: The CONTRACTOR shall allow adequate time for the solvent cement joints to cure. Curing time shall be per the solvent cement manufacturer's recommendation. Prior to enclosure or burying, piping systems shall be pressure tested as defined by the ENGINEER and in accordance with Section 01445, for a period of not less than two hours, without exceeding the rated tolerances of the material. Caution – Do not use air or gas for testing PVC pipe. Where no pressures are indicated, the pipes shall be subject to 1-1/2 times the maximum working pressure. The CONTRACTOR shall furnish all test equipment, labor, materials, and devices.

C. Leakage shall be determined by loss of pressure. Fixtures, devices, or other accessories that would be damaged if subjected to the test pressure shall be disconnected and ends of the branch lines shall be plugged or capped as appropriate during the testing procedures.

D. Leaks shall be repaired to the satisfaction of the ENGINEER, and the system shall be retested until no leaks are found.

END OF SECTION

SECTION 02762

PAINTED TRAFFIC LINES AND MARKINGS

PART 1 GENERAL

1.01 SUMMARY

A. Work in this section includes: Traffic stripes and pavement marking in the types and arrangements as specified herein and replacement of existing markings obliterated by Contract work.

B. Provide all labor, equipment and materials to perform all traffic line and marking replacement required for project construction, complete as specified and shown on the Plans.

1.02 RELATED WORK

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. State of California, Department of Transportation (Caltrans):

1. Standard Specifications.

1.04 SUBMITTALS

A. Submittals shall be in accordance with Section 01300.

B. Submit:

1. Materials list of items proposed to be provided under this Section.

2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

3. Photographs, scale drawings, or other data acceptable to the ENGINEER, showing types of graphics proposed to be used.

4. Proposed work sequence and traffic control plan for work on or adjoining public rights-of-way.

1.05 QUALITY ASSURANCE

A. Alignment, layout, tolerances, appearance, and protection shall comply with Caltrans Standard Specifications Sections 84-1.02, -1.03, and -1.04.

B. Comply with product manufacturer's recommendations. Clean all surfaces thoroughly and remove all deleterious materials present.

C. Mask and protect all surfaces not to be painted and protect vegetation from overspray.

D. Provide traffic control devices and personnel to safely direct vehicle traffic and to protect painted surfaces.

PART 2 PRODUCTS

2.01 PAVEMENT MARKING PAINT

A. Provide paint specifically formulated for use as pavement marking in automobile traffic areas, and in the colors selected by the ENGINEER from standard colors of the approved manufacturer. Paint must conform to requirements of State and local air quality control boards.

B. Products:

1. "Traffic Paint" manufactured by J.E. Bauer Company, Tnemec, "Romark Traffic" manufactured by Glidden-Durkee, "Traffic and Zone Marking Paint" manufactured by PPG, or equal.

2. Other products conforming to California State Specification 8010-91D-30 and masking.

2.02 OTHER MATERIALS

A. Provide other materials, such as stencils and masking, not specifically described but required for a complete and proper installation, as selected by the CONTRACTOR subject to the approval of the ENGINEER.

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

B. Surfaces which are to receive traffic stripes and pavement markings shall be cleaned of all dirt and loose material prior to painting or marking.

3.02 APPLICATION

A. Secure the ENGINEER's approval of graphics design and layout prior to start of application. Application methods shall conform to Caltrans Standard Specifications Section 84 unless otherwise stated herein.

B. Using proper masking, stencils, and application equipment recommended for the purpose by the manufacturer of the approved paint, apply the approved paint in strict accordance with its manufacturer's recommendations.

C. Apply minimum two coats of paint.

D. Striping pattern shall be as follows:

1. Single traffic stripe – Unless otherwise shown on the Drawings, a 4-inch wide broken yellow line.

2. Edge stripe - Unless otherwise shown on the Drawings, a 3-inch wide solid white line.

3. Stop bar (limit line) - Unless otherwise shown on the Drawings, a solid 12 inch wide white line.

4. Other markings – As shown on the Drawings.

E. Rate of Application. Apply paint at the following minimum rates:

1. Traffic stripe - 5 gal/mile first coat; 7 gal/mile second coat.

2. Solid stripe - 14 gal/mile first coat; 18 gal/mile second coat.

3.03 PROTECTION

A. Provide traffic cones, barricades, and other devices needed to protect the paint until it is sufficiently dry to withstand traffic.

3.04 CLEANUP

A. When paint is thoroughly dry, visually inspect the entire application, and

1. Touchup as required to provide clean, straight lines and surfaces throughout.

B. Using a permanently opaque paint identical in color to the surface on which the paint was applied, block out and eliminate all traces of splashed, tracked, and/or spilled pavement marking paint from the background surfaces.

C. Remove all stencils, product containers, masking, and other materials from the Site.

END OF SECTION

SECTION 02900

LANDSCAPE PLANTING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and the Provisions of Bid and Contract Documents, including General and Supplementary Conditions and Division 1 Specification Sections, shall apply to the work specified in this Section.

B. Habitat Management Plan (HMP) for the Los Osos Wastewater Project, Los Osos, San Luis Obispo County, Dated November 2011. This document sets forth implementation procedures for required habitat mitigation for the project.

1.02 DESCRIPTION

A. All work shall conform to the provisions set forth within the approved HMP and these construction documents. Provisions made within these construction documents shall complement the HMP and provide additional direction for implementation. Any conflicts between these plans and the HMP shall be brought to the landscape architect's attention prior to construction.

B. Work Included: Provide all material, labor, equipment and services necessary for the furnishing and installation of a complete planting installation, as shown on the drawings and as specified herein. The work may include, but is not limited to:

1. Finish grading of landscaped areas.
2. Soil amendment.
3. Soil separator.
4. Sub-drains.
5. Drain rock.
6. Planting.
7. Sand and soil mix.
8. Eucalyptus Bark Chip Mulch.
9. Root control barrier.
10. Maintenance through Final Acceptance.
11. Warranty replacement.

B. Related Work:

Section 02281: Automatic Irrigation System

1.03 DEFINITIONS

A. Site Soil: All existing soil on the site.

B. Soil Mix: Homogenous mixture of specific components for use as a planting medium in planters.

C. Planter Backfill: Distinct layers of soil mix placed in planters to depths required to achieve finish grade.

1.04 QUALITY ASSURANCE

A. Testing Laboratory: Recognized laboratory for soil and plant disease analysis for ornamental horticulture, approved by the ENGINEER. Testing laboratory is to perform all work in accordance with the current methods of the Association of Official Agricultural Chemists.

1.05 REFERENCE STANDARDS: Comply with the applicable provisions of the following:

A. Testing Laboratory: Recognized laboratory for soil and plant disease analysis for ornamental horticulture, approved by the ENGINEER. Testing laboratory is to perform all work in accordance with the current methods of the Association of Official Agricultural Chemists.

1.06 REFERENCE STANDARDS: Comply with the applicable provisions of the following:

A. Nomenclature: "An Annotated Checklist of Woody Ornamental Plants of California, Washington, and Oregon", Mathias and McClintock, California Agricultural Experimental Station Extension Service, University of California, 1979, Publication No. 4091.

B. Staking and Guying Procedures: "Staking Landscape Trees", University of California Extension Publication #2576.

C. Pruning Procedures: "Pruning Landscape Trees", University of California Extension Publication #2574.

1.07 SUBMITTALS

A. General: Submittals to be in accordance with the requirements of Section 01300 - Submittals. Review or acceptance, as specified, by the ENGINEER is required prior to commencement of work.

B. Samples: Submit the following to the ENGINEER for acceptance:

1. Soil Separator: One square foot minimum, accompanied by product data.

2. Drain Rock: One-half cubic foot.

3. Wood Bark Mulch: One-half cubic foot.

4. Root Control Barrier: One square foot sample panel, accompanied by product data.

C. Product Data: Submit the following product information to the ENGINEER for acceptance:

1. Tree Ties: Manufacturer's literature.

2. Tree Stakes: Manufacturer's literature.

3. Soil Amendments & Fertilizers: Manufacturer's literature.

D. Test Reports: Provide the following tests and submit the results to the ENGINEER: Test reports are to be the test number specified, as provided by Soil and Plant Laboratory, Santa Ana, CA, or approved equal.

1. Existing Site Soil: Provide one test at each of the pump sites. Provide four (4) tests at opposite corners of the Broderson Site. Test A05, for agricultural suitability, fertility, particle size analysis; including recommendations for soil amendment, and fertilization during the maintenance period.

2. Import Soil: Submit test reports of representative sample(s) for approval prior to delivery and for every 100 yards delivered to the site. Test A05, for agricultural suitability, fertility, particle size analysis; including recommendations for soil amendment, and fertilization during the maintenance period.

3. Organic Amendments, Fir Bark: Test A08: Partial organic amendment evaluation.

4. All Other Fertilizers and Amendments: For standard products, submit manufacturer's analysis. For all other products, submit analysis by testing laboratory.

5. Sand: Test A-02, agricultural suitability; Test A-20-1: Particle size, US sieve system, percent by weight.

E. Herbicides: Submit manufacturer's analysis. Schedule for application of herbicides must be approved by the ENGINEER.

F. Soil Mix: Submit separate one-gallon samples of each accepted planter soil mix component and one-ounce samples of the fertilizers to the ENGINEER. Samples will be combined in the specified proportion by the testing laboratory, and tested to establish standards to which all batches of soil mix used on the job shall conform. Thereafter, submit test of a representative sample from every batch mixed, minimum one report for every 100 yards mixed. Test A01: Agricultural fertility.

G. Record Drawings: Prepare "As-built" plans noted below. Submit to the ENGINEER prior to the 30-day maintenance observation.

1. "As-built" Planting Plan: Indicate plant type, count, size and locations.

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Fertilizers and Amendments: Store fertilizers and amendments, bark mulch, soil mixes, and other materials which could stain concrete and similar surfaces in such a manner that staining does not occur.

B. Plants: Maintain all plant material in a healthy growing condition prior to and during planting operations. Protect plants at all times from sun and drying winds. Plants that cannot be planted immediately upon delivery shall be kept in the shade, well protected and watered. Plant material delivered to the site must be planted within 3 days of site delivery. Plants that cannot be installed on this work schedule shall be returned to the grower until installation requirements can be met.

1.09 SUBSTITUTIONS, ADDITIONS AND DELETIONS

A. General: Submit proposals for substitutions in accordance with section 01630 Substitutions and Product Options. Acceptance by the ENGINEER is required prior to proceeding with the work under this Section.

B. The ENGINEER reserves the right to substitute plant material of sizes similar to material specified, as the work progresses, at no additional cost to the OWNER.

1.10 WARRANTY

A. General: Become familiar with the anticipated growing conditions prior to commencement of work. Notify the ENGINEER immediately in writing of any conditions which will prevent the proper execution of the warranty responsibilities specified. Failure to so notify the ENGINEER constitutes acceptance of the growing conditions. Any removal, repair or replacement of plant material required by unsuitable conditions found after work has begun shall be done at no additional cost to the OWNER.

B. Requirements:

1. Plant Material: Warrant that all trees under this Contract will be vigorous, healthy, free of dead or dying branches and branch tips, bearing foliage of normal density and color, and will otherwise comply with the specifications in PART 2 PRODUCTS of this Section, for a period of one year from date of Final Acceptance. Any delay in completion of planting operations, which extends the planting into more than one growing season shall extend the warranty period correspondingly.

2. Replacements: Without cost to the OWNER, in a timely manner and as directed by the ENGINEER, replace all plants not meeting the requirements above during and at the end of the warranty period. Replacements shall closely match adjacent specimens of the same species in size and shall comply with all requirements of this specification.

PART 2 PRODUCTS

2.01 PLANTS

A. General: Plants shall be locally nursery grown in accordance with good horticultural practices under climatic conditions similar to those of project for at least one year unless otherwise approved by OWNER.

B. Acclimatization: The CONTRACTOR is responsible for supplying plant material that has been properly acclimated and conditioned, in accordance with good horticultural practices, for the exposure, wind and humidity levels, soil conditions, etc., encountered at the project site and in the proposed plant location.

C. Coordination: The CONTRACTOR shall coordinate his acclimatization schedule with the ENGINEER as to allow an adequate conditioning period for the plant material prior to the approved date of planting commencement. Notify the ENGINEER in writing prior to proceeding with any acclimatization work if approved work schedule allows insufficient time to acclimate the material.

D. Quality: Plants shall be superior in form, compactness and symmetry; sound, healthy and vigorous, well branched and densely foliated when in leaf; free of disease, insect pests, eggs or larvae, and free from physical damage or adverse conditions that would prevent thriving growth.

E. Size:

1. Plants shall conform to measurements specified. Measure plants when branches are in their normal position. Height and spread dimensions specified refer to the main body of plant and not branch tip to tip. Take caliper measurements at a point on the trunk 6 inches above natural ground line for trees up to 4 inches in caliper, and at a point 12 inches above the natural ground line for trees over 4 inches in caliper.

2. If a range of size is given, no plant shall be less than the minimum size and not less than 40% of the plants shall be as large as the maximum size specified.

3. The measurements specified are the measurements after pruning, where pruning is required. Plants that meet the measurements specified, but do not possess a normal balance between height, spread, and caliper, shall be rejected.

4. Plants larger than specified may be used if approved by the ENGINEER, and if provided at no additional cost to the OWNER. If larger plants are approved, the root ball shall be increased in proportion to the size of the plant; irrigation system shall also be adjusted as required to accommodate larger plants, in accordance with Section 02281 – Automatic Irrigation System.

F. Species: Tag each plant prior to delivery to the site; label with genus, species and variety. Any plants not so identified will be subject to rejection by the ENGINEER. Replace all plant material determined by the ENGINEER within two years following the final acceptance of the project, to be untrue to the species, clone and/or variety specified, to the equal condition of adjacent plants at the time of replacement, at no additional cost to the OWNER.

G. Root Ball:

1. Do not supply any bare root or ball and burlapped stock unless approved by the ENGINEER.

2. Sizes: As specified on the plans. Where no root ball dimensions have been specified, supply material in container sizes specified.

3. Material: Root ball shall consist of a soil or soil mix that is compatible with the soil or soil mix into which the plant will be planted, and that provides for thorough drainage, aeration, and adequate moisture and nutrient retention. Having sufficient density and firmness that when planted, the plant will stand upright and stable without need for additional support.

4. Containers: All plant material shall have been grown in the containers in which delivered for at least six months, but not over two years. Containers for trees shall be constructed to the specified dimensions in such a manner that the resultant root ball will approximate the slopes into which the individual tree(s) is to be planted.

5. Root Pruning: Where root pruning is required to provide material of the specified size, or for planting in the sloped containers, the pruning is to be done under the direction of a Certified Arborist. No root pruning is to be done within one year of installation unless approved by the ENGINEER.

H. Trunks and Branches: Do not prune plants before delivery. All trunks are to be straight and of uniform taper, larger at the bottom unless otherwise specified. Plants with damaged or crooked leaders, or multiple leaders, unless specified, will be rejected. Plants with abrasions of the bark, sun scalds, disfiguring knots, or fresh cuts of limbs over 3/4 inch, which have not completely callused, will be rejected. Any plant unable to stand upright without support will be rejected.

I. Do all work necessary to bring and maintain material in conformance with the requirements of this Section.

2.02 SOILS AND PLANTER BACKFILL

A. General:

1. Soil Preparation shall conform to 4.1 General Site Preparation of the Habitat Management Plan

2. All soils to be used in areas to be planted on the project shall be free of rocks over one inch in diameter, and free of foreign debris. Soil shall be free from sub-soil, refuse, plants or roots, clods, weeds, viable weed seeds, sticks, solvents, petroleum products, concrete, base rock, or other deleterious or extraneous material. Soil shall be free of soil-borne diseases, and capable of sustaining healthy plant life.

B. Imported Topsoil:

1. Topsoil shall be fertile, friable soil of loamy character, containing an amount of organic matter normal to the region. All imported topsoil used on the job shall be from the same source.

2. Make all arrangements for obtaining and testing imported topsoil. Submit test results of a representative sample of the proposed supply for approval by the ENGINEER well in advance of its scheduled delivery to the site. The approved sample will establish the standards to which all imported topsoil used on the job must conform.

3. Do all work necessary to bring imported topsoil to standards specified above.

4. Transport imported topsoil directly from source to final position. If stockpiling is required, locations and amounts of stockpiles will be designated by the ENGINEER.

5. The ENGINEER reserves the right to take additional samples of imported topsoil at the site. If subsequent testing proves material to be at variance with the approved sample, remove rejected soil from the site and replace immediately at no additional cost to the OWNER.

2.03 SOIL ADDITIVES

A. Nitrogen Stabilized Fir Bark On-Grade: Meeting the following specifications:

1. Particle Size (dry weight basis):

Sieve Size	Percent Passing
6.35 mm (1/4 inch)	95 – 100
2.38 mm (No. 8, 8 mesh)	50 – 80
500 micron (No. 35, 32 mesh)	0 – 25

2. Organic Content: Determined by ash analysis. Minimum 92% based on dry weight.

3. Nitrogen: Minimum 0.8% nitrogen based on dry weight.

4. Salinity: Maximum saturation extract conductivity 3.5 milliohms per cm at 25 degrees centigrade.

5. Iron: Minimum 0.08% dilute acid soluble Fe based dry weight, if iron treated.

6. Bulk Density: 400 pounds per cubic yard.

B. Fine Fir Bark in Planters:

1. Particle Size (Dry Weight Basis):

Sieve Size	Percent Passing
6.35 mm (1/8 inch)	95 – 100
2.38 mm (No. 8, 8 mesh)	75 – 100
500 micron (No. 35, 32 mesh)	0 – 30

2. Organic Content, Bulk Density and Chemistry: As specified for nitrogen-stabilized fir bark above.

C. Fine Sand:

1. Particle Size (dry weight basis):

Sieve Size	Percent Passing
No. 4	100
No. 10	95 – 100
No. 18	90 – 100
No. 35	65 – 100
No. 60	0 – 50
No. 140	0 – 20
No. 270	0 – 7

2. Salinity: Maximum saturation extract conductivity range in millimhos per cm at 25 degrees centigrade: 0-3.0.

3. Boron: Maximum saturation extract concentration 1.0 ppm.

4. Sodium: Maximum sodium absorption ratio (SAR) 6.0.

2.04 FERTILIZERS AND AMENDMENTS

A. Granular Fertilizer: Slow release granular fertilizer (14-14-14) shall be furnished in manufacturer's standard containers bearing original labels showing quantity, analysis and name of manufacturer.

B. Calcium Carbonate Lime: Ground oyster shell flour type.

2.05 MATERIALS

A. General: All materials supplied shall be free of deleterious and extraneous substances including contaminants detrimental to plant growth, such as excess salts, boron, solvents, etc.

B. Drain Rock: 3/4-inch diameter river rock or approved equal.

C. Guying and Staking Materials:

1. Tree Stakes: Two (2) 10' Lodge pole Stakes per installation

2. Cinch ties: 1/2-inch diameter black rubber tubing.

E. Water: Clean, potable and free of deleterious matter.

F. Pre-Emergent Herbicide: As approved by the ENGINEER per the HMP section 4.1.1.2 Noxious Weed Species.

G. Tree Paint: "Tree Seal" by Morrison, "Flexiblac 3230" as manufactured by Samuel Cabot, Inc., Boston, MA, Ortho "Pruning Seal", or approved equal.

H. Anti-Desiccant: For retarding excessive loss of plant moisture and inhibiting wilt, sprayable, water insoluble vinyl-vinyledine complex which will produce a moisture regarding barrier.

Forming at temperatures commonly encountered out-of-doors during planting season. Film thus formed shall have a mvt (moisture vapor transmission rate) of not more than 10 grams per 24 hours at 70 percent humidity. Furnish evidence that the material can be used safely on plant materials specified.

I. Hardware:

1. All hardware required for fabrication and erection including brackets, hangers, hinges, fasteners, and nails to be hot-dip galvanized.

2. Screws, nuts, bolts and washers to be stainless steel.

J. Wood Bark Mulch: 1/4-inch to 5/8-inch diameter, Cedar Bark Mulch containing no viable weeds or seed.

K. Root Control Barrier: "Deep Root Control Barrier", stock number UB24-2 as manufactured by Deep Root Corp., 15040 Golden West Circle, Westminister, CA 92683 (714) 898-0563, or approved equal.

PART 3 EXECUTION

Refer to Section 5 of the HMP – Site Specific Restoration Plans for installation procedures for the following project sites: Giacomazzi, Sunny Oaks, Mid-Town, Broderson, Solano, & East Ysabel.

3.01 FIELD QUALITY CONTROL

A. Pre-Construction Conference: Schedule a pre-construction conference with the ENGINEER at least 7 days before beginning work under this Section. Submit written request for conference at least 7 days prior to proposed time of conference. Purpose of this conference is to review questions CONTRACTOR may have regarding the work, administrative procedures during construction and project work schedule.

B. Progress Observations: In addition to the installation observations specified below, periodic progress observations will be made by the ENGINEER.

C. Installation Observations: Specifically requested the following observations:

1. Observation of planter backfill and finish grading prior to planting. Plants shall be on-site and tagged for observation.

2. Observation of layout and placement of plant material at time of planting.

D. Maintenance Period: The CONTRACTOR will perform maintenance of all landscaping for a period of 120 days after completion of plant installation. For the purpose of establishing the 120-day maintenance period and observing completion of the work of this Section through Final Acceptance, five (5) separate field visits shall occur chronologically as follows:

1. Observation for Maintenance Period Commencement.

2. 30-Day Progress Maintenance Observation.

3. 60-Day Progress Maintenance Observation.

4. 90-Day Progress Maintenance Observation.

5. Final Observation.

3.02 ORDERING, REVIEW AND ACCEPTANCE OF PLANT MATERIAL

A. Ordering:

1. Within 30 days after award of contract, submit written certification to the ENGINEER of the quantity and species of plant material ordered, and the nursery(s) supplying the material.

2. The CONTRACTOR is responsible for providing all plant material in the quantities and sizes specified on the drawings, and for making all arrangements in advance that may be required to obtain these materials. If any material specified will be unavailable at the time of planting, submit written verification to the ENGINEER along with the bid.

B. Review of Plant Material: Before planting operations begin, all plant materials shall be reviewed for conformance to the design intent of the Contract Documents by the ENGINEER. Submit written request for review of plant material at least 10 days prior to commencement of planting operations. Review by the ENGINEER does not waive the OWNER's right of rejection during planting or any time thereafter.

C. Rejection of Material: The ENGINEER reserves the right to review and reject plant material at any time, and at the place of growth, for nonconformance to the Specifications. Do not install plant material which has not been reviewed at the project site by the ENGINEER.

3.03 FINISH GRADING

A. General: Shall conform with HMP section 4.1 General Site Preparation and the following. All areas to be planted on the project shall be free of rocks over one inch in diameter to a depth of 8" minimum below finish grade, and free of foreign debris, subsoil, refuse, plants or roots, clods, weeds, sticks, solvents, petroleum products, concrete, base rock, or other deleterious or extraneous material. Areas to be planted shall be free of soil-borne diseases and capable of sustaining healthy plant life. Do all work necessary to bring site soil, import soil and planter backfill to compliance with these requirements. Remove from the project site and dispose of in a legal manner any soils and material not meeting these requirements. Subject to acceptance of the ENGINEER, all soil and material not meeting these requirements shall be the property of the CONTRACTOR.

B. Noxious Weed Abatement: Shall conform with HMP section 4.1.1.2

C. Surface Drainage: CONTRACTOR is responsible for proper surface drainage of planted areas. Report in writing to the ENGINEER any discrepancies in the Contract Documents, obstructions on the site, or any other conditions that the CONTRACTOR feels prevent establishing proper drainage, and obtain the ENGINEER's instructions prior to proceeding with the work affected.

D. Final Contouring:

1. Handle and place the soil to depths required. Remove all rocks and clods over one inch in diameter. Provide for surface drainage and cut all necessary drain swales.

2. Work soil sufficiently so that after rolling and after full settlement has occurred, the site will be graded to within ±0.10 of a foot from the lines, grades and elevations shown, and as may be directed by the ENGINEER. Finished surface shall be smooth and uniform and shall be free of depressions that retain standing water or any surface irregularities that would impede proper drainage. Unless otherwise noted, all soil finish grades shall be 1-1/2 inches below finish grade of adjacent walks, pavements and curbs, and top of wall elevations.

E. Erosion Repair:

1. Erosion Control shall conform to Section 4.1.1.3 of the HMP.

2. Repair all erosion damage that occurs until Final Acceptance. Take all measures necessary to prevent erosion occurring during work under this Section. Provide and amend replacement soil in accordance with this Section.

F. On-Grade: In on-grade locations, this CONTRACTOR shall receive the site ±.15 feet from the finish grades shown on the drawings. The CONTRACTOR shall establish finish grades in these planting areas by using approved imported topsoil.

G. Cross-Rip: Cross-rip all on-grade planting areas to a minimum depth of 12 inches.

H. On-Grade Fill Areas: The ENGINEER will observe all subgrade prior to placement of fill soil. Thoroughly scarify and cross-rip all areas to receive fill to a depth of 12 inches prior to placement of fill.

3.04 SOIL AMENDMENT ON-GRADE

A. General:

1. Soil amendments and fertilizers shall be provided as recommended in the required soil tests performed by the approved testing laboratory.

2. After finish grading operations are completed, obtain required soils test and submit test report results to the ENGINEER for review. Sampling procedures and number of samples shall be as recommended by the Testing Laboratory and reflect the scope, scale and complexity of the project and soil conditions present.

3. The following soil amendments and fertilizers are to be used for bid pricing only.

4. General: After finish grading operations are completed, rototill top 6 inches as required in at least 2 perpendicular directions, and with soil at the proper moisture content so that all clods greater than 1 inch diameter will be broken up resulting in a homogenous blend of amended soil.

B. Site Soil: Amend the surface 6 inches by thoroughly blending the following amendments per 1000 square feet.

Amount	Ingredient
6 cubic yards	Nitrogen Stabilized 0" – 1/4" Fir Bark
15 pounds	12-12-12 Commercial Fertilizer as Specified
15 pounds	Soil Sulfur
100 pounds	Agricultural Gypsum

C. Backfill Mix (on-grade locations): Amend site soil as follows per cubic yard.

Amount	Ingredient
3/5 cubic yard	Surface Soil
2/5 cubic yard	Nitrogen Stabilized 0" to 1/4" Fir Bark
1 pound	12-12-12 Commercial Fertilizer as Specified
2 pounds	Iron Sulfate as Specified
10 pounds	Agricultural Gypsum

D. Additional Amendments: Soil amendment recommendations will vary for planting areas if imported topsoil is required to establish finish grade. Provide all additional amendments as may be required by subsequent soil testing of approved imported topsoil and as directed by the ENGINEER.

3.05 SOILS FIELD QUALITY CONTROL

A. General: Keep a record of where each batch of imported topsoil delivered is deposited in the landscape; mark graphically on a separate, clean set of black line prints.

B. Deficient Soils: Remove all soils determined by the ENGINEER to be deficient and provide all additional amendments as directed by the ENGINEER to modify deficient soils at no additional cost to the OWNER.

3.06 HANDLING OF PLANT MATERIAL

A. General: Conform to Section 4.2.1 of the HMP and the following.

B. Do not bind or handle any plant in such a way that would result in damage to the plant material. Lift and handle plants only from bottom of root ball.

B. Access: The CONTRACTOR shall be responsible for accessing and installing all plant material at the job site. The CONTRACTOR shall inspect the job site and become familiar with the accessing requirements and restrictions. Plant material shall be carefully bound with clear plastic wrap, burlap or other lightweight fabric as required to allow access. Care should be exercised to prevent damage or breakage to limbs, and ropes or other lines should not be allowed to damage bark. At the time of submitting bid, the CONTRACTOR shall notify the ENGINEER, in writing, of any conditions that would prevent the accessing and installation of the specified plant material.

C. Container Stock:

1. General: Do not lift or handle container plants by tops, stems, or trunks at any time.

2. Boxed Stock: Remove bottom of box prior to placement of plant in planting pit. Cut bands and remove box sides just prior to backfilling.

3. Canned Stock: Remove canned stock carefully after cans have been cut on two sides with acceptable cutter. Do not use spade to cut cans.

4. Ball and Burlap Stock: Dig ball and burlap (B & B) plants with firm balls of earth of diameter not less than that recommended by the American Standard for Nursery Stock, and of sufficient depth to include the fibrous and feeder roots. Plants moved with ball will not be accepted if the ball is cracked or broken before or during planting operations.

D. Anti-Desiccant: At CONTRACTOR's option, spray all evergreen and deciduous plant material in full leaf with anti-desiccant, in accordance with manufacturer's instructions. Apply an adequate film over trunks, branches, twigs and foliage. Take precautions as necessary to prevent damage, particularly from sun scald.

3.07 LAYOUT OF PLANT MATERIAL

A. General: The ENGINEER will review for conformance to the design intent of the Contract Documents locations of all plants in the field prior to planting. Notify the ENGINEER and schedule layout review sufficiently in advance of planting to allow for review and adjustment without disrupting construction schedule.

B. Trees: Layout tree locations shown on the drawings using a 3-foot lath (or other acceptable method), color-coded to indicate each species. The ENGINEER will review locations of trees in the field, as denoted by lath stakes, after trees are delivered to the site, but before placement and positioning. After placement of trees in approved locations, but before final planting, notify ENGINEER to review final positioning of trees.

C. Other Plant Material: Layout all other plant material where shown on the drawings.

D. Adjustments: The ENGINEER reserves the right to make minor adjustments in the layout of all plant material; adjust irrigation system as necessary.

3.08 EXCAVATION OF PLANTING PITS ON-GRADE

A. General: Excavate plant pits by hand or with a backhoe; use of augers will not be permitted. Prior to planting and backfill, scarify the sides and bottom of the pit as required to eliminate any glazed surfaces. Excavate container-grown tree, shrub, and vine holes to the following dimensions:

1. 1, 5, and 15 gallon containers: Two times the size of the root ball in width and depth.

2. 24-inch boxes and larger: Large enough to allow one foot of space around the ball in all directions.

3. Holes on mounds: Dig plant holes on mounds deeper than normal.

B. Excess Soil: Transport and dispose of off-site in a legal manner any excess excavated soil.

C. Obstructions: If rocks, underground construction work, tree roots or other unknown obstructions are encountered in the excavation of plant holes, alternate locations may be selected by ENGINEER. Report all such conditions in writing to the ENGINEER. If a change in the location of the planting pit is unacceptable to the ENGINEER, the original planting pit shall be over-excavated to remove the obstructions to a minimum dimension of 12" beyond the sides and bottom of the tree pit as typically specified. Obtain the ENGINEER's instructions prior to proceeding with the work affected.

3.09 DETRIMENTAL SOILS AND DRAINAGE

A. General: Prior to planting, test drain all planting areas as follows:

1. On-Grade Plant Pits: Fill with 12 inches of water. Water should drain completely in 48 hours.

2. Plant Beds: Irrigate until soil is saturated. Saturated condition should not remain after 24 hours.

B. Drainage Chimneys:

1. General: For plant pits failing the initial drainage test, provide drainage chimneys as shown on the drawings and as directed by the ENGINEER.

2. Neatly auger drainage chimneys to a depth directed by the ENGINEER. Remove loose soil from hole and plant pit. Locate chimneys at perimeter of plant pit. Repeat test for proper drainage.

3. Once required drainage test has been passed, backfill chimneys with drain rock, flush with bottom of pit. Cover chimneys with soil separator.

C. Failure of Drainage Test: report in writing to the ENGINEER all areas not passing these tests and all soil conditions that the CONTRACTOR considers detrimental to growth of plant material. State condition and proposal and cost estimate for correcting the condition. Obtain the ENGINEER's instructions prior to proceeding with the work affected. Repeat drainage testing and correction of conditions in this manner as necessary until tests are passed. Failure to perform drainage tests and/or to notify the ENGINEER in writing of the conditions specified above renders the CONTRACTOR responsible for all plant failure that occurs as a result of inadequate drainage or detrimental soil conditions, as determined by the ENGINEER.

3.10 PLANTING OPERATIONS

A. General: Do not plant any material that has not been reviewed by the ENGINEER upon delivery to the project site or that has been rejected for any reason. Do not plant under unfavorable weather conditions.

B. Container Stock: After removing plants from their containers, disentangle any small roots that encircle the container. Do not cut or otherwise disturb the root ball. Inspect all plants for root-

bound condition; do not install root-bound plants or plants found to have cracked or broken root balls when taken from the container.

C. Backfilling: Backfill plant pits as shown on the drawings and specified herein. Set plant plumb and brace rigidly in position until backfill has been tamped solidly around the root ball. When plant holes have been backfilled approximately 2/3 full, water thoroughly, saturating root ball, before installing remainder of backfill to top of hole, eliminating air pockets.

D. Top-dress Fertilizing On-Grade: When plant installation is complete, fertilize all container planting areas with top-dress fertilizer at the rate of 4 lbs. per 100 square feet.

E. Mulching: Mulch all containerized planting areas (excluding hydroseeded areas) with 2 inch layer of wood bark mulch unless otherwise shown. Spread mulch uniformly to form a smooth cover free of bare spots and mounds.

G. Settlement: As shown on the drawings, the crowns of all plants shall be at least 1/2 inch above the surrounding grade after all settlement has occurred.

H. Watering Basins On-Grade: Form a watering basin, an excavated ring around the root ball of the plant for each tree and shrub. Do not form watering basins in lawn areas.

I. Watering: Thoroughly water all plants immediately after planting, taking care to avoid erosion.

3.11 STAKING AND GUYING

A. General: Complete staking and guying immediately after planting. Perform in accordance with reference standards, unless otherwise shown on the drawings or directed by the ENGINEER. Securely stake all trees planted on the site using staking type shown on the drawings. The ENGINEER reserves the right to make modifications to staking procedures as required to accommodate field conditions at no additional cost to the OWNER.

B. Staking: Stake trees as shown on the drawings.

3.12 PRUNING

A. Existing Stock: Prune plants only at the direction of the ENGINEER and according to reference standards. Pruning shall be performed by or under supervision of a certified arborist within the project county.

1. Remove all dead wood, suckers and broken or badly bruised branches.

2. Use only disinfected, sharp tools.

3. Preserve the natural character of the plant. Do not prune tree such that the canopy is lopsided or unevenly distributed.

4. Apply tree seal to cuts over one inch diameter in accordance with manufacturer's instructions.

B. Root Pruning: Roots greater than 1" in diameter shall not be pruned unless previously approved by a certified arborist. All earthwork to be performed under the dripline shall be performed by hand. Do not store mechanical or any other heavy equipment under the dripline of trees.

C. New Container Stock: Prune plants only at the direction of the ENGINEER and according to reference standards to preserve the natural character of the plant. Remove all dead wood, suckers and broken or badly bruised branches. Remove sucker basal and lateral growth to prevent resprouting; retain normal side branching. Use only disinfected, sharp tools. Improperly pruned trees will be subject to rejection by the ENGINEER. Apply tree seal to cuts over one inch diameter in accordance with manufacturer's instructions.

3.13 GROUND COVER PLANTING

A. Finish Grading: Place and amend soil or planter backfill, and do all work to provide the correct finish grades in the planting areas as specified.

B. Pre-emergent herbicide Application On-Grade Only: Apply pre-emergent herbicide, Surflan A.S. at the rate of 5-1/3 pounds per acre applied in 25 gallons of water to all on-grade locations. Apply before wood bark mulch application.

C. Mulching: Apply wood bark mulch to all planter areas at least 2 inches deep covering all exposed soil / planter backfill mix or erosion control fabric areas. Herbicide activity is enhanced when wood bark mulch is applied over the herbicide and irrigated.

D. Planting: Plant ground cover plants through wood bark mulch and erosion control fabric at the specified triangular spacings. Make planting hole with a hand mattock avoiding mixing surface applied herbicide into planting hole.

E. Activation of Herbicide On-Grade Only: After planting, irrigate with at least one inch of water to activate the herbicide. Water areas carefully, taking care to avoid erosion. Repair erosion occurring from careless watering immediately. Remove, repair and replace adjacent planting and soil damaged by careless watering and translocation of herbicide.

3.14 INSTALLATION OF DRAIN ROCK AND/OR GRAVEL MULCH

A. Install where and to depths shown on the drawings. Do all work required to ensure the drain rock is clean and free of sticks, clods, and other deleterious matter before it is placed.

3.15 MAINTENANCE

A. Maintenance shall conform to Section 7 of the HMP and the following criteria. The OWNER will provide a qualified biologist or restoration specialist and county staff to monitor and maintain installations to meet the requirements of the HMP. The Landscape Contractor will be required to work in tandem with the county and provide their own maintenance period as follows:

B. General: Maintain all plant and planting areas from time of delivery, through installation and the 120-day maintenance period until Final Acceptance.

C. Schedule: Submit a proposed maintenance work schedule to the ENGINEER in writing for review at least 30 days prior to commencement of maintenance work. All maintenance work shall be done at times approved by the ENGINEER so as not to conflict with the operation of the project.

D. Maintenance Procedures:

1. Coordinate with County staff to produce maintenance and watering schedule to avoid any potential conflicts that may occur.

2. General: Maintenance of new planting consists of, but is not limited to: Watering, cultivating, fertilizing, weeding, mulching; restaking, resetting plants to proper grades or upright positions; restoring watering basins; providing such sprays and invigorants as are necessary to keep the planting free of insects and disease and in thriving condition; restoring finish grades by replenishing planter areas with soil; replacing eroded soil, or soil made sterile by herbicidal application, with approved and tested imported topsoil; repairing damage to jute mesh; taking precautions as necessary to prevent sun scald damage.

2. Protection: Protect planting areas and plants against damage until Final Acceptance. Maintenance also includes temporary fences (as listed in Section 5.7 of HMP), barriers, and signs as required for protection. If any plant becomes damaged or injured, treat or replace as directed by the ENGINEER at no additional cost to the OWNER.

3. Fertilization: Including, but not necessarily limited to the following applications:

a. All Containerized planting areas: 16-6-8 fertilizer at the rate of 7 pounds per 1,000 square feet, 30 days after installation.

b. Apply 16-6-8 fertilizer at 45-day intervals after the 30-day application until landscape areas become well established.

D. Observation for Maintenance Period Commencement: Make request for observation after all plant material is installed and after first lawn cutting and after all irrigation work and other work of this Section is completed. Maintenance period shall begin upon observation and review by the ENGINEER and shall continue for a minimum of 90 days until Final Acceptance.

E. 30-day Progress Maintenance Observation:

1. General: Notify the ENGINEER and request 30 days after commencement of landscape maintenance period for a progress maintenance observation. All items determined to be deficient during the observation for maintenance period commencement shall be completed prior to the meeting. In addition, prior to this meeting, furnish the ENGINEER with the following information:

a. An as-built "Record Drawing" of all plantings installed, as specified.

b. All supplier invoices for the nursery stock, commercial fertilizers, soil amendments, mulches and herbicides as shown and specified, and as installed.

c. Maintenance schedule for fertilization, irrigation, and for cutting of all lawn areas.

d. Failure to submit the above items to the ENGINEER may result in the delay of the 30-day progress maintenance observation and the extension of the 90-day maintenance period.

e. Notify the ENGINEER prior to the 30-day progress maintenance observation of any conditions that impede proper plant establishment and/or growth.

F. 60-Day Progress Maintenance Observation: Notify the ENGINEER 60 days after commencement of the landscape maintenance period and request the 60-day maintenance observation. Prior to this observation, all items determined to be deficient during the 30-day progress maintenance observation shall be completed.

G. 90-Day Progress Maintenance Observation: Notify the ENGINEER 90 days after commencement of the landscape maintenance period and request the 90-day maintenance observation. Prior to this observation, all items determined to be deficient during the 60-day progress maintenance observation shall be completed.

3.16 FINAL OBSERVATION

A. General: Notify the ENGINEER and request final observation 120 days after commencement of the landscape maintenance period, and after all work of this Section, Section 02281 and previously identified deficiencies have been corrected.

B. Termination of Observation: During the final observation, any landscape item previously identified as deficient in the 30-day, 60-day, or 90-day progress maintenance observations, and determined by the ENGINEER to be still deficient, shall automatically terminate the final observation and result in the extension of the maintenance period an additional 30 days at no additional cost to the OWNER.

END OF SECTION

SECTION 02910

TREE PROTECTION AND TRIMMING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and the Provisions of Bid and Contract Documents, including General and Supplementary Conditions and Division 1 Specification Sections, shall apply to the work specified in this Section.

B. Habitat Management Plan (HMP) for the Los Osos Wastewater Project, Los Osos, San Luis Obispo County, Dated November 2011. This document sets forth implementation procedures for required habitat mitigation for the project.

1.02 DESCRIPTION

A. All work shall conform to the provisions set forth within the approved HMP and these construction documents. Provisions made within these construction documents shall complement the HMP and provide additional direction for implementation. Any conflicts between these plans and the HMP shall be brought to the landscape architect's attention prior to construction.

B. Preserve, protect, and prune as necessary existing trees and shrubs, and other vegetation indicated to remain.

C. All trees and plant materials to remain on site shall be protected from all trades working on the job, and it shall be the CONTRACTOR's responsibility to insure that all subcontractors are aware of and held responsible for any damage to existing trees and plant material. In addition, the CONTRACTOR shall be held responsible to insure that following protective measures are carried out throughout the entire construction period.

D. Maintenance: throughout the life of the construction project, the CONTRACTOR shall be responsible for overseeing the watering, fertilizing, pruning, and other measures necessary to protect all existing trees.

E. Replacement of damaged trees due to construction activities.

1.03 SUBMITTALS

A. Submit manufacturer's cut-sheets for protective fencing.

1.04 QUALITY ASSURANCE

A. All pruning of trees shall be performed by or under the supervision of an ISA certified arborist.

1.05 PROJECT CONDITIONS

A. Keep tree/shrub protective devices installed and in working order at all times throughout construction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Tree protection fencing: Temporary fencing sufficient to keep people and vehicles out of protected zones.

PART 3 EXECUTION

3.01 GENERAL

A. Protect all trees from stockpiling, material storage including soil, vehicle parking and driving within the tree drip line. Restrict foot traffic to prevent excessive compacting of soil over root systems.

B. All CONTRACTORs, subcontractors, and their personnel must be informed and educated to the policies, penalties, and/or fines concerning the removal or destruction of existing trees, whether intentional or accidental. All personnel are to review all tree protection measures prior to working at the construction site.

C. All trees remaining onsite within 50 ft. of construction shall be fenced prior to start of construction or grading. The fence should be placed 1.5 times the radius of the dripline away from the trunk whenever possible. This fence shall not be removed during construction unless approved by the Arborist.

D. Protect root systems of existing trees, shrubs, and ground covers from damage due to chemically injurious materials in solution caused by runoff and spillage during mixing, placement of construction materials, and drainage from stored materials.

E. Consult with an ISA certified arborist prior to pruning any tree. All pruning of trees shall be kept to a minimum and must follow ISA standards.

F. CONTRACTOR shall consult with an arborist before removing any trees within the dripline of another protected tree to remain.

G. Protect root system from flooding, erosion, excessive wetting and drying resulting from de-watering and other operations.

H. Above ground surface runoff shall not be directed into the tree canopy area from adjacent areas. Ensure that sidewalks or other construction do not trap water near the tree.

I. Encroachment (grade changes – cuts, fills, or trenching) within the dripline shall be kept to a minimum.

J. Encroachment shall be limited to one side of the tree and should not come any closer to the trunk than ½ the radius of the drip line or 10’ whichever is greater.

K. Trenching within the dripline shall be hand dug. Roots 2: in diameter and over should be left intact unless approved for removal by the Arborist. Consult with arborist for proper tools to use to remove/cut roots.

L. Grubbing within the dripline will be done by hand.

M. Protect all existing plant material to remain against unnecessary cutting, breaking, and skinning of roots and branches, skinning and bruising of bark.

N. No soil sterilants shall be applied under pavement near existing trees.

O. Do not allow fires under and adjacent to trees or other plants which are to remain.

P. Intentional or accidental destruction of trees and shrubs which are designated to remain may result in a fine. Fines can be equal to or greater than ISA assessed values of trees (or shrubs).

3.02 CLEANING

A. Remove all protective devices at the end of construction.

END OF SECTION

SECTION 02920

HYDROSEEDING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and the Provisions of Bid and Contract Documents, including General and Supplementary Conditions and Division 1 Specification Sections, shall apply to the work specified in this Section.

B. Habitat Management Plan (HMP) for the Los Osos Wastewater Project, Los Osos, San Luis Obispo County, Dated November 2011. This document sets forth implementation procedures for required habitat mitigation for the project.

1.02 DESCRIPTION

A. All work shall conform to the provisions set forth within the approved HMP and these construction documents. Provisions made within these construction documents shall complement the HMP and provide additional direction for implementation. Any conflicts between these plans and the HMP shall be brought to the landscape architect's attention prior to construction.

B. The work includes:

1. Soil preparation
2. Hydroseeding
3. Maintenance

C. Related work:

1. Section 02200: Earthwork
2. Section 02281: Automatic Irrigation System
3. Section 02900: Landscape Planting

1.03 QUALITY ASSURANCE

A. Provide and pay for materials testing. Testing agency shall be acceptable to the ENGINEER. Provide representative material samples proposed for use.

1.04 SUBMITTALS

A. Submit seed vendor's certification for required seed mixes, indicating percentage by weight, and percentages of purity, germination, and weed seed for each seed mix.

B. Submit the following material samples:

1. Seed Mix Types 1 thru 5 as directed per HMP

2. Hydro-Mulch

C. Submit the following materials certification:

1. Fertilizer(s) analysis.

2. Binder.

3. Polymer.

4. Mulch.

D. Submit materials test report.

E. Upon acceptance of hydroseeded areas, submit written maintenance instructions recommending procedures for maintenance of native plant areas.

1.05 DELIVERY STORAGE & HANDLING

A. Deliver seed, mulch and fertilizer materials in original unopened containers, showing weight, analysis, and name of manufacturer. Store in a manner to prevent moisture and degradation of seeds.

1.06 PROJECT CONDITIONS

A. Work Notification: Notify ENGINEER at least 7 working days prior to start of hydroseeding operations.

B. Protect existing utilities, paving, and other facilities from damage caused by seeding operations.

C. Perform hydroseeding work only after planting and other work affecting ground surface has been completed.

D. Restrict traffic from seeded areas until the area is established. Erect fencing, signs, and barriers as required.

E. Provide hose and lawn watering equipment as required (Pump Station Sites).

F. Seeding shall be performed during weather conditions conducive to seed germination.

1.07 WARRANTY

A. Provide a uniform stand of grass by watering, mowing, and maintaining hydroseeded areas until final acceptance. Re-seed areas which fail to provide a uniform stand of grass, with specified materials, until all affected areas are accepted by the ENGINEER.

PART 2 PRODUCTS

2.01 MATERIALS

A. Seed Mixes: As directed in the Habitat Management Plan

B. Hydro-Mulch: Agrono-Mulch or equal conforming to Caltrans Standard.

C. Binder: Ecology Control-M-Binder organic seeding additive. Fiber Plus Polymer: Terra-Sorb GB or approved equal.

2.02 EQUIPMENT

A. Equipment shall have a built in agitation system and operating capacity sufficient to agitate, suspend and homogeneously mix a slurry containing not less than 20 kilos (44 lbs.) of organic mulching amendment plus fertilizer chemical additives and solids for each 100 gallons of water.

2.03 WATER

A. Free of substance harmful to seed growth. Hoses or other methods of transportation furnished by CONTRACTOR. Refer to governing Water Agency.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine related work including irrigation and grading of surfaces before proceeding with any work and inform ENGINEER in writing of conditions, which may prevent the proper execution of this work. Failure to report unsuitable conditions will require the Sub-Contractor to rectify unacceptable work at no additional cost to the CONTRACTOR.

3.02 PREPARATION

A. Coordinate all hydroseed preparation operations with the County's biologist prior to installation to insure conformance with HMP. Limit preparation to areas, which will be immediately hydroseeded.

B. Manually remove noxious weeds and existing vegetation as directed in the HMP and dispose off-site.

C. Water all planting areas thoroughly and continuously for a period of three consecutive weeks. The ENGINEER shall approve specified watering duration and frequency program designed to germinate all residual weed seeds.

D. Discontinue watering process for 2 days. Then apply a nonselective broad spectrum systemic herbicide if perennial weeds are apparent. The type of chemical to be used shall be determined by a licensed pest control herbicide applicator in accordance with pest control advisor's recommendations. Apply no water for a minimum of 4 days following application of contact weed killer.

E. Allow sufficient period of time to insure that all weeds are dead. Follow herbicide manufacturer's directions.

F. Water all planting areas thoroughly and continuously for a period of 3 weeks. A shorter watering period may be permissible at the discretion of the ENGINEER or his pest control advisor. Discontinue watering process for 1 day prior to the second application of the herbicide spraying. Reapplying the spraying operation with a straight contact weed killer according to pest control advisor's recommendations. Allow a minimum of 4 days without irrigation for effective final week kill.

G. Clear all desiccated weeds from the lawn to the finished grade.

H. Water all planting areas thoroughly and continuously for 3 consecutive days to saturate upper layers of soil prior to hydroseeding operations.

I. Allow planting area soil surface to dry out for one day only prior to the hydroseeding application. Exercise care to not allow the soil surface to be super saturated with water prior to the hydroseeding installation. At the same time the soil surface should not be bone dry. There should be some residual moisture within the first 1/4" of the soil surface.

3.03 INSTALLATION

A. Hydroseeding:

1. Hydroseed immediately after preparation of bed between April 1 and June 1 or at such other times acceptable to the ENGINEER.

2. Hydroseed indicated areas within contract limits and areas adjoining contract limits disturbed as a result of construction operations.

B. Hydroseed Application and Rates:

1. Use a hydromulcher sprayer and mix in accordance with manufacturer's recommendations.

2. Apply hydroseed slurry to indicated areas at the following rates:

a. Seed: as directed in HMP Section 5.

b. Mulch: 1500 lbs. per acre

c. Binder: 120 lbs. per acre

d. Polymer: 50 lbs. per acre

3.05 MAINTENANCE

A. Upon completion of hydroseeding operations, maintain all hydroseeded areas for a period of 90 days as follows:

B. Watering:

1. Germination stage irrigation: Approximately 25 hours after hydromulching the planting areas, initiate the watering sequence. Water as directed by County's biologist to moisten the soil thoroughly to the depth of the slurry mulch taking care not to super saturate or wash away the slurry and seed. Perform frequent, light irrigation until seed has germinated. Repair all seed washing or erosion.

2. Establishment stage watering: After germination, reduce the irrigation frequency while increasing the duration of each watering. The specific watering program shall be approved by the ENGINEER but should approximate watering once a day for 90 days.

3. Hardening off stage irrigation: At the end of the 90-day establishment period, as determined by the ENGINEER, reduce the watering duration sufficiently to allow for maximum water penetration for the expanding root system, while at the same time taking care not to cause erosion. The precise watering reduction program shall be determined by the ENGINEER.

4. Final determination: Watering requirements will be determined by the ENGINEER upon completion of the 90 days.

C. Fertilization: Fertilize all hydroseeded areas, as indicated in Soil Preparation, General Notes, Drawings, beginning 90 days from the start of the maintenance period. Submit written fertilization/ watering and weeding/pre-emergent program to ENGINEER.

D. Weeding: All concentrated developments of weed growth appearing in the hydroseeded areas during the maintenance period shall be removed at 30-day intervals. Sub-Contractor may elect to remove such concentrations of weeds manually or by an approved herbicide program.

E. Repair, rework, and re-seed all areas that have washed out, are eroded, or do not catch.

3.06 ACCEPTANCE

A. Hydroseeded areas will be inspected at completion of installation and accepted subject to compliance with specified materials and installation requirements.

B. Inspection to determine acceptance of hydroseeded areas will be made by the ENGINEER, upon CONTRACTOR's request. Provide notification at least 10 working days before requested inspection date.

1. Hydroseeded areas will be acceptable provided all requirements, including maintenance, have been complied with, and a healthy, uniform, close stand of the specified grass is established free of weeds, undesirable grass species, disease, and insect.

2. No individual seeded areas shall have bare spots or unacceptable cover totaling more than 2% of the individual areas, in areas requested to be inspected.

C. Final acceptance will be give at the end of the maintenance period or once 80 percent germination and plant establishment has been obtained, as determined by the ENGINEER.

D. Final approval and acceptance will be given in writing by the ENGINEER following a final acceptance inspection. The ENGINEER reserves the option to extend the maintenance period if he determines the project warrants further maintenance to fulfill the 80 percent coverage that is required by contract.

3.07 CLEANING – Perform cleaning during installation of the Work and upon completion of the Work. Remove from site all excess materials, debris, and equipment. Repair damage resulting from seeding operations.

END OF SECTION

SECTION 02930

REVEGETATION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and place loam, finish grade, apply fertilizer, hydraulically or manually apply seed and mulch and maintain all seeded areas as specified herein, including all areas disturbed.

1.02 RELATED WORK

A. Site Preparation is included in Section 02100.

B. Earthwork is included in Section 02200.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, complete shop drawings, materials and equipment furnished under this Section including seed mixtures and product label information.

B. Samples of all materials shall be submitted for inspection and acceptance upon ENGINEER's request.

C. Submit native seed collection plan to comply with Habitat Management Plan (in Appendix E of these Specifications).

PART 2 PRODUCTS

2.01 MATERIALS

A. See seed quantities/type in Habitat Management Plan (HMP).

2.02 NATIVE SEED COLLECTION/PLANT PROPAGATION

A. All native seed / plant material must be collected from local sources (20 miles of coast, from Piedras Blancas to North to Pt. Conception to South).

B. Only local seed may be used.

C. Seed collector shall be responsible for securing right of entry for seed collection purposes.

D. ENGINEER shall approve seed collection approach/plan.

PART 3 EXECUTION

3.01 APPLICATION

A. Unless otherwise shown on the Drawings, loam shall be placed to a minimum depth of 4-in in areas indicated to be naturalized.

B. For all areas to be seeded:

1. Lime shall be applied at the rate of 25 lbs/1,000 sq ft.

2. Fiber mulch shall be applied at the rate of 20 lbs/1,000 sq ft.

C. The application of fertilizer and lime may be performed hydraulically in one operation with hydroseeding and mulching. If lime is applied in this manner, clean all structures and paved areas of unwanted deposits.

3.02 INSTALLATION

A. The subgrade of all areas to be loamed and seeded shall be raked and all rubbish, sticks, roots and stones larger than 2-in shall be removed. Subgrade surfaces shall be raked or otherwise loosened immediately prior to being covered with loam. Subgrade shall be inspected and approved by the ENGINEER before loam is placed.

B. Loam shall be placed over approved areas to a depth sufficiently greater than required so that after natural settlement and light rolling, the complete work will conform to the lines, grades and elevations indicated. No loam shall be spread in water or while frozen or muddy.

C. Seeding, mulching and conditioning shall only be performed during those periods within the seasons which are normal for such work as determined by the weather and locally accepted practice, as approved by the ENGINEER. Hydroseed only on a calm day.

D. Schedules for seeding and fertilizing must be submitted to the ENGINEER for approval prior to the work.

E. Seeding shall be done within 10 days following soil preparation. Seed shall be applied hydraulically at the rates and percentages indicated. The spraying equipment and mixture shall be so designed that when the mixture is sprayed over an area, the grass seed and mulch shall be equal in quantity to the specified rates. Prior to the start of work, the ENGINEER shall be furnished with a certified statement for approval as to the number of pounds of materials to be used per 100 gallons of water. This statement shall also specify the number of square feet of seeding that can be covered with the quantity of solution in the Hydroseeder.

F. In order to prevent unnecessary erosion of newly graded slopes and unnecessary siltation of drainage ways, carry out seeding and mulching as soon as satisfactory completion of a unit or portion of the project. A unit of the work will be defined as not more than 20,000 sq ft.

G. When protection of newly graded areas is necessary at a time that is outside of the normal seeding season, protect those areas by whatever means necessary (such as straw applied with a tar tack) or by other measures as approved by the ENGINEER.

H. Native seed should be applied only at onset of rainy season.

3.03 SEEDING IN WOODED AND UNGRADED AREAS

A. For preparation and seeding in wooded areas under this Contract and where no grading is required, all of the specified materials and procedures shall be utilized except that no disking shall be performed within the drip line of trees to be preserved. The seed bed shall be prepared by the addition of a thin layer of top soil roughly 1-in deep.

3.04 MAINTENANCE AND PROVISIONAL ACCEPTANCE

A. Furnish full and complete written instructions for maintenance of the lawns to the ENGINEER at the time of provisional acceptance.

B. The inspection by the ENGINEER will determine whether maintenance shall continue in any area of manner.

3.05 GUARANTEE PERIOD AND FINAL ACCEPTANCE

A. All seeded areas shall be guaranteed for not less than 1 full year from the time of provisional acceptance.

B. At the end of the guarantee period, inspection will be made by the ENGINEER upon written request submitted at least 10 days before the anticipated date. Lawn areas not demonstrating satisfactory stands as outlined above, as determined by the ENGINEER, shall be renovated, reseeded and maintained meeting all requirements as specified herein.

C. After all necessary corrective work has been completed, the ENGINEER shall certify in writing the final acceptance of the lawns.

END OF SECTION

Division 3 Concrete

SECTION 03100

CONCRETE FORMS AND ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Concrete forms and accessories.

B. Related Sections. See Related Sections for additional requirements applicable to this Section (typical).

1. Section 03250 – Concrete Joints and Joint Accessories.

2. Section 03200 – Concrete Reinforcement.

3. Section 03300 – Cast-in-Place Concrete.

4. Section 03600 – Grout.

5. Section 03922 – Modifications and Repair to Concrete.

1.02 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 301 - Specifications for Structural Concrete.

2. ACI 318 - Building Code Requirements for Structural Concrete.

3. ACI 347 – Guide to Formwork for Concrete.

B. American Plywood Association (APA):

1. Material grades and designations as specified.

1.03 DEFINITIONS

A. Architectural concrete is wall, slab, or beam concrete which will have surfaces exposed to view in the finished work.

1.04 SYSTEM DESCRIPTION

A. Design Requirements:

1. All forms and shoring shall be designed at no additional cost to the OWNER by a professional Civil or Structural Engineer registered in the State of California.

2. Formwork shall be designed in accordance with the requirements of ACI 301, ACI 318, and ACI 347 and shall comply with all applicable regulations and codes.

3. The design shall consider any special requirements due to the use of plasticized and/or retarded set concrete.

B. Performance Requirements: All forms shall be designed and constructed to provide a flat, uniform concrete surface requiring minimal finishing or repairs. Form design shall accommodate all of concrete mix designs being used by the CONTRACTOR.

1. Furnish all labor, materials, equipment and incidentals required and design, install and remove formwork for cast-in-place concrete as shown on the Drawings and as specified herein.

2. Secure to forms as required or set for embedment as required, all miscellaneous metal items, sleeves, reglets, anchor bolts, inserts and other items furnished under other Sections and required to be cast into concrete.

1.05 SUBMITTALS

A. Submit to the ENGINEER all submittals in accordance with Section 01300.

B. Product Details: Submit to the ENGINEER, product data showing materials of construction for:

1. Form release agent

2. Form ties

4. Bond breakers

C. Shop Drawings

1. Location and sequence of the concrete placements.

2. Review of pour sequence, form system and panel layout shall be for appearance and strength of the completed structure only. Favorable review by the ENGINEER of forming plans or procedures shall not relieve the CONTRACTOR of responsibility for the strength, safety or correctness of methods used, the adequacy of equipment, or carrying out the work in full compliance with the requirements of the Drawings and as specified herein.

D. Calculations

1. Submit design calculations and details prepared and sealed by a Professional Civil or Structural Engineer registered in the State of California for all forms and shoring.

E. Samples

1. The CONTRACTOR shall demonstrate to the ENGINEER on a designated area of the concrete substructure exterior surface that the form release agent will not adversely affect concrete surfaces to be painted, coated or otherwise finished and will not affect the forming materials. This demonstration shall include the application of these finishes in accordance with the requirements of the Contract Documents over areas of at least 16 square feet each.

PART 2 PRODUCTS

2.01 MATERIALS

A. Forms for cast-in-place concrete shall be made of wood, metal, or other approved material. Wood forms for architectural concrete and all surfaces in contact with water shall be new and unused and new plywood shall be on such forms for each use. Construct wood forms of sound lumber or plywood of suitable dimensions and free from knotholes and loose knots. Where used for exposed surfaces, dress and match boards. Sand plywood smooth and fit adjacent panels with tight joints. Metal forms may be used when approved by the ENGINEER.

B. Wall Forms

1. At the start of Work on this Project, all forms for all exposed exterior and interior concrete walls and all surfaces in contact with water shall be new and unused "Plyform" exterior grade plywood panels manufactured in compliance with the APA and bearing the trademark of that group, or equal. Provide B grade or better veneer on all faces to be placed against concrete during forming. The class of material and grades of interior plies shall be of sufficient strength and stiffness to provide a flat, uniform concrete surface requiring minimal finishing and grinding. Forms may be re-used up to two times provided they are thoroughly cleaned, holes are neatly plugged, and the surface is satisfactory in the opinion of the ENGINEER.

2. Forms for architectural concrete shall be constructed of materials and in a manner that will result in rigid forms with sufficient strength to withstand, without noticeable deflection, movement, or leakage, the high hydraulic pressures resulting from rapid filling of the forms and heavy high frequency vibration of the concrete. Deflection in formwork shall be limited to 1/360 of each component span. Form joints shall be laid out in a uniform pattern unless otherwise indicated on the Drawings.

3. All joints or gaps in forms shall be taped, gasketed, plugged, and/or caulked with an approved material so that the joint will remain watertight and will withstand placing pressures without bulging outward or creating surface patterns.

4. Forms for circular structures shall conform to the circular shape of the structure. Straight panels may be substituted for circular panels if the straight panels do not

exceed 2-ft in width nor deflect more than 3-1/2 degrees per joint, nor conflict with specific notes on the Drawings.

C. Rustications shall be at the location and shall conform to the details shown on the Drawings. Moldings for chamfers and rustications shall be milled and planed smooth. Rustications and corner strips shall be of a nonabsorbent material, compatible with the form surface and fully sealed on all sides to prohibit the loss of paste or water between the two surfaces.

D. Form Release Agent

1. Coat all forming surfaces in contact with concrete which will not be painted, using an effective, non-staining, non-residual, water based, bond-breaking form coating unless otherwise noted.

E. Concrete surfaces which are to be painted shall be formed with hard plastic finished plywood or a similar material which does not require a form release agent unless the CONTRACTOR can substantiate to the satisfaction of the ENGINEER that the form release agent will not remain on the formed surface after it is stripped.

F. Form Ties

1. Form ties encased in concrete shall be designed so that, after removal of the projecting part, no metal shall remain within 1-1/2-in of the face of the concrete. The part of the tie to be removed shall be at least 1/2-in diameter or be provided with a wood or plastic cone at least 1/2-in diameter and 1-1/2-in long. Form ties in concrete exposed to view shall be the cone-washer type.

2. Flat bar ties for panel forms shall have plastic or rubber inserts having a minimum depth of 1-1/2-in and sufficient dimensions to permit proper patching of the tie hole.

3. Ties for liquid containment structures shall have an integral waterstop that is welded to the tie.

4. Common wire shall not be used for form ties.

PART 3 EXECUTION

3.01 EXAMINATION

A. Forms for walls shall have removable panels at the bottom for cleaning, inspection and joint surface preparation. Forms for wall heights in excess of 16 feet shall have closable intermediate inspection ports. Tremies and hoppers for placing concrete shall be used to allow concrete inspection, prevent segregation and prevent the accumulation of hardened concrete on the forms above the fresh concrete.

B. Confirm dimensions for all concrete equipment pads (for all types of equipment, electrical, instrumentation, mechanical, etc.) with actual equipment to be installed and

installation details and anchorage calculations prior to forming. Change sizes of equipment pads to match actual equipment (larger or smaller) as required at no additional cost to the OWNER.

3.02 PREPARATION

A. Wood forms in contact with concrete which are not to be painted shall be coated with an effective release agent prior to form installation.

B. Steel forms shall be thoroughly cleaned and mill scale and other ferrous deposits shall be sandblasted or otherwise removed from the contact surface for all forms, except those utilized for surfaces receiving a rough finish. All forms shall have the contact surfaces coated with a release agent unless they are to be painted.

3.03 INSTALLATION

A. General

1. Forms shall be used for all cast-in-place concrete including sides of footings except for pipe and conduit encasements where concrete may be placed directly against the side of the trench. Forms shall be constructed and placed so that the resulting concrete will be of the shape, lines, dimensions and appearance indicated on the Drawings.

2. Molding, bevels, or other types of chamfer strips shall be placed to produce blockouts, rustications, or chamfers as shown on the Drawings or as specified herein. Chamfer strips shall be provided at horizontal and vertical projecting corners to produce a 3/4-in chamfer. Rectangular or trapezoidal moldings shall be placed in locations requiring sealants where specified or shown on the Drawings. Sizes of moldings shall conform to the sealants manufacturer's recommendations.

3. Forms shall be sufficiently rigid to withstand construction loads and vibration and to prevent displacement or sagging between supports. Construct forms so that the concrete will not be damaged by their removal. The CONTRACTOR shall be entirely responsible for the adequacy of the forming system.

4. Form material that is allowed to be reused in unexposed conditions shall have all surfaces in contact with concrete thoroughly cleaned, all damaged places repaired, all projecting nails withdrawn and all protrusions smoothed. Reuse of wooden forms for other than surfaces not exposed to view will not be permitted.

5. Metal items such as rebar, wire, or plates used to support pipe penetrations, and pipe embedments shall have minimum clearance of 2-inch from reinforcing steel bars.

B. Form Tolerances

1. Forms shall be surfaced, designed and constructed in accordance with the recommendations of ACI 347 and shall meet the following additional requirements for the specified finishes.

2. Formed Surface Exposed to View: Edges of all form panels in contact with concrete shall be flush within 1/32-in and forms for plane surfaces shall be such that the concrete will be plane within 1/16-in in 4-ft. Forms shall be tight to prevent the passage of mortar, water and grout. The maximum deviation of the finish wall surface at any point shall not exceed 1/4-in from the intended surface as shown on the Drawings. Form panels shall be arranged symmetrically and in an orderly manner to minimize the number of seams.

3. Formed surfaces not exposed to view or buried shall meet requirements of Class "C" Surface in ACI 347.

4. Formed rough surfaces including mass concrete, pipe encasement, electrical duct encasement and other similar installations shall have no minimum requirements for surface smoothness and surface deflections. The overall dimensions of the concrete shall be plus or minus 1-in.

5. Formed Concrete Surfaces to Receive Paint: Surface deflections shall be limited to 1/32-in at any point and the variation in wall deflection shall not exceed 1/16-in per 4-ft. The maximum deviation of the finish wall surface at any point shall not exceed 1/4-in from the intended surface as shown on the Drawings.

C. Removal of Forms

1. The CONTRACTOR shall be responsible for all damage resulting from removal of forms. Forms and shoring for structural slabs or beams shall remain in place in accordance with ACI 301 and ACI 347, and the requirements herein.

2. Except as otherwise specifically authorized by the ENGINEER, forms shall not be removed before the concrete has attained the following percentage of its specified design strength, nor before reaching the following time after completion of concrete placement (whichever is the longer):

TABLE 03100-1
MINIMUM TIME TO FORM REMOVAL

Forms for	Percentage of Specified Strength	Time after Placement
Sides of footings, and encasements	--	12 hours with air temperature above 50^{o}
Elevated beams and slabs	100	14 days
Sides of walls	30	48 hours

3. Shores for elevated slabs and beams shall not be removed until the concrete has attained its specified design strength.

3.04 FIELD QUALITY CONTROL

A. Inspection

1. The ENGINEER shall be notified when the forms are complete and ready for inspection at least 12 hours prior to the proposed concrete placement.

2. CONTRACTOR shall ensure that all metal pipeline embeds are separated from form ties and rebar by a minimum of 2-inch to keep pipelines electrically isolated.

3. Failure of the forms to comply with the requirements specified herein, or to produce concrete complying with requirements of this Section, shall be grounds for rejection of that portion of the concrete work. Rejected work shall be repaired or replaced as directed by the ENGINEER at no additional cost to the OWNER. Such repair or replacement shall be subject to the requirements of this Section and Section 03922.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Concrete Reinforcement.

B. Related Sections. See Related Sections for additional requirements applicable to this Section (typical).

1. Section 01300 – Submittals.

2. Section 03100 – Concrete Forms and Accessories.

3. Section 03250 – Concrete Joints and Joint Accessories.

4. Section 03300 – Cast-in-Place Concrete.

5. Section 03305 – Electrical and Instrumentation Duct Encasement Concrete.

6. Section 03600 – Grout.

7. Section 03922 – Modifications and Repair to Concrete.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

2. ASTM A185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

3. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

4. ASTM A706 - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.

B. American Concrete Institute (ACI):

1. ACI 301 - Specifications for Structural Concrete.

2. ACI 315 - Details and Detailing of Concrete Reinforcement.

3. ACI 318 - Building Code Requirements for Structural Concrete.

4. ACI 530 – Building Code Requirement for Masonry Structures.

5. ACI SP-66 - ACI Detailing Manual.

C. Concrete Reinforcing Steel Institute (CRSI):

1. Manual of Standard Practice.

D. American Welding Society (AWS):

1. AWS D1.4 - Structural Welding Code Reinforcing Steel.

E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.03 SUBMITTALS

A. Submit to the ENGINEER all submittals in accordance with Section 01300.

B. Product Data: Submit product data showing materials of construction for:

1. Reinforcing steel.

2. Mechanical reinforcing steel splicers. Product data including ICC Evaluation Service Reports.

3. Fiber reinforcements.

C. Shop Drawings: Submit to shop drawings showing details of installation for:

1. Reinforcing steel placing drawings. Placement drawings shall conform to the recommendations of ACI 315 and shall not be copies of the Contract Drawings. New scaled drawings shall be prepared showing plans, all vertical structure elevations, sections, and details as required to clearly delineate the reinforcing. All reinforcement in a concrete placement shall be included on a single placement drawing or cross-referenced to the pertinent main placement drawing. The main drawing shall include bar lists, schedule, bending details, placing plans and elevations, clear concrete cover, splice locations, splice length, and the additional reinforcement (around openings, at corners, etc.) shown on the standard detail sheets. Bars to be of special steel or special yield strength are to be clearly identified.

2. Bill of material (bar list). Clearly show the placement of each bar listed in the bill of materials on the placement drawings.

3. Bar bending details. The bars shall be referenced to the same identification marks shown on the placement drawings. Include standard bending diagrams in the submittal, as applicable. Bars to be of special steel or special yield strength shall be clearly identified.

4. Schedule of all placements to contain synthetic reinforcing fibers. The amount of fibers per cubic yard to be used for each of the placements shall be noted on the schedule.

D. Samples

1. Two samples of each type of mechanical reinforcing steel splicers.

2. Two samples of fiber reinforcement.

E. Quality Assurance/Control: Submit test reports of each of the following items.

1. Certified copy of mill test on each steel proposed for use showing the physical properties of the steel and the chemical analysis.

2. Certified copy of test reports for each foreign manufactured steel proposed for use in the fabrication of reinforcement. The tests shall be specifically made for this project at the expense of the CONTRACTOR by a domestic independent testing laboratory certified to perform the tests. The testing shall be for conformity to the applicable ASTM standard.

3. Welder's certification. The certification shall be in accordance with AWS D1.4 when welding of reinforcement required.

1.04 QUALITY ASSURANCE

A. Provide services of a manufacturer's representative, with at least 2 years experience in the use of the reinforcing fibers for a construction meeting prior to the first use and for assistance during the first placement of the material.

B. CONTRACTOR shall ensure that all metal pipeline embeds are separated from form ties and rebar by a minimum of 2-inch, in order to keep pipelines electrically isolated.

1.05 DELIVERY, STORAGE AND HANDLING

A. Reinforcing steel shall be substantially free from mill scale, rust, dirt, grease, or other foreign matter.

B. Reinforcing steel shall be shipped and stored with bars of the same size and shape fastened in bundles with durable tags, marked in a legible manner with waterproof markings showing the same "mark" designations as those shown on the submitted placement drawings.

C. Reinforcing steel shall be stored off the ground, protected from moisture and kept free from dirt, oil, or other injurious contaminants.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials shall be new and shall comply with the following material specifications.

B. Deformed Concrete Reinforcing Bars: ASTM A615, Grade 60 deformed bars..

C. Concrete Reinforcing Bars required on the Drawings to be Welded: ASTM A706.

1. ASTM A615 Grade 60 may be used for ASTM A706 provided the following requirements are satisfied:

a. The actual yield strength of the reinforcing steel based on mill tests shall not exceed the specified yield strength by more than 18,000 psi. Retests shall not exceed this value by more than an additional 3,000 psi.

b. The ratio of the actual ultimate tensile strength to the actual tensile yield strength of the reinforcement shall not be less than 1.25.

c. The carbon equivalency (CE) of bars shall be 0.55 or less.

D. Spiral Reinforcement

1. ASTM A615, Grade 60 for plain or deformed bars.

2. ASTM A82 for cold-drawn wire.

E. Welded Steel Wire Fabric: ASTM A185.

F. Reinforcing Steel Accessories

1. Plastic Protected Bar Supports: CRSI Bar Supports, Class 1 - Maximum Protection.

2. Stainless Steel Protected Wire Bar Supports: CRSI Bar Supports, Class 2 - Moderate Protection with legs made wholly from stainless steel wire.

3. Precast Concrete Bar Supports: CRSI Bar Supports, Precast Concrete Bar Supports. Precast concrete blocks that have equal or greater strength than the surrounding concrete.

G. Tie Wire

1. Tie wires for reinforcement shall be 16-gauge or heavier, black annealed wire.

H. Mechanical Reinforcing Steel Coupling System

1. Use only where indicated. Mechanical reinforcing steel coupling system shall be positive connecting taper threaded type employing a hexagonal coupler . Coupling system shall meet all ACI 318 requirements. Bar ends must be taper

threaded with coupler manufacturer's bar threader to ensure proper taper and thread engagement. Provide with cap on female end to exclude dirt, debris and wet concrete. Couplers shall be torqued to manufacturer's recommended value.

2. Unless otherwise noted on the Drawings, mechanical reinforcing steel coupling system shall produce a splice strength in tension or compression of not less than 125 percent of the ASTM specified minimum yield strength of the reinforcing bar. Base yield strength on Grade 60 reinforcing unless otherwise indicated or specified.

3. Compression type mechanical splices shall provide concentric bearing from one bar to the other bar.

I. Headed Reinforcement

1. Headed reinforcement bars shall be mechanical devices complying with ACI 318 Section 12.6 for use as mechanical anchorage to develop steel reinforcement bars in tension as an alternate to standard hooks or development lengths. Development length shall be as required per manufacturer recommendations unless detailed otherwise in the Drawings. Headed reinforcement shall be HRC 555 Headed Reinforcing Bars by Headed Reinforcement Corporation, Fountain Valley, CA or equal.

J. Fiber Reinforcement (Synthetic Reinforcing Fiber)

1. Synthetic reinforcing fiber for concrete shall be 100 percent polypropylene collated, fibrillated fibers as manufactured by Fibermesh Company of Synthetic Industries Inc., Chattanooga, TN - Fibermesh or equal. Fiber length and quantity for the concrete mix shall be in strict compliance with the manufacturer's recommendations as approved by the ENGINEER.

2.02 FABRICATION

A. Comply with the CRSI Manual of Standard Practice.

B. Bend bars cold. Do not straighten or rebend bars.

C. Bend bars around a revolving collar having a diameter not less than that recommended by the CRSI or ACI 318.

D. Saw cut bar ends that are to be butt spliced, placed through limited diameter holes in metal, or threaded. Terminate saw cut ends in flat surfaces within 1-1/2 degrees of a right angle to the axis of the bar.

PART 3 EXECUTION

3.01 INSTALLATION

A. Surface condition, bending, spacing and tolerances of placement of reinforcement shall comply with the CRSI Manual of Standard Practice. The CONTRACTOR shall be solely responsible for providing an adequate number of bars and maintaining the spacing and clearances shown on the Drawings.

B. Except as otherwise indicated on the Drawings, the minimum concrete cover of reinforcement shall be as follows:

1. Concrete cast against and permanently exposed to earth: 3-in

2. Concrete exposed to soil, water, sewage, sludge and/or weather: 2-in (including bottom cover of slabs over water or sewage)

3. Concrete not exposed to soil, water, sewage, sludge and/or weather:

a. Slabs (top and bottom cover), walls and joists – 1.5-in

b. Beams and columns (principal reinforcement) - 2-in

C. Reinforcement which will be exposed for a considerable length of time after being placed shall be coated with a heavy coat of neat cement slurry.

D. No reinforcing steel bars shall be welded either during fabrication or erection unless specifically shown on the Drawings or specified herein, or unless prior written approval has been obtained from the ENGINEER. All bars that have been welded, including tack welds, without such approval shall be immediately removed from the work. When welding of reinforcement is approved or called for, it shall comply with AWS D1.4.

E. Reinforcing steel interfering with the location of other reinforcing steel, conduits or embedded items may be moved within the specified tolerances or one bar diameter, whichever is greater. Greater displacement of bars to avoid interference shall only be made with the approval of the ENGINEER. Do not cut reinforcement to install inserts, conduits, mechanical openings or other items without the prior approval of the ENGINEER.

F. Securely support and tie reinforcing steel to prevent movement during concrete placement. Secure dowels in place before placing concrete. Wire tie ends shall be bent away from the outer surface of all concrete elements.

G. Reinforcing steel bars shall not be field bent except where shown on the Drawings or specifically authorized in writing by the ENGINEER. If authorized, bars shall be cold-bent around the standard diameter spool specified in the CRSI. Do not heat bars. Closely inspect the reinforcing steel for breaks. If the reinforcing steel is damaged, replace, Cadweld or otherwise repair as directed by the ENGINEER. Do not bend reinforcement after it is embedded in concrete.

H. Reinforcing steel bars shall have minimum clearance of 2-in from all metal items such as rebar, wire, or plates used to support pipe penetrations and pipe embedments.

I. Reinforcing steel bars shall be cleaned before concrete placement. Reinforcing substantially (as determined by the ENGINEER) covered in rust shall be sandblasted clean prior to concrete placement.

3.02 REINFORCEMENT AROUND OPENINGS

A. Unless specific additional reinforcement around openings is shown on the Drawings, provide additional reinforcing steel on each side of the opening equivalent to one half of the cross-sectional area of the reinforcing steel interrupted by an opening. The bars shall have sufficient length to develop bond at each end beyond the opening or penetration.

3.03 SPLICING OF REINFORCEMENT

A. Lap splices shall be provided as shown on the Drawings. For lap splices not shown, request clarification from the ENGINEER.

B. Splicing of reinforcing steel in concrete elements noted to be "tension members" on the Drawings shall be avoided whenever possible. However, if required for constructability, splices in the reinforcement subject to direct tension shall be welded to develop, in tension, at least 125 percent of the specified yield strength of the bar. Splices in adjacent bars shall be offset the distance of a Class B splice.

C. Install wire fabric in as long a length as practicable. Wire fabric from rolls shall be rolled flat and firmly held in place. Splices in welded wire fabric shall be lapped in accordance with the requirements of ACI-318 but not less than 12-in. The spliced fabrics shall be tied together with wire ties spaced not more than 24-in on center and laced with wire of the same diameter as the welded wire fabric. Do not position laps midway between supporting beams, or directly over beams of continuous structures. Offset splices in adjacent widths to prevent continuous splices.

3.04 ACCESSORIES

A. The CONTRACTOR shall be solely responsible for determining, providing and installing accessories such as chairs, chair bars and the like in sufficient quantities and strength to adequately support the reinforcement and prevent its displacement during the erection of the reinforcement and the placement of concrete.

B. Use precast concrete blocks where the reinforcing steel is to be supported over soil.

C. Use plastic protected bar supports or steel supports with plastic tips where the reinforcing steel is to be supported on forms for a concrete surface that will be exposed to weather, high humidity, or liquid (including bottom of slabs over liquid containing areas). Use stainless steel supports or plastic tipped metal supports in all other locations unless otherwise noted on the Drawings or specified herein.

D. Alternate methods of supporting top steel in slabs, such as steel channels supported on the bottom steel or vertical reinforcing steel fastened to the bottom and top mats, may be used if approved by the ENGINEER.

3.05 FIELD QUALITY CONTROL

A. Inspection: In no case shall any reinforcing steel be covered with concrete until the installation of the reinforcement, including the size, spacing and position of the reinforcement has been inspected by an ICC certified Special Inspector and the Inspector's release to proceed with the concreting has been obtained. The Inspector shall be given a minimum of 2 working days prior notice of the readiness of placed reinforcement for observation. The forms shall be kept open until the Inspector has finished his/her observations of the reinforcing steel.

B. CONTRACTOR shall ensure that all metal pipeline embeds are separated from form ties and rebar by a minimum of 2-inch to keep pipelines electrically isolated.

END OF SECTION

SECTION 03250

CONCRETE JOINTS AND JOINT ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Furnish all labor, materials, equipment and incidentals required and install accessories for concrete joints as shown on the Drawings and as specified herein. See the related sections for additional work and requirements.

B. Related Sections. See Related Sections for additional requirements applicable to this Section (typical).

1. Section 03100 – Concrete Forms and Accessories.

2. Section 03200 – Concrete Reinforcement.

3. Section 03300 – Cast-In-Place Concrete.

4. Section 03350 – Concrete Finishing.

5. Section 03600 – Grout.

6. Section 03922 – Modifications and Repair to Concrete.

7. Section 05500 –Metal Fabrications.

8. Section 07901 – Joint Sealants.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. ASTM C881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

2. ASTM C1059 - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.

3. ASTM D1751 - Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction. (Nonextruding and Resilient Bituminous Types).

4. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

B. U.S. Army Corps of Engineers (CRD).

1. CRD C572 - Specification for Polyvinylchloride Waterstops.

C. International Concrete Repair Institute (ICRI):

1. ICRI Guideline No. 03732 – Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.

D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply unless otherwise noted.

1.03 SUBMITTALS

A. Submit to the ENGINEER all submittals in accordance with Section 01300.

B. Product data. Submittals shall include the following:

1. Expansive Waterstops: Product data including catalogue cut, technical data, location of use, storage requirements, splicing methods, installation instructions and conformity to ASTM standards.

2. Premolded joint fillers: Product data including catalogue cut, technical data, storage requirements, installation requirements, location of use and conformity to ASTM standards.

3. Bond breaker: Product data including catalogue cut, technical data, storage requirements, installation requirements, location of use and conformity to ASTM standards.

4. Bonding agents: Product data including catalogue cut, technical data, storage requirements, product life, application requirements and conformity to ASTM standards.

C. Certifications

1. Certification that all materials used within the joint system are compatible with each other.

1.04 QUALITY ASSURANCE

A. Provide services of a manufacturer's field representative of the sealant who has performed at least five projects of similar size and complexity within the last 5 years. The field representative shall be present at the work site prior to any mixing of components to instruct on mixing, application and inspection procedures and to inspect the finish of the prepared surfaces prior to application of the sealant.

B. The manufacturer's field representative shall make at least one additional visit to the site as the work progresses and shall report on each visit to the CONTRACTOR and the

ENGINEER, advising as to whether the application is being performed in accordance with this Section and the manufacturer's printed instructions.

C. Injectable waterstop hose system shall be installed by an applicator certified by the manufacturer. Applicator of injectable waterstop hose system shall have a minimum of 5 years experience installing injectable waterstop systems.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver products in original, unopened containers displaying the manufacturer's label showing manufacturer name, product identification and batch number.

B. Store products as recommended by the manufacturer.

PART 2 PRODUCTS

2.01 GENERAL

A. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

B. All materials used together in a given joint (bond breakers, backer rods, joint fillers, sealants, etc.) shall be compatible with one another. Coordinate selection of suppliers and products to ensure compatibility. Under no circumstances shall asphaltic or bituminous bond breakers or joint fillers be used in joints receiving sealant.

C. All chemical sealant type waterstops shall be products specifically manufactured for the purpose for which they will be used and the products shall have been successfully used on similar structures for more than five years.

2.02 MATERIALS

A. Expansive Waterstops

1. Hydrophilic Waterstops - Non-expansion joint. The waterstops shall be preformed hydrophilic rubber seals. Installation adhesives used with the expansive waterstops shall be as recommended by the waterstop manufacturer. The waterstop shall be Earth Shield Type 20 by JP Specialties, Inc., Lake Elsinore, CA, or equal.

2. Injected Tube Waterstops – Non-expansion joint. The permeable injection tubes shall be composed of a reinforcing spiral covered with an inner and outer protective membrane. The injection material shall be a polyurethane grout with an accelerator system. The accelerator shall be capable of controlling the reaction time up to one hour. After reaction, the polyurethane grout shall form a flexible closed cell polyurethane form. The system shall be INJECTO with Flex LV resin by DeNeef America, Inc., ULTRA SEAL System with AKWASEAL grout by Colloid Environmental Technologies Co., Arlington Heights, IL, or equal.

B. Retrofit Waterstops

1. PVC Retrofit Waterstops for non-expansion joints: "T" type waterstop conforming to CRD C572 and made by extruding elastomeric plastic compound with virgin polyvinylchloride as the basic resins. The compound shall contain no reprocessed materials. Minimum tensile strength of waterstop 1750 psi. Waterstop shall be style 609 system, complete with Type 304 stainless steel batten bars and 1/4-in diameter stainless steel expansion bolts, by Greenstreak Plastic Products, St. Louis, MO or equal.

C. Premolded Joint Filler

1. Premolded joint filler - structures. Self-expanding cork, premolded joint filler shall conform to ASTM D1752, Type III. The thickness shall be 3/4-in unless shown otherwise on the Drawings.

2. Premolded joint filler - sidewalk and roadway concrete pavements or where fiber joint filler is specifically noted on the Drawings. The joint filler shall be asphalt-impregnated fiber board conforming to ASTM D1751. Thickness shall be 3/4-in unless otherwise shown on the Drawings. Fiber joint filler shall be sealed with a joint sealant where recommended by the joint filler manufacturer.

D. Bond Breaker

1. Bond breaker tape shall be an adhesive-backed glazed butyl or polyethylene tape which will satisfactorily adhere to the premolded joint filler or concrete surface as required. The tape shall be the same width as the joint unless otherwise noted.

2. Except where tape is specifically called for on the drawings, bond breaker for concrete shall be either bond breaker tape or a non-staining type bond prevention coating such as Silcoseal Select, by Nox-Crete Products Group or equal.

E. Bonding Agent

1. Epoxy bonding agent shall be a two-component, solvent-free, moisture insensitive, epoxy resin material conforming to ASTM C881 (2002), Type V. The bonding agent shall be Sikadur 32 Hi-Mod by Sika Corporation of Lyndhurst, NJ; Concresive Liquid (LPL) by BASF of Shakopee, MN, or equal.

2. Latex bonding agent shall be a non-reemulsifiable acrylic-polymer latex conforming to ASTM C1059, Type II.

F. Joint Sealant

1. Joint sealants shall be two-part urethane sealant as specified in Section 07901. Minimum sealant thickness at concrete joints shall be 3/8-in.

PART 3 EXECUTION

3.01 INSTALLATION

A. Expansive Waterstops

1. Install waterstops at joints where specifically noted on the Drawings. Waterstops shall be continuous around all corners and intersections so that a continuous seal is provided.

2. Each piece of the waterstop shall be of maximum practicable length to provide a minimum number of connections or splices. Connections and splices shall conform to the manufacturer's recommendations and as specified herein.

3. Prepare the joint surfaces, install primers or adhesives, and install expansive waterstops in accordance with the manufacturer's instructions.

B. Injected Tube Waterstops

1. Injected Tube Waterstops shall be installed in accordance with the manufacturer's recommendations. Injection ports shall not be spaced greater than 25 feet. The joint surfaces shall be wire brushed and scraped as necessary to expose an uncontaminated surface. The joint shall then be cleaned with pressurized air to remove all residue and debris. Immediately prior to resin injection, the injection tubes shall be flushed with water to clean and moisten the full length of the tube. Resin injection shall be in accordance with the manufacturer's recommendations. The injection tube shall be sealed and injection commenced on the next adjacent tube prior to the setting of the resin.

C. Retrofit Waterstops

1. Provide straight butt joints for field splices. Make splices on a bench. Use a power saw and guide to cut straight ends to be spliced. Heat fuse weld splices using a Teflon coated thermostatically controlled waterstop splicing iron following the manufacturer's recommendations. The finished splices shall provide a cross-section that is dense and free of porosity. ENGINEER may conduct destructive tests of splices by cutting along one half of the splice length and by cutting perpendicular to the splice at several locations on the remaining half of the splice length. The right of the ENGINEER to make such tests shall not be construed as creating any obligation to make such tests, and not exercising this right to do so shall not relieve the CONTRACTOR from meeting the requirements of these Specifications. Completed splices shall exhibit a continuous and uniform bead of excess melted material. The welded material shall not look noticeably different from the parent material. Splices shall not show misalignment of center bulbs or ribs greater than 1/16-in, lack of fusion, porosity, pinholes, cracks, charred or burnt material, bubbles, or separation of cooled splice when bent by hand. If a splice displays any of these defects, reject the splice, recut back at least 1-in from rejected splice on each side, and reweld.

2. Secure waterstops in joints before concrete is placed in accordance with the manufacturer's recommendations. Use epoxy gel if required in the

manufacturer's recommendations. Center the waterstop in the joint or as shown in the Drawings. Secure the waterstop centered on and perpendicular to the joint and to maintain this position during concrete placement.

D. Construction Joints

1. Make construction joints only at locations shown on the Drawings or as approved by the ENGINEER. Any additional or relocation of construction joints proposed by the CONTRACTOR, must be submitted to the ENGINEER for written approval.

2. Provide sealant grooves for joint sealant where indicated on the Drawings.

3. At all construction joints and at concrete joints designated on the Drawings to be "roughened", uniformly roughen the surface of the concrete to Concrete Surface Profile (CSP) 9 per ICRI Guideline 03732 with ¼-in minimum amplitude. This roughened surface may be accomplished by raking the plastic concrete or by bushhammering or chiseling hardened concrete surfaces or raking plastic concrete. Thoroughly clean joint surfaces of loose or weakened materials by waterblasting or sandblasting. Saturate the joints and adjacent concrete surfaces to at least 12-in past the joint with water 12 hours before and again immediately prior to concrete placement.

4. In lieu of the above method for bonding plastic concrete to hardened concrete, the following optional method may be used. Concrete must be allowed to set a minimum of 28 days. Use an epoxy bonding agent applied to roughened and cleaned surfaces of set concrete in strict accordance with manufacturer's recommendations.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Cast-in-place concrete. See the related sections for additional work and requirements.

B. Related Sections. See Related Sections for additional requirements applicable to this Section (typical).

1. Section 03100 – Concrete Forms and Accessories.

2. Section 03200 – Concrete Reinforcement.

3. Section 03250 – Concrete Joints and Accessories.

4. Section 03350 – Concrete Finishing.

5. Section 03600 – Grouts.

6. Section 03922 – Concrete Repair.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

2. ASTM C33 - Standard Specification for Concrete Aggregates.

3. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

4. ASTM C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

5. ASTM C94 - Standard Specification for Ready-Mixed Concrete.

6. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

7. ASTM C150 - Standard Specification for Portland Cement.

8. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.

9. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

10. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

11. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.

12. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

13. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.

14. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

B. American Concrete Institute (ACI):

1. ACI 304R - Guide for Measuring, Mixing, Transporting and Placing Concrete.

2. ACI 305R - Hot Weather Concreting.

3. ACI 306.1 - Standard Specification for Cold Weather Concreting.

4. ACI 318 - Building Code Requirements for Structural Concrete.

5. ACI 350 - Code Requirements for Environmental Engineering Concrete Structures.

C. National Ready Mixed Concrete Association (NRMCA)

1. Quality Control Manual, Section 3 - Certification of Ready Mixed Concrete Production Facilities.

D. Truck Mixer Manufacturers Bureau (TMMB)

1. TMMB 100 - Truck Mixer, Agitator and Front Discharge Concrete Carrier Standards.

E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.03 SUBMITTALS

A. Submit to the ENGINEER all submittals in accordance with Section 01300.

B. Product Data: Submit product data including the following:

1. Sources of cement, pozzolan, and aggregates.

2. Material Safety Data Sheets (MSDS) for all concrete components and admixtures.

3. Air-entraining admixture. Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations and conformity to ASTM standards.

4. Water-reducing admixture. Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations and conformity to ASTM standards.

5. High-range water-reducing admixture (superplasticizer). Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations, retarding effect, slump range and conformity to ASTM standards. Identify proposed locations of use.

6. Concrete mixes: For each formulation of concrete proposed for use, submit constituent quantities per cubic yard, water-cementitious ratio, air content, concrete slump, type and manufacturer of cement. See also the required test reports and certifications listed below. Provide either (a) or (b) below for each mix design proposed.

   a. Compression test results for proposed mixes. Include standard deviation data for each proposed concrete mix based on statistical records.

   b. The curve of water-cementitious materials ratio versus concrete cylinder strength based on laboratory tests. Provide average cylinder strength test results at 7, 14, and 28 days for each mix.

7. Sheet curing material. Product data including catalogue cut, technical data and conformity to ASTM C171 standard.

8. Liquid curing compound. Product data including catalogue cut, technical data, storage requirements, product life, application rate and conformity to ASTM C309 standard. Identify proposed locations of use.

B. Samples

1. Fine and coarse aggregates if requested by the ENGINEER.

C. Quality Assurance/Control

1. Test Reports

   a. Fine aggregates for conformity with ASTM C33 - sieve analysis, physical properties, and deleterious substance.

   b. Coarse aggregates for conformity with ASTM C33 - sieve analysis, physical properties, and deleterious substances.

   c. Cements for conformity with ASTM C150 - chemical analysis and physical properties for each type.

d. Pozzolans for conformity with ASTM C618 - chemical analysis and physical properties.

e. Proposed concrete mixes - compressive strength, slump, and air content.

2. Certifications

a. Certify admixtures used in the same concrete mix are compatible with each other and the aggregates.

b. Certify that the CONTRACTOR is not associated with the independent testing laboratory proposed for use by the CONTRACTOR nor does the CONTRACTOR or officers of the CONTRACTOR's organization have a beneficial interest in the laboratory.

3. Work Plans

a. Hot weather concreting.

1.04 QUALITY ASSURANCE

A. Reinforced concrete shall comply with ACI 318, ACI 350 and other stated requirements, codes and standards. The most stringent requirement of the codes, standards and this Section shall apply when conflicts exist.

B. Independent testing laboratory shall meet the requirements of ASTM E329 and ASTM C1077 and be acceptable to the ENGINEER. Laboratories affiliated with the CONTRACTOR or in which the CONTRACTOR or officers of the CONTRACTOR's organization have a beneficial interest are not acceptable.

C. Only one source of cement and aggregates shall be used on any one structure. Concrete shall be uniform in color and appearance.

D. Concrete meeting: A meeting will be held between the ENGINEER and the CONTRACTOR to review the detailed requirements of the CONTRACTOR's proposed concrete design mixes and to determine the procedures for producing proper concrete construction. The meeting shall be held no later than 30 days prior to the first concrete placement. All parties involved in concrete work shall attend the conference including the following:

1. CONTRACTOR’s superintendent and/or project manager;

2. CONTRACTOR's concrete supplier testing laboratory representative (optional as determined by the ENGINEER);

3. Concrete subcontractor;

4. Reinforcing steel subcontractor and detailer;

5. Concrete supplier;

6. Admixture manufacturer's representative(s).

Meeting discussion topics will include, but not be limited to: methods of hot and cold weather concrete placement, concrete placement during rainy weather, underwater concrete placement of seal slab, cleanliness of rebar before placement of concrete, concrete mix design(s) and source of concrete materials, concrete shrinkage for key structures, waterstop placement, use of admixtures, concrete curing methods, concrete finishes (Section 03350), grouts (Section 03600), and rebar submittals.

E. If, during the progress of the work, it is impossible to secure concrete of the required workability and strength with the materials being furnished, the ENGINEER may order such changes in proportions or materials, or both, as may be necessary to secure the desired properties. All changes so ordered shall be made at no additional cost to the OWNER.

F. If, during the progress of the work, the materials from the sources originally accepted change in characteristics, the CONTRACTOR shall, at no additional cost to the OWNER, make new acceptance tests of aggregates and establish new design mixes.

G. Field testing and inspection services and related laboratory tests required will be provided by the ENGINEER. The cost of such work, except as specifically stated otherwise, will be paid by the OWNER. The CONTRACTOR shall be responsible for the cleanup and disposal of testing waste at the project site. The following items will be tested by the ENGINEER to verify conformity with this Specification Section.

1. Concrete placements - compressive strength (cylinders), compressive strength (cores), temperature, slump, and air content.

2. Other materials or products that may come under question.

H. All materials incorporated in the work shall conform to accepted samples and test reports.

1.05 DELIVERY, STORAGE AND HANDLING

A. Cement: Store in weathertight buildings, bins or silos to provide protection from dampness and contamination and to minimize warehouse set.

B. Aggregate: Arrange and use stockpiles in bunkers or other physical structures to avoid excessive segregation or contamination with other materials or with other sizes of like aggregates. Build stockpiles in successive horizontal layers not exceeding 3-ft in thickness. Complete each layer before the next is started. Do not use frozen or partially frozen aggregate.

C. Sand: Arrange and use stockpiles in bunkers or other physical structures to avoid contamination. Allow sand to drain to a uniform moisture content before using. Do not use frozen or partially frozen aggregates.

D. Admixtures: Store in closed containers to avoid contamination, evaporation or damage. Provide suitable agitating equipment to assure uniform dispersion of ingredients in admixture solutions which tend to separate. Protect liquid admixtures from freezing and other temperature changes which could adversely affect their characteristics.

E. Pozzolan: Store in weathertight buildings, bins or silos to provide protection from dampness and contamination.

F. Sheet Curing Materials: Store in weathertight buildings or off the ground and under cover.

G. Liquid Curing Compounds: Store in closed containers.

PART 2 PRODUCTS

2.01 MATERIALS

A. General

1. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration required.

2. Like items of materials shall be the end products of one manufacturer in order to provide standardization for appearance, maintenance and manufacturer's service.

3. Materials shall comply with this Section and any applicable State or local requirements.

B. Cement: Domestic portland cement complying with ASTM C150. Air entraining cements shall not be used. Cement brand shall be subject to approval by the ENGINEER and one brand shall be used on any one structure. The following cement type(s) shall be used:

1. Class B Concrete - Type II with the equivalent alkalies, as defined in Table 2 of ASTM C150, limited to a maximum of a 0.60% (low-alkali cement).

2. Class D and Class E Concrete - Type II, low-alkali cement with fly ash resulting in C_3A being below 8 percent of total cementitious content.

C. Fine Aggregate: Washed inert natural sand conforming to the requirements of ASTM C33.

D. Coarse Aggregate: Well-graded crushed stone or washed gravel conforming to the requirements of ASTM C33. Grading requirements shall be as listed in ASTM C33 Table 2 for the specified coarse aggregate size number. Limits of Deleterious Substances and Physical Property Requirements shall be as listed in ASTM C33 Table 3 for severe weathering regions. Size numbers for the concrete mixes shall be as shown in Table 03300-1 herein.

E. Water: Potable water free from injurious amounts of oils, acids, alkalis, salts, organic matter, or other deleterious substances.

F. Admixtures: Admixtures shall be free of chlorides and alkalis (except for those attributable to water). When it is required to use more than one admixture in a concrete mix, the admixtures shall be from the same manufacturer. Admixtures shall be

compatible with the concrete mix including other admixtures and shall be suitable for use in contact with potable water after 30 days of concrete curing.

1. Air-Entraining Admixture: The admixture shall comply with ASTM C260. Proportioning and mixing shall be in accordance with manufacturer's recommendations.

2. Water-Reducing Agent: The admixture shall comply with ASTM C494, Type A. Proportioning and mixing shall be in accordance with manufacturer's recommendations.

3. High-Range Water-Reducer (Superplasticizer): The admixture shall comply with ASTM C494, Type F and shall result in non-segregating plasticized concrete with little bleeding and with the physical properties of low water/cement ratio concrete. The treated concrete shall be capable of maintaining its plastic state in excess of 2 hours. Proportioning and mixing shall be in accordance with manufacturer's recommendations.

4. Admixtures causing retarded or accelerated setting of concrete shall not be used without written approval from the ENGINEER. When allowed, the admixtures shall combine retarding or accelerating with water reducing or high range water reducing admixtures.

G. Pozzolan (Fly Ash). Pozzolan shall be Class C or Class F fly ash complying with ASTM C618 except the Loss on Ignition (LOI) shall be limited to 3 percent maximum.

H. Sheet Curing Materials. Waterproof paper, polyethylene film or white burlap-polyethylene sheeting all complying with ASTM C171.

I. Liquid Curing Compound. Liquid membrane-forming curing compound shall comply with the requirements of ASTM C309, Type 1-D (clear or translucent with fugitive dye) and shall contain no wax, paraffin, or oil.

2.02 MIXES

A. Measuring Materials

1. Concrete shall be composed of portland cement, fine aggregate, coarse aggregate, water and admixtures as specified and shall be produced by a plant acceptable to the ENGINEER. All constituents, including admixtures, shall be batched at the plant except a high-range water-reducer may also be added in the field.

2. Measure materials for batching concrete by weighing in conformity with and within the tolerances given in ASTM C94 and ACI 304R except as otherwise specified. Scales shall have been certified by the local Sealer of Weights and Measures within 1 year of use.

3. Measure the amount of free water in fine aggregates within 0.3 percent with a moisture meter. Compensate for varying moisture contents of fine aggregates. Record the number of gallons of water as-batched on printed batching tickets.

4. Admixtures shall be dispensed either manually using calibrated containers or measuring tanks, or by means of an automatic dispenser approved by the manufacturer of the specific admixture.

   a. Charge air-entraining and chemical admixtures into the mixer as a solution using an automatic dispenser or similar metering device.

   b. Inject multiple admixtures separately during the batching sequence.

B. Mix Design

1. Development of mix designs and testing shall be by an independent testing laboratory acceptable to the ENGINEER and engaged by the CONTRACTOR at no additional cost to the OWNER.

2. Select proportions of ingredients to meet the design strength and materials limits specified in Table 03300-1 and to produce placeable, durable concrete conforming to these specifications. Proportion ingredients to produce a homogenous mixture which will readily work into corners and angles of forms and around reinforcement without permitting materials to segregate or allowing excessive free water to collect on the surface.

3. The design mix shall be based on one of the following:

   a. Standard deviation shall be based on the modification factors for standard deviation tests contained in ACI 318.

   b. Trial mixtures developed by the design mix shall be based on standard deviation data of prior mixes with essentially the same proportions of the same constituents or, if such data is not available, be developed by a testing laboratory engaged by the CONTRACTOR and at no additional cost to the OWNER.

   The water content of the concrete mix, determined by laboratory testing, shall be based on a curve showing the relation between water cementitious ratio and 7 and 28 day compressive strengths of concrete made using the proposed materials. The curves shall be determined by four or more points, each representing an average value of at least three test specimens at each age. The curves shall have a range of values sufficient to yield the desired data, including the specified design strengths as modified below, without extrapolation. The water content of the concrete mixes to be used, as determined from the curve, shall correspond to strengths 16 percent greater than the specified design strengths. The resulting mix shall not conflict with the limiting values for maximum water cementitious ratio and net minimum cementitious content as specified in Table 03300-1. Acceptance of mixes based on standard deviation shall be based on the modification factors for standard deviation tests contained in ACI318.

4. Entrained air, as measured by ASTM C231, shall be as shown in Table 03300-1. If the air-entraining agent proposed for use in the mix requires testing methods other than ASTM C231 to accurately determine air content, make special note of this requirement in the admixture submittal.

5. Slump of the concrete as measured by ASTM C143, shall be as shown in Table 03300-1. If a high-range water-reducer (superplasticizer) is used, the slump indicated shall be that measured before superplasticizer is added. Plasticized concrete shall have a slump ranging from 7 to 10-in.

6. Proportion admixtures according to the manufacturer's recommendations. Two or more admixtures specified may be used in the same mix provided that the admixtures in combination retain full efficiency and have no deleterious effect on the concrete or on the properties of each other.

TABLE 03300-1

CONCRETE MIX REQUIREMENTS

Class	Design Strength (1)	Cement (2)	Fine Aggregate (2)	Coarse Aggregate (3)	Minimum Cementitious Content (4)
B	3000	C150 Type II	C33	57	480
D	4000	C150 Type II	C33	67	590
E	5000	C150 Type II	C33	57	650

Class	W/C Ratio (5)	Fly Ash	AE Range (6)(7)	WR (8)	HRWR (9)	Slump Range Inches
B	0.54 max.	15-20% (10)	3.5 to 5	Yes	No	1-3
D	0.44 max.	15-20% (10)	3.5 to 5	Yes	Yes	3-5
E	0.40 max	15-20% (10)	3.5 to 5	Yes	No	3-5

NOTES:
(1) Minimum compressive strength in psi at 28 days
(2) ASTM designation
(3) Size Number in ASTM C33
(4) Cementitious content in lbs/cu yd
(5) W/C is Water-Cementitious ratio by weight
(6) AE is percent air-entrainment
(7) AE for concrete slabs may be less than 3 percent
(8) WR is water-reducer admixture
(9) HRWR is high-range water-reducer admixture
(10) Percentage of the total cement plus pozzolan content, by weight

C. Mixing and Transporting

1. Provide ready-mixed concrete produced by equipment complying with ACI 318 and ASTM C94 and produced by a plant certified by the NRMCA. Do not hand-mix. All truck mixers shall carry a rating plate conforming to TMMB 100. Clean each transit mix truck drum and reverse drum rotation before the truck proceeds under the batching plant. Equip each transit-mix truck with a continuous, nonreversible, revolution counter showing the number of revolutions.

2. Ready-mix concrete shall be transported to the site in watertight agitator or mixer trucks loaded not in excess of their rated capacities as stated on the name plate.

3. Keep the water tank valve on each transit truck locked at all times. Any addition of water must be approved by the ENGINEER. Added water shall be incorporated by additional mixing of at least 35 revolutions. All added water shall be metered and the amount of water added shall be shown on each delivery ticket.

4. Comply with ACI 318, ACI 304R and ASTM C94 for all central plant and rolling stock equipment and methods.

5. Select equipment of size and design to ensure continuous flow of concrete at the delivery end. Metal or metal-lined non-aluminum discharge chutes shall be used and shall have slopes not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20-ft long and chutes not meeting slope requirements may be used if concrete is discharged into a hopper before distribution.

6. Do not retemper (mixing with or without additional cement, aggregate, or water) concrete or mortar which has partially hardened.

7. Handle concrete from mixer to placement providing concrete of specified quality in the placement area and not exceeding the maximum time interval specified in Paragraph 2.02 C.9. Dispatch trucks from the batching plant so they arrive at the work site just before the concrete is required, thus avoiding excessive mixing of concrete.

8. Furnish a delivery ticket for ready mixed concrete to the ENGINEER as each truck arrives. Each ticket shall provide a printed record of the weight of cement and each aggregate as batched individually. Use the type of indicator that returns for zero punch or returns to zero after a batch is discharged. Clearly indicate the weight of fine and coarse aggregate, cement and water in each batch, the quantity delivered, the time any water is added, and the numerical sequence of the delivery. Show the time of day batched and time of discharge from the truck. Indicate the number of revolutions of the truck mixer. Annotate each delivery ticket with the structure and component where the concrete was placed.

9. Temperature and Mixing Time Control

a. In cold weather, maintain the as-mixed temperature of the concrete and concrete temperatures at the time of placement in the forms as indicated in Table 03300-3.

b. If water or aggregate has been heated, combine water with aggregate in the mixer before cement is added. Do not add cement to mixtures of water and aggregate when the temperature of the mixture is greater than 90 degrees F.

c. In hot weather, cool ingredients before mixing to maintain temperature of the concrete below the maximum placing temperature of 90 degrees F. Well-crushed ice may be substituted for all or part of the mixing water.

d. The maximum time interval between the addition of mixing water and/or cement to the batch and the placing of concrete in the forms shall not exceed the values shown in Table 03300-2.

TABLE 03300-2

MAXIMUM TIME TO DISCHARGE OF CONCRETE

Air or Concrete Temperature (whichever is higher)	Maximum Time
Above 90 Degree F (32 Degree C) (Note 1)	60 minutes
80 to 90 Degree F (27 to 32 Degree C)	60 minutes
70 to 79 Degree F (21 to 26 Degree C)	60 minutes
40 to 69 Degree F (5 to 20 Degree C)	90 minutes

Note 1: In air temperatures above 90 degrees F, the temperature of concrete being placed shall not exceed 90 degrees F.

If an approved high-range water-reducer (superplasticizer) is used to produce plasticized concrete, the maximum time interval shall not exceed 90 minutes.

D. Concrete Appearance

1. Concrete mix showing either poor cohesion or poor coating of the coarse aggregate with paste shall be remixed. If this does not correct the condition, the concrete shall be rejected. If the slump is within the allowable limit, but excessive bleeding, poor workability, or poor finishability are observed, changes in the concrete mix shall be obtained only by adjusting one or more of the following:

a. The gradation of aggregate.

b. The proportion of fine and coarse aggregate.

c. The percentage of entrained air, within the allowable limits.

2. Concrete for the work shall provide a homogeneous structure which, when hardened, will have the required strength, durability and appearance. Mixtures and workmanship shall be such that concrete surfaces, when exposed, will require no finishing. When concrete surfaces are stripped, the concrete, when viewed in good lighting from 10-ft away, shall be pleasing in appearance, and at 20-ft shall show no visible defects.

2.03 SOURCE QUALITY CONTROL

A. Compression Tests: Provide testing of the proposed concrete mix or mixes to demonstrate compliance with the specified design strength requirements in conformity with Section 2.02B.

PART 3 EXECUTION

3.01 INSTALLATION

A. Placing

1. The class of concrete shall be per Table 03300-3 or as shown on the Drawings. Place all concrete in accordance with the recommendations contained in ACI304R. Concrete shall not be placed when rainfall (or forecast rainfall) is sufficient to cause damage to the work. Concrete placement in progress shall be stopped when rainfall occurs unless the concrete is completely protected from rainfall damage. Verify that all formwork completely encloses concrete to be placed and is securely braced prior to concrete placement. Remove ice, excess water, dirt and other foreign materials from forms. Confirm that reinforcement and other embedded items are securely in place. Have competent workers at the location of the placement. Workers shall be able to ensure that reinforcing steel and embedded items remain in designated locations while concrete is being placed. Sprinkle semi-porous subgrades or forms to eliminate suction of water from the mix. Seal extremely porous subgrades in an approved manner.

2. Deposit concrete as near its final position as possible to avoid segregation due to rehandling or flowing. Place concrete continuously at a rate which ensures the concrete is being integrated with fresh plastic concrete. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials or on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within the section. If the section cannot be placed continuously, place construction joints as specified or as approved.

3. Pumping of concrete will be permitted. Use a mix design and aggregate sizes suitable for pumping and submit for approval. Do not use pipelines made of aluminum or aluminum alloy. When concrete is pumped, slump will be determined at point of truck discharge and air content will be determined at point of placement.

4. Remove temporary spreaders from forms when the spreader is no longer needed. Temporary spreaders may remain embedded in concrete only if it is a non-water containing structure, when made of galvanized metal or concrete, and only if prior approval from the ENGINEER has been obtained.

5. Do not place concrete for supported elements until concrete previously placed in the supporting element (slabs and/or walls) has reached adequate strength.

6. Where surface mortar is to form the base of a finish, especially surfaces designated to be painted, work coarse aggregate back from forms with a suitable tool to bring the full surface of the mortar against the form. Prevent the formation of excessive surface voids.

7. Slabs

   a. After suitable bulkheads, screeds and jointing materials have been positioned, the concrete shall be placed continuously between construction joints beginning at a bulkhead, edge form, or corner. Each batch shall be placed into the edge of the previously placed concrete to avoid stone pockets and segregation.

   b. Avoid delays in casting. If there is a delay in casting, the concrete placed after the delay shall be thoroughly spaded and consolidated at the edge of that previously placed to avoid cold joints. Bring concrete to correct level and strike off with a straightedge. Use bullfloats or darbies to smooth the surface, leaving it free of humps or hollows.

   c. Where slabs are to be placed integrally with the walls below them, place the walls and compact as specified. Allow 1 hour to pass between placement of the wall and the overlying slab to permit consolidation of the wall concrete. Keep the top surface of the wall moist so as to prevent cold joints.

8. Formed Concrete

   a. Place concrete in forms using tremie tubes and taking care to prevent segregation. Maintain bottom of tremie tubes in contact with the concrete already placed. Do not permit concrete to drop freely more than 4-ft. Place concrete for walls in 12 to 24-in lifts, keeping the surface horizontal. If plasticized concrete is used, the maximum lift thickness may be increased to 4-ft and the maximum free fall of concrete shall not exceed 4-ft.

B. Compacting

1. Consolidate concrete by vibration, puddling, spading, rodding or forking so that concrete is thoroughly worked around reinforcement, embedded items and openings and into corners of forms. Puddling, spading, etc, shall be continuously performed along with vibration of the placement to eliminate air or stone pockets which may cause honeycombing, pitting or planes of weakness.

2. Compact all concrete with mechanical vibrators. No concrete shall be ordered until sufficient approved vibrators (including standby units in working order) are on the job.

3. Use mechanical vibrators having a minimum frequency of 8000 vibrations per minute. Insert and withdraw vibrators vertically at points from 18 to 30-in apart. At each insertion, vibrate sufficiently to consolidate concrete, generally from 5 to 15 seconds. Do not segregate concrete through overvibration. Keep a spare vibrator on the site during concrete placing operations.

4. Concrete Slabs: Concrete for slabs less than 8-in thick shall be consolidated with vibrating screeds; slabs 8-in and thicker shall be compacted with internal vibrators and (optionally) with vibrating screeds. Vibrators shall always be placed into concrete vertically and shall not be laid horizontally or laid over.

5. Walls and Columns: Use internal vibrators (rather than form vibrators) unless otherwise approved by the ENGINEER. In general, for each vibrator needed to melt down the batch at the point of discharge, one or more additional vibrators must be used to densify, homogenize and perfect the surface. Insert vibrators vertically at regular intervals, through the fresh concrete and slightly into the previous lift, if any.

6. Amount of Vibration: Use vibrators to consolidate properly placed concrete. Do not use vibrators to move or transport concrete in the forms. Continue vibration until:

   a. Frequency of vibrator returns to normal.

   b. Surface appears liquefied, flattened and glistening.

   c. Trapped air ceases to rise.

   d. Coarse aggregate has blended into surface, but has not disappeared.

C. Curing

1. Protect all concrete work against injury from the elements and defacements of any nature during construction operations.

2. Curing Methods

   a. Curing Methods for Concrete Surfaces: Cure concrete to retain moisture and maintain a temperature of at least 50 degrees F at the concrete surface for a minimum of 7 days after placement. Use the following curing methods as specified:

      1) Water Curing: Keep entire concrete surface wet by ponding, continuous sprinkling or covered with saturated burlap. Begin wet cure as soon as concrete attains an initial set and maintain wet cure 24 hours a day.

2) Sheet Material Curing: Cover entire surface with sheet material. Securely anchor sheeting to prevent wind and air from lifting the sheeting or entrapping air under the sheet. Place and secure sheet as soon as initial concrete set occurs.

3) Liquid Membrane Curing: Apply over the entire concrete surface except for surfaces to receive additional concrete. Curing compound shall NOT be placed on any concrete surface where additional concrete is to be placed, where concrete sealers or surface coatings are to be used, or where the concrete finish requires an integral floor product. Curing compound shall be applied as soon as the free water on the surface has disappeared and no water sheen is visible, but not after the concrete is dry or when the curing compound can be absorbed into the concrete. Application shall be in compliance with the manufacturer's recommendations.

b. Specified Applications of Curing Methods.

1) Slabs for Water Containment Structures: Water curing only.

2) Slabs on Grade and Footings (not used to contain water): Water curing, sheet material curing or liquid membrane curing.

3) Structural Slabs (other than water containment): Water curing or liquid membrane curing.

4) Horizontal Surfaces which will Receive Additional Concrete, Coatings, Grout or Other Material that Requires Bond to the substrate: Water curing.

5) Formed Surfaces: None if nonabsorbent forms are left in place 7 days. Water cure if absorbent forms are used. Sheet cured or liquid membrane cured if forms are removed prior to 7 days. Exposed horizontal surfaces of formed walls shall be water cured for 7 days or until next placement of concrete is made.

6) Concrete Joints: Water cured or sheet material cured.

3. Finished surfaces and slabs shall be protected from the direct rays of the sun to prevent checking and crazing.

D. Cold Weather Concreting:

1. "Cold weather" is defined as a period when for more than 3 successive days, the average daily outdoor temperature drops below 40 degrees F. Calculate average daily temperature as the average of the highest and the lowest temperature during the period from midnight to midnight.

2. Cold weather concreting shall conform to ACI 306.1 and the additional requirements specified herein. Temperatures at the concrete placement shall be recorded at 12 hour intervals (minimum).

3. The CONTRACTOR shall discuss a cold weather work plan with the ENGINEER. The discussion shall encompass the methods and procedures proposed for use during cold weather including the production, transportation, placement, protection, curing and temperature monitoring of the concrete. The procedures to be implemented upon abrupt changes in weather conditions or equipment failures shall also be discussed. Cold weather concreting shall not begin until the work plan is acceptable to the ENGINEER.

4. The minimum temperature of concrete immediately after placement and during the protection period shall be as indicated in Table 3. The temperature of the concrete in place and during the protection period shall not exceed these values by more than 20 degrees F. Prevent overheating and non-uniform heating of the concrete.

TABLE 03300-3

Concrete Temperatures

	Minimum Dimension of Section	
	< 12-in	12 to 36-in
Min. conc temp:	55 Degree F	50 Degree F

5. Protect concrete during periods of cold weather to provide continuous warm, moist curing (with supplementary heat when required) for a total of at least 350 degree-days of curing.

   a. Degree-days are defined as the total number of 24 hour periods multiplied by the weighted average daily air temperature at the surface of the concrete (e.g.: 5 days at an average 70 degrees F = 350 degree-days).

   b. To calculate the weighted average daily air temperature, sum hourly measurements of the air temperature in the shade at the surface of the concrete taking any measurement less than 50 degrees F as 0 degrees F. Divide the sum thus calculated by 24 to obtain the weighted average temperature for that day.

6. Do not use salt, manure or other chemicals for protection.

7. At the end of the protection period, allow the concrete to cool gradually to the ambient temperature. If water curing has been used, do not expose concrete to temperatures below those shown in Table 3 until at least 24 hours after water curing has been terminated and air dry concrete for at least 3 days prior to first exposure to freezing temperatures.

8. During periods not defined as cold weather, but when freezing temperatures are expected or occur, protect concrete surfaces from freezing for the first 24 hours after placing.

E. Hot Weather Concreting

1. "Hot weather" is defined as any combination of high air temperatures, low relative humidity and wind velocity which produces a rate of evaporation estimated in accordance with ACI 305R, approaching or exceeding 0.2 lbs/sqft/hr.

2. Concrete placed during hot weather, shall be batched, delivered, placed, cured and protected in compliance with the recommendations of ACI 305R and the additional requirements specified herein.

a. Temperature of concrete being placed shall not exceed 90 degrees F and every effort shall be made to maintain a uniform concrete mix temperature below this level. The temperature of the concrete shall be such that it will cause no difficulties from loss of slump, flash set or cold joints.

b. Promptly deliver concrete to the site and promptly place the concrete upon its arrival at the site, not exceeding the maximum time interval specified in Paragraph 3.02I.4. Provide vibration immediately after placement.

c. The ENGINEER may direct the CONTRACTOR to immediately cover plastic concrete with sheet curing material.

3. The CONTRACTOR shall discuss with the ENGINEER a work plan describing the methods and procedures proposed to use for concrete placement and curing during hot weather periods. Hot weather concreting shall not begin until the work plan is acceptable to the ENGINEER.

F. Removal of Forms

1. Form and shoring removal shall conform to the requirements specified in Section 03100.

3.02 FIELD QUALITY CONTROL

A. The placing and curing of concrete shall be subject to the inspection of the Special Inspector at all times. The CONTRACTOR shall advise the Special Inspector of his/her readiness to proceed at least 2 working days prior to each concrete placement. The Special Inspector will inspect the preparations for concreting including the preparation of previously placed concrete, the reinforcing steel and the alignment, cleanliness and tightness of formwork. No placement shall be made without the inspection and acceptance of the Special Inspector.

B. Sets of field control cylinder specimens will be taken by the ENGINEER (or Inspector) during the progress of the work, in compliance with ASTM C31. The number of sets of

concrete test cylinders taken of each class of concrete placed each day shall not be less than one set per day, nor less than one set for each 150 cu yds of concrete nor less than one set for each 5,000 sq ft of surface area for slabs or walls.

1. A "set" of test cylinders consists of five cylinders: one to be tested at 7 days and two to be tested and their strengths averaged at 28 days. The fourth and fifth cylinders may be used for a special test at 3 days or to verify strength after 28 days if 28 day test results are low. Compressive strength tests shall comply with ASTM C39.

2. When the average 28 day compressive strength of the cylinders in any set falls below the specified design strength or below proportional minimum 7 day strengths (where proper relation between seven and 28 day strengths have been established by tests), proportions, water content, or temperature conditions shall be changed by the CONTRACTOR to achieve the required strengths.

C. The CONTRACTOR shall cooperate in the making of tests by allowing free access to the work for the selection of samples, providing an insulated and closed, wood or metal curing box for specimens, affording protection to the specimens against injury or loss through the CONTRACTOR's operations and furnish material and labor required for the purpose of taking concrete cylinder samples. All shipping of specimens will be paid for by the OWNER. The cleanup and disposal of test waste shall be the responsibility of the CONTRACTOR.

D. Slump tests will be made in the field by the Special Inspector immediately prior to placing the concrete. Such tests shall be made in accordance with ASTM C143. Slump test shall be taken at point of truck discharge for each set of test cylinders defined above. If the slump is outside the specified range, the concrete shall be rejected.

E. Air Content: Test for air content shall be made by the Special Inspector on fresh concrete samples. Air content test shall be taken at point of placement for each set of test cylinders defined above. Air content for concrete made of ordinary aggregates having low absorption shall be made in compliance with either the pressure method complying with ASTM C231 or by the volumetric method complying with ASTM C173.

F. The ENGINEER may have cores taken from any questionable area in the concrete work such as construction joints and other locations as required for determination of concrete quality. The results of tests on such cores shall be the basis for acceptance, rejection or determining the continuation of concrete work. The right of the ENGINEER to take such cores shall not be construed as creating any obligation to take such cores, and not exercising this right to do so shall not relieve the CONTRACTOR from meeting the requirements of these Specifications.

G. The CONTRACTOR shall cooperate in obtaining cores by allowing free access to the work and permitting the use of ladders, scaffolding and such incidental equipment as may be required. The CONTRACTOR shall repair all core holes with non-shrink grout as specified in Section 03600. The work of cutting, testing, and repairing the cores will be at the expense of the CONTRACTOR if defective work is uncovered. If no defective work is found, such cost will be at the expense of the OWNER.

3.03 ADJUSTING

A. Failure to Meet Requirements

1. Should the strengths shown by the test specimens made and tested in compliance with the previous provisions fall below the values given in Table 03300-1, the ENGINEER shall have the right to require changes in the mix design to apply to the remainder of the work. Furthermore, the ENGINEER shall have the right to require additional curing on those portions of the structure represented by the test specimens which failed. The cost of such mix design changes and additional curing shall be at no additional cost to the OWNER. In the event that such additional curing does not give the strength required, as evidenced by core and/or load tests, the ENGINEER shall have the right to require strengthening or replacement of those portions of the structure which fail to develop the required strength. The cost of all such core borings and/or load tests and any strengthening or concrete replacement required because strengths of test specimens are below that specified, shall be entirely at no additional cost to the OWNER. In such cases of failure to meet strength requirements the CONTRACTOR and ENGINEER shall confer to determine what adjustment, if any, can be made in compliance with Sections titled "Strength" and "Failure to Meet Strength Requirements" of ASTM C94. The "purchaser" referred to in ASTM C94 is the CONTRACTOR in this Section.

2. When the tests on control specimens of concrete fall below the specified strength, the ENGINEER will permit check tests for strengths to be made by means of typical cores drilled from the structure in compliance with ASTM C42 and C39. In the case of cores not indicating adequate strength, the ENGINEER, in addition to other recourses, may require, at no additional cost to the OWNER, load tests on any one of the slabs, beams, piles, caps, and columns in which such concrete was used. Tests need not be made until concrete has aged 60 days.

3. Should the 28-day strength of test cylinders fall below 60 percent of the required minimum 28 day strength, the concrete shall be rejected and shall be removed and replaced.

B. Patching and Repairs

1. It is the intent of these Specifications to require quality work including forming, mixture and placement of concrete and curing so completed concrete surfaces will require no patching or repairs.

2. As soon as the forms have been stripped and the concrete surfaces exposed, remove fins and other projections; fill recesses left by the removal of form ties; and repair surface defects which do not impair structural strength. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete.

3. Immediately after removal of forms, remove tie cones and metal portions of ties. Promptly fill holes upon stripping as follows: Moisten the hole with water, followed by a 1/16-in brush coat of neat cement slurry mixed to the consistency of a heavy paste. Immediately plug the hole with a 1 to 1.5 mixture of cement and concrete sand mixed slightly damp to the touch (just short of "balling").

Hammer the grout into the hole until dense, and an excess of paste appears on the surface in the form of a spiderweb. Trowel smooth with heavy pressure. Avoid burnishing.

4. When filling tie cone holes and patching or repairing exposed surfaces, the same source of cement and sand as used in the parent concrete shall be employed. Adjust color if necessary by addition of proper amounts of white cement. Rub lightly with a fine Carborundum stone at an age of 1 to 5 days if necessary to bring the surface down with the parent concrete. Do not damage or stain the surrounding parent concrete. Wash thoroughly to remove all rubbed matter.

5. Defective concrete as determined by the ENGINEER shall be repaired as specified in Section 03922 at no additional cost to the OWNER.

3.04 SCHEDULE

A. The following (Table 03300-3) are the general applications for the various concrete classes and design strengths:

TABLE 03300-3
CONCRETE SCHEDULE

Class	Design Strength (psi)	Description
B	3,000	Concrete fill, duct and pipe encasements, thrust blocks, concrete overlay slabs
D	4,000	Pavements, sidewalk, and curb
E	5,000	Walls, footings, slabs on grade, suspended slab and beam systems, and all other structural concrete

END OF SECTION

SECTION 03305

ELECTRICAL AND INSTRUMENTATION DUCT ENCASEMENT CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Electrical and instrumentation duct (conduit or raceways) encasement concrete.

B. Related Sections. See Related Sections for additional requirements applicable to this Section (typical).

1. Section 03100 – Concrete Forms and Accessories.

2. Section 03200 – Concrete Reinforcement.

3. Section 03250 – Concrete Joints and Joint Accessories.

4. Section 03300 – Cast-in-Place Concrete.

5. Section 03922 – Concrete Repair.

6. Section 16600 – Underground Systems.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cement, aggregate and all other concrete components shall be as specified in Section 03300 for Class B concrete except that aggregate size shall not exceed 3/8-in. Add a minimum of 6 pounds of red coloring pigment per cubic yard of concrete.

B. Encasement concrete reinforcement shall be in accordance with Section 03200. Submission of reinforcing steel mill certifications is not required.

PART 3 EXECUTION

3.01 INSTALLATION

A. Concrete shall conform to the requirements of Section 03300 and as specified herein. The ENGINEER may direct the Special Inspector to test the concrete in accordance with the field quality control measures described in Section 03300, with the modification of one set of cylinders every 150 cubic yards of concrete placed, and as determined by the ENGINEER. The CONTRACTOR shall assist in taking samples for such testing.

B. Forms, where required by above grade encasement, shall comply with the requirements of Specification Section 03100.

C. All duct encasement concrete placements shall be continuous between manholes or handholes and between manholes or handholes and structures.

D. Where duct encasements pass through concrete building walls or concrete electrical structures (e.g. manholes, handholes, etc.), concrete encasements shall be extended through and finished flush with the inside surfaces unless otherwise noted.

E. Debris, rocks, standing water, and soil shall be kept off and out from between ducts before concrete encasement. Rebar shall be kept free of mud and shall be properly supported above ground contact.

F. Reinforce encasements as and where indicated on the Drawings.

G. Refer to Section 16600 and the Drawings for additional installation requirements.

END OF SECTION

SECTION 03350

CONCRETE FINISHING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Concrete finishing and types of finishes

B. Related Sections. See Related Sections for additional requirements applicable to this Section (typical).

1. Section 03100 – Concrete Forms and Accessories.

2. Section 03200 – Concrete Reinforcement.

3. Section 03300 – Cast-in-Place Concrete.

4. Section 03600 – Grout.

5. Section 03922 – Concrete Repair.

6. Section 07100 – Bituminous Damp Proofing.

7. Section 09902 – Painting.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM C33 - Standard Specification for Concrete Aggregates.

2. ASTM C309 – Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.03 SUBMITTALS

A. Product Data: Submit to the ENGINEER, in accordance with Section 01300, product data showing materials of construction and details of installation for:

1. Concrete sealer: Submit confirmation that the sealer is compatible with other finishes that will be applied to the surfaces.

1.04 QUALITY ASSURANCE

A. Pre-Installation Meetings

1. The CONTRACTOR shall make available at no additional cost to the OWNER, upon 72 hours notification, the services of a qualified field representative of the manufacturer of curing compound or sealer to instruct the user on the proper application of the product under prevailing job conditions.

B. For concrete which will receive additional applied finishes or materials, the surface finish specified is required for the proper application of the specified manufacturer's products. Where alternate products are approved for use, determine if changes in finish are required and provide the proper finish to receive these products.

C. Changes in finish made to accommodate products different from those specified shall be performed at no additional cost to the OWNER. Submit the proposed new finish and their construction methods to the ENGINEER for approval.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 PREPARATION

A. Formed Surfaces

1. Forms shall not be removed before the requirements of Section 03100 have been satisfied.

2. Do not damage edges or obliterate the lines of chamfers, rustications or corners when removing the forms or performing any other work adjacent thereto.

3. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete. Surfaces to remain exposed showing white surface deposits (calcium carbonate, etc.) shall be cleaned of such deposits until a uniform gray color is achieved.

4. Cure concrete as specified in Section 03300, unless otherwise noted by the ENGINEER. Modify curing methods to be compatible with the written instructions of special concrete coating manufacturers.

B. Floors and Slabs

1. Immediately after floor or slab placement, screed concrete to the grades and surfaces shown on the Drawings. Complete screeding before any excess moisture or bleeding water is present on the surface.

a. Level floors and slabs to a tolerance of plus or minus 1/8-in when checked with a 10-ft straightedge placed anywhere on the slab in any direction.

b. Pitch floors uniformly toward low points, sumps, or drains and as shown on the Drawings, such that there are no low spots left undrained.

c. At dished floor drains, depress drain inlet one inch, and taper the one inch depression over a two foot radius, unless indicated otherwise.

d. Failure to meet either of the above requirements shall be cause for removal, grinding, or other correction, as directed by the ENGINEER.

2. Immediately after final screeding, evenly sprinkle the surface with a dry cement/sand shake in the proportion of two sacks of portland cement to 350 lbs of coarse natural concrete sand at the rate of approximately 500 lbs /1,000 sq ft of floor. Do not sprinkle neat, dry cement on the surface.

a. The application of the cement/sand shake may be eliminated at the discretion of the ENGINEER, if the base slab concrete exhibits adequate fattiness and homogeneity and the need is not indicated.

3. Immediately after sprinkling, float the surface, filling all surface voids and slightly embedding the coarse aggregate.

4. After floating, defer additional finishing operations until the concrete has stiffened sufficiently to sustain foot pressure with an indentation of not more than 1/4-in.

5. After all bleed water and excess moisture has left the surface, edge and joint concrete as specified or shown.

a. Edge concrete sidewalks, driveways, and steps.

b. Do not edge floor slabs that will be covered with tile or carpet unless noted on the Drawings. Slab edges at joints may be lightly stoned after forms are stripped and before adjacent placements are made in such areas.

c. Place tooled joints using a straightedge at locations shown on the Drawings.

d. Where acceptable to the ENGINEER, saw-cut contraction joints with a power blade 4 to 12 hours after slab placement and finishing.

6. Water shall not be used to supplement hand or power troweling.

3.02 CONSTRUCTION

A. Rough-Form Finish

1. Immediately after stripping forms and before concrete has changed color, carefully remove all fins and projections. Clean surfaces of tie holes.

2. Promptly fill holes left by tie cones and repair defects as specified in Section 03100 and 03300.

B. Sacked Finish

1. Provide rough-form finish as specified. While the wall is still damp apply a thin coat of medium consistency neat cement slurry by means of bristle brushes to provide a bonding coat within all pits, air holes or blemishes in the parent concrete. Avoid coating large areas of the finished surfaces with the slurry at one time.

2. Before the slurry has dried or changed color, apply a dry (almost crumbly) grout consisting of 1 volume cement to 1-1/2 volumes of clean masonry sand having a fineness modulus of approximately 2.25 and complying with the gradation requirements of ASTM C144. Uniformly apply grout using damp (neither dripping nor dry) pads of coarse burlap approximately 6-in square used as a float. Scrub grout into the pits and air holes to provide a dense mortar in the imperfections to be patched.

3. Allow the mortar to partially harden for 1 or 2 hours depending upon the weather. If the air is hot and dry, keep the wall damp during this period using a fine, fog spray. When the grout has hardened sufficiently so it can be scraped from the surface with the edge of a steel trowel without damaging the grout in the small pits or holes, cut off all that can be removed with a trowel.

4. Allow the surface to dry thoroughly and rub it vigorously with clean dry burlap to completely remove any dried grout. No visible film of grout shall remain after this rubbing. The entire cleaning operation for any area must be completed the day it is started. Do not leave grout on surfaces overnight. Allow sufficient time for grout to dry after it has been cut off with the trowel so it can be wiped off clean with the burlap.

5. On the day following the repair of pits, air holes and blemishes, the surfaces shall again be wiped off clean with dry, used pieces of burlap containing old hardened mortar which will act as a mild abrasive. After this treatment, there shall be no built-up film remaining on the parent surface. If, however, such a film is present, a fine abrasive stone shall be used to remove all such material without breaking through the surface film of the original concrete. Such scrubbing shall be light and sufficient only to remove excess material without changing the texture of the concrete.

6. Follow the final bagging or stoning operation with a thorough wash-down with stiff bristle brushes to remove extraneous materials from the surface. Spray the

wall with a fine fog spray periodically to maintain a continually damp condition for at least 3 days after the application of the repair grout.

C. Floated Finish

1. Float the concrete surface when the concrete has hardened sufficiently to support a power float without its digging into or disrupting the surface or a finisher and knee boards with no more than 1/4-in indentation. Start floating along walls and around columns, and in areas most exposed to sun or wind, and then move systematically across the surface leaving a matte finish.

2. Restore edging or jointing removed by floating. Maintain joint uniformity and line.

D. Steel Trowel Finish

1. Screed and float concrete as described in the preceding paragraphs. Immediately after surface moisture has disappeared, steel trowel to produce a smooth, impervious surface, free from trowel marks. Provide a minimum of two trowelings unless otherwise specified or noted. The final troweling shall produce a ringing sound from the trowel. Do not use dry cement or additional water in troweling.

2. For surfaces to receive the traffic-bearing or other special coatings, trowel the surface to meet the recommendations of the coating manufacturer for best performance of their products. Complete the first troweling keeping the trowel blade as flat against the surface as possible. Increase the pitch or tilt between the trowel blade and the surface for each successive troweling. Permit the concrete to harden slightly between successive trowelings.

3. Restore edging or jointing removed by floating. Maintain joint uniformity and line.

   a. Power floats shall be heavy, revolving disk type power compacting machines capable of providing a 200 lb compaction force distributed over a 24-in diameter disk.

   b. Troweling machines equipped with float (shoe) blades that are slipped over the trowel blades may be used for floating. However, floating with a troweling machine equipped with normal trowel blades will not be permitted. The use of any floating or troweling machine, which has a water attachment for wetting the concrete surface during finishing, will not be permitted.

   c. In lieu of power floating, small areas may be hand floated. While the concrete is still green, but sufficiently hardened to support a finisher and kneeboards with no more than 1/4-in indentation, float the surface to a true, even plane with no coarse aggregate visible. Use sufficient pressure on the floats to bring moisture to the surface.

E. Light Broomed Finish

1. Steel trowel finish the concrete, as specified above but omit the final troweling and finish the surface by drawing a fine-hair broom lightly across the surface. Broom in the same direction and parallel to expansion joints, or in the case of inclined slabs, perpendicular to the slope, or except as directed otherwise.

F. Broomed Finish

1. Steel trowel finish the concrete, as specified above but omit the final troweling. While the concrete is still soft enough, finish the surface with a stiff coarse fiber broom to produce the pattern and depth of scoring as approved by the ENGINEER.

2. Before placing grout, clean surface of debris, dust, and loose concrete, and prepare as indicated in Section 03600.

G. Power Machine Finish

1. In lieu of hand steel trowel finishing, an approved power machine for finishing concrete floors and slabs may be used in accordance with the directions of the machine manufacturer and as approved by the ENGINEER. Do not use a power machine until the concrete has attained the necessary set to allow finishing without introducing high and low spots in the slab. Hand steel trowel the areas of slabs not accessible to power equipment. Provide a final steel troweling done by hand over all areas.

3.03 APPROVAL OF FINISHES

A. All concrete surfaces, when finished, will be inspected by the ENGINEER.

B. Refinish or rework unsatisfactory finishes until approved by the ENGINEER, at no additional cost to the Owner.

C. After finishing horizontal surfaces, regardless of the finishing procedure specified, the concrete shall be cured in compliance with Section 03300 unless otherwise directed by the ENGINEER.

3.04 SCHEDULE OF FINISHES

A. Concrete shall be finished as specified either to remain as natural concrete or to receive an additional applied finish or material under another Section.

B. Concrete for the following conditions shall be finished as noted on the Drawings. If not noted on the Drawings concrete shall be finished as follows:

1. Concrete to receive dampproofing or waterproofing: Rough-form finish.

2. Concrete not exposed to view in the finished work, and not scheduled to receive an additional applied finish or material: Rough-form finish at vertical surfaces, consolidate and screed to grade at horizontal surfaces.

3. Exterior vertical concrete above grade exposed to view (and to 12-in below grade): Sacked finish.

4. Interior overhead and vertical concrete exposed to view except in water containment areas and except where scheduled to be painted: Sacked finish. See

5. Interior overhead and vertical concrete exposed to view and scheduled to be painted: Rough-form finish.

6. Vertical and overhead concrete in water containment areas: Sacked finish on surfaces exposed to view and extending to two feet below normal operating water level; rough-form finish on remainder of submerged areas.

7. Interior or exterior horizontal concrete exposed to view and not scheduled to receive an additional finish: steel-trowel finish.

8. Concrete for exterior walking surface and exterior stairs: Broomed finish perpendicular to direction of traffic.

9. Concrete for interior stairs: Light broomed finish, non-slip.

10. Concrete slabs on which process liquids flow or in contact with sludge: Steel trowel finish.

11. Concrete to receive an applied coating: Refer to manufacturer's written directions and on-site direction by manufacturer's representative.

12. Concrete tank bottoms to be covered with grout: Broomed finish. See Section 03600 for additional requirements.

END OF SECTION

SECTION 03600

GROUT

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Grout installation, and sampling and testing of materials and products by an independent testing laboratory acceptable to the ENGINEER but engaged by and at the expense of the CONTRACTOR.

B. Related Sections. See Related Sections for additional requirements applicable to this Section (typical).

1. Section 03100 – Concrete Forms and Accessories.

2. Section 03200 – Concrete Reinforcement.

3. Section 03250 – Concrete Joints and Joint Accessories.

4. Section 03300 – Cast-in-Place Concrete.

5. Section 03922 – Concrete Repair.

6. Section 05500 – Metal Fabrications.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. ASTM C531 - Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical Resistant Mortars, Grouts and Monolithic Surfacings and Polymer Concretes

2. ASTM C579 - Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts and Monolithic Surfacings and Polymer Concretes

3. ASTM C827 - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures

4. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, shop drawings and product data showing materials of construction and details of installation for:

1. Commercially manufactured nonshrink cementitous grout. The submittal shall include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to required ASTM standards and Material Safety Data Sheet.

2. Commercially manufactured nonshrink epoxy grout. The submittal shall include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to required ASTM standards and Material Safety Data Sheet.

3. Cement grout. The submittal shall include the type and brand of the cement, the gradation of the fine aggregate, product data on any proposed admixtures and the proposed mix of the grout.

4. Concrete grout. The submittal shall include data as required for concrete as delineated in Section 03300 and for fiber reinforcement as delineated in Section 03200. This includes the mix design, constituent quantities per cubic yard and the water/cement ratio.

B. Samples

1. Samples of commercially manufactured grout products when requested by the ENGINEER.

2. Aggregates for use in concrete grout when requested by the ENGINEER.

C. Laboratory Test Reports

1. Submit laboratory test data as required under Section 03300 for concrete to be used as concrete grout.

D. Qualifications

1. Submit documentation that manufacturers of commercially manufactured grout products have at least 10 years experience in the production and use of the proposed grouts which they will supply.

1.04 QUALITY ASSURANCE

A. Qualifications

1. Manufacturers of commercially manufactured grout products shall have a minimum of 10 years experience in the production and use of the type of grout proposed for the work.

2. The independent testing laboratory shall be a reputable laboratory, acceptable to the ENGINEER, having experience with testing procedures and associated equipment as required by this Section. Laboratories affiliated with the CONTRACTOR or in which the CONTRACTOR or its officers have a beneficial interest are not acceptable.

B. Pre-installation Conference

1. Well in advance of grouting, hold a pre-installation meeting to review the requirements for surface preparation, mixing, placing and curing procedures for each product proposed for use. Parties concerned with grouting shall be notified of the meeting at least 10 days prior to its scheduled date.

C. Services of Manufacturer's Representative

1. A qualified field technician of the nonshrink grout manufacturer, specifically trained in the installation of the products, shall attend the pre-installation conference and shall be present for the initial installation of each type of nonshrink grout. Additional services shall also be provided, as required, to correct installation problems.

D. Field Testing

1. All field testing and inspection services required will be provided by the OWNER. The CONTRACTOR shall assist in the sampling of materials and shall provide any ladders, platforms, etc, for access to the work. The methods of testing will comply with the applicable ASTM Standards.

2. The field testing of Concrete Grout will be as specified for concrete in Section 03300.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the jobsite in original, unopened packages, clearly labeled with the manufacturer's name, product identification, batch numbers and printed instructions.

B. Store materials in full compliance with the manufacturer's recommendations. Total storage time from date of manufacture to date of installation shall be limited to 6 months or the manufacturer's recommended storage time, whichever is less.

C. Material which becomes damp or otherwise unacceptable shall be immediately removed from the site and replaced with acceptable material at no additional expense to the OWNER.

D. Nonshrink cement-based grouts shall be delivered as preblended, prepackaged mixes requiring only the addition of water.

E. Nonshrink epoxy grouts shall be delivered as premeasured, prepackaged, three component systems requiring only blending as directed by the manufacturer.

1.06 DEFINITIONS

A. Nonshrink Grout: A commercially manufactured product that does not shrink in either the plastic or hardened state, is dimensionally stable in the hardened state and bonds to a clean base plate.

PART 2 PRODUCTS

2.01 GENERAL

A. The use of a manufacturer's name and product or catalog number is for the purpose of establishing the standard of quality desired.

B. Like materials shall be the products of one manufacturer or supplier in order to provide standardization of appearance.

2.02 MATERIALS

A. Nonshrink Cementitious Grout

1. Nonshrink cementitious grouts shall conform to ASTM C1107. Grouts shall be portland cement based, contain a pre-proportioned blend of selected aggregates and shrinkage compensating agents and require only the addition of water. Nonshrink cementitious grouts shall not contain expansive cement or metallic particles. The grouts shall exhibit no shrinkage when tested in conformity with ASTM C827.

a. General purpose nonshrink cementitious grout shall conform to the standards stated above and shall be SikaGrout 212 by Sika Corp.; Construction Grout by BASF Building Systems; NS Grout by The Euclid Chemical Co.; or equal.

b. Flowable (Precision) nonshrink cementitious grout shall conform to the standards stated above and shall be Masterflow 928 by BASF Building Systems; Hi-Flow Grout by the Euclid Chemical Co.; SikaGrout 212 by Sika Corp.; or equal.

B. Nonshrink Epoxy Grout

1. Nonshrink epoxy grout shall be pre-proportioned, prepackaged, three component, 100 percent solids system consisting of epoxy resin, hardener, and blended aggregate. It shall have a compressive strength of 10,000 psi in 7 days when tested in conformity with ASTM C579 and have a maximum thermal expansion of 30 x 10^{-6} when tested in conformity with ASTM C531. The grout shall be Masterflow 648 CP by BASF Building Systems; Sikadur 42 Grout-Pak by Sika Corp.; E^3-G by the Euclid Chemical Co. or equal.

C. Cement Grout

1. Cement grouts shall be a mixture of one part portland cement conforming to ASTM C150, Types I, II, or III and 1 to 2 parts sand conforming to ASTM C33 with sufficient water to place the grout. The water content shall be sufficient to impart workability to the grout but not to the degree that it will allow the grout to flow.

D. Concrete Grout

1. Concrete grout shall conform to the requirements of Section 03300 except as specified herein. It shall be proportioned with cement, coarse and fine aggregates, water, water reducer and air entraining agent to produce a mix having a nominal strength of 3000 psi at 28 days. Coarse aggregate size shall be 3/8-in maximum. Slump should not exceed 5-in.

2. Add synthetic reinforcing fibers as specified in Section 03200 to the concrete grout mix at the rate of 1.5 lbs of fibers per cubic yard of grout. Add fibers from the manufacturer's pre-measured bags and according to the manufacturer's recommendations to ensure complete dispersion of the fiber bundles as single monofilaments within the concrete grout

E. Water

1. Potable water, free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

PART 3 EXECUTION

3.01 PREPARATION

A. Placed grout where indicated or specified over cured concrete which has attained its specified design strength unless otherwise approved by the ENGINEER.

B. Concrete surfaces to receive grout shall be clean and sound; free of ice, frost, dirt, grease, oil, curing compounds, laitance and paints and free of all loose material or foreign matter which may affect the bond or performance of the grout.

C. Roughen concrete surfaces by chipping, sandblasting, or other mechanical means to bond the grout to the concrete. Remove loose or broken concrete. Irregular voids or projecting coarse aggregate need not be removed if they are sound, free of laitance and firmly embedded into the parent concrete.

1. Air compressors used to clean surfaces in contact with grout shall be the oilless type or equipped with an oil trap in the airline to prevent oil from being blown onto the surface.

D. Remove all loose rust, oil or other deleterious substances which may affect the bond or performance of the grout from metal embedments or bottom of baseplates prior to the installation of the grout.

E. Wash concrete surfaces clean and then kept moist for at least 24 hours prior to the placement of cementitious or cement grout. Saturation may be achieved by covering the concrete with saturated burlap bags, use of a soaker hose, flooding the surface, or other method acceptable to the ENGINEER. Upon completion of the 24 hour period, visible water shall be removed from the surface prior to grouting. The use of an adhesive bonding agent in lieu of surface saturation shall only be used when approved by the ENGINEER for each specific location of grout installation.

F. Epoxy-based grouts do not require the saturation of the concrete substrate. Surfaces in contact with epoxy grout shall be completely dry before grouting.

G. Provide forms for grout. Line or coat forms with release agents recommended by the grout manufacturer. Provide forms anchored in place and shored to resist the forces imposed by the grout and its placement.

1. Forms for all grout other than concrete grout shall be designed to allow the formation of a hydraulic head and shall have chamfer strips built into forms.

H. Level and align the structural or equipment bearing plates in accordance with the structural requirements and the recommendations of the equipment manufacturer.

I. Support equipment during alignment and installation of grout by shims, wedges, blocks or other approved means. The shims, wedges and blocking devices shall be prevented from bonding to the grout by appropriate bond breaking coatings and removed after grouting unless otherwise approved by the ENGINEER. Grout voids created by the removal of shims, wedges and blocks.

3.02 INSTALLATION - GENERAL

A. Mix, apply and cure products in strict compliance with the manufacturer's recommendations and this Section.

B. Have sufficient manpower and equipment available for rapid and continuous mixing and placing. Keep all necessary tools and materials ready and close at hand.

C. Maintain temperatures of the foundation plate, supporting concrete, and grout between 40 and 90 degrees F during grouting and for at least 24 hours thereafter or as recommended by the grout manufacturer, whichever is longer. Take precautions to minimize differential heating or cooling of baseplates and grout during the curing period.

D. Take special precautions for hot weather or cold weather grouting as recommended by the manufacturer when ambient temperatures and/or the temperature of the materials in contact with the grout are outside of the 60 and 90 degrees F range.

E. Install grout in a manner which will preserve the isolation between the elements on either side of the joint where grout is placed in the vicinity of an expansion or control joint.

F. Reflect all existing underlying expansion, control and construction joints through the grout.

3.03 INSTALLATION - CEMENT GROUTS AND NONSHRINK CEMENTITIOUS GROUTS

A. Mix in accordance with manufacturer's recommendations. Do not add cement, sand, pea gravel or admixtures without prior approval by the ENGINEER.

B. Do not mix by hand. Mix in a mortar mixer with moving blades. Pre-wet the mixer and empty excess water. Add premeasured amount of water for mixing, followed by the grout. Begin with the minimum amount of water recommended by the manufacturer and then add the minimum additional water required to obtain workability. Do not exceed the manufacturer's maximum recommended water content.

C. Placements greater than 3-in in depth shall include the addition of clean, washed pea gravel to the grout mix when approved by the manufacturer. Comply with the manufacturer's recommendations for the size and amount of aggregate to be added.

D. Provide forms as specified in Paragraph 3.01G. Place grout into the designated areas in a manner which will avoid segregation or entrapment of air. Do not vibrate grout to release air or to consolidate the material. Placement should proceed in a manner which will ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.

E. Place grout rapidly and continuously to avoid cold joints. Do not place cement grouts in layers. Do not add additional water to the mix (retemper) after initial stiffening.

F. Just before the grout reaches its final set, cut back the grout to the substrate at a 45 degree angle from the lower edge of bearing plate unless otherwise approved by the ENGINEER. Finish this surface with a wood float (brush) finish.

G. Begin curing immediately after form removal, cutback, and finishing. Keep grout moist and within its recommended placement temperature range for at least 24 hours after placement or longer if recommended by the manufacturer. Saturate the grout surface by use of wet burlap, soaker hoses, ponding or other approved means. Provide sunshades as necessary. If drying winds inhibit the ability of a given curing method to keep grout moist, erect wind breaks until wind is no longer a problem or curing is finished.

3.04 INSTALLATION - NONSHRINK EPOXY GROUTS

A. Mix in accordance with manufacturer’s recommendations. Mix full batches only, to maintain proper proportions of resin, hardener and aggregate. Do not vary the ratio of components or add solvent to change the consistency of the grout mix. Do not overmix. Do not entrain air bubbles by mixing too quickly.

B. Monitor ambient weather conditions and contact the grout manufacturer for special placement procedures to be used for temperatures below 60 or above 90 degrees F.

C. Place grout rapidly and continuously to avoid cold joints. Place grout in lifts in accordance with manufacturer’s recommendations.

D. Provide forms as specified in Paragraph 3.01G. Place grout into the designated areas and prevent entrapment of air. Fill all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes and vent holes as necessary.

E. Minimize "shoulder" length (extension of grout horizontally beyond base plate). In no case shall the shoulder length of the grout be greater than the grout thickness.

F. Finish grout by puddling to cover all aggregate and provide a smooth finish. Break bubbles and smooth the top surface of the grout in conformity with the manufacturer's recommendations.

G. Epoxy grouts are self curing and do not require the application of water. Maintain the formed grout within its recommended placement temperature range for at least 24 hours after placement, until grout compressive strength reaches 1000 psi or as recommended by the manufacturer, whichever is longer.

3.05 INSTALLATION - CONCRETE GROUT

A. Inspect slabs finished under Section 03350 and scheduled to receive concrete grout. Protect and keep the surface clean until placement of concrete grout.

B. Remove the debris and clean the surface by sweeping and vacuuming of all dirt and other foreign materials. Pressure wash the surface. Do not flushing of debris into drain lines.

C. Saturate the concrete surface for at least 24 hours prior to placement of the concrete grout by use of saturated burlap bags, soaker hoses, or ponding. Remove excess water just prior to placement of the concrete grout. Place a cement slurry immediately ahead of the concrete grout so that the slurry is moist when the grout is placed. Work the slurry over the surface with a broom until it is coated with approximately 1/16 to 1/8-in thick cement paste.

D. Steel trowel finish as specified in Section 03350. Cure the concrete grout as specified for cast-in-place concrete in Section 03300.

3.06 GROUT SCHEDULE

A. The following list indicates where the particular types of grout are to be used:

1. General purpose nonshrink cementitious grout: Use at all locations where nonshrink grout is indicated on the Drawings except for base plates greater in area than 3-ft wide by 3-ft long and except for the setting of anchor rods, anchor bolts or reinforcing steel in concrete.

2. Flowable nonshrink cementitious grout: Use under all base plates greater in area than 3-ft by 3-ft. Use at all locations indicated to receive flowable nonshrink grout by the Drawings. The CONTRACTOR, at his/her option and convenience, may also substitute flowable nonshrink grout for general purpose nonshrink cementitious grout. Provide confinement for nonshrink grout as required by the manufacturer.

3. Nonshrink epoxy grout: Use at all locations specifically indicated to receive epoxy grout. Provide confinement for nonshrink grout as required by the manufacturer.

4. Cement grout: Use where indicated on the Drawings.

5. Concrete grout: Use for overlaying the base concrete as indicated on the Drawings.

END OF SECTION

SECTION 03922

CONCRETE REPAIR

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Cutting, removing, repairing or otherwise modifying parts of existing concrete structures or appurtenances as shown on the Drawings and as specified herein. Work under this Section shall also include bonding new concrete to existing concrete.

B. In general, work under this Section will be performed as a remedy for improperly placed or poorly placed concrete. Such work shall be performed only after receiving written directions from the ENGINEER. Remedies for improperly placed or poorly placed concrete shall be performed at no additional cost to the OWNER.

C. Related Sections. See Related Sections for additional requirements applicable to this Section (typical).

1. Section 03100 – Concrete Forms and Accessories.

2. Section 03200 – Concrete Reinforcement.

3. Section 03250 – Concrete Joints and Joint Accessories.

4. Section 03300 – Cast-in-Place Concrete.

5. Section 03600 – Grout.

6. Section 05500 – Metal Fabrications.

1.02 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM C881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

2. ASTM C882 - Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Sheer.

3. ASTM C883 - Standard Test Method for Effective Shrinkage of Epoxy-Resin Systems Used with Concrete.

4. ASTM D570 - Standard Test Method for Water Absorption of Plastics.

5. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.

6. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics.

7. ASTM D732 - Standard Test Method for Shear Strength of Plastics by Punch Tool.

8. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

B. International Concrete Repair Institute (ICRI):

1. ICRI Guideline No. 03732 – Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.

C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.03 SUBMITTALS

A. Submit manufacturer's technical literature on all product brands proposed for use, to the ENGINEER for review. The submittal shall include the manufacturer's installation and/or application instructions.

B. When substitutions for acceptable brands of materials specified herein are proposed, submit brochures and technical data of the proposed substitutions to the ENGINEER for approval before delivery to the project.

1.04 QUALITY ASSURANCE

A. No existing structure or concrete shall be shifted, cut, removed, or otherwise altered until authorization is given by the ENGINEER.

B. When removing materials or portions of existing structures and when making openings in existing structures, all precautions shall be taken and all necessary barriers, shoring and bracing and other protective devices shall be erected to prevent damage to the structures beyond the limits necessary for the new work, protect personnel, control dust and to prevent damage to the structures or contents by falling or flying debris. Unless otherwise permitted, shown or specified, line drilling will be required in cutting existing concrete.

C. Manufacturer Qualifications: The manufacturer of the specified products shall have a minimum of 10 years experience in the manufacture of such products and shall have an ongoing program of training, certifying and technically supporting the CONTRACTOR's personnel.

D. Contractor Qualifications: Contractors shall complete a program of instruction in the application of the approved manufacturer's material specified in this Section and provide certification from the manufacturer attesting to their training and status as an approved applicator.

E. Furnish a notarized certificate stating that the materials specified meet the requirements and have the manufacturer's current printed literature on the specified product.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver the specified products in original, unopened containers with the manufacturer's name, labels, product identification and batch numbers.

B. Store and condition the specified product as recommended by the manufacturer.

PART 2 PRODUCTS

2.01 MATERIALS

A. General

1. Materials shall comply with this Section and any state or local regulations.

B. Epoxy Bonding Agent

1. General

a. The epoxy bonding agent shall be a two-component, solvent-free, asbestos-free moisture insensitive epoxy resin material used to bond plastic concrete to hardened concrete complying with the requirements of ASTM C881, Type II and the additional requirements specified herein.

2. Material

a. Properties of the cured material:

1) Compressive Strength (ASTM D695): 8500 psi minimum at 28 days.

2) Tensile Strength (ASTM D638): 4000 psi minimum at 14 days.

3) Flexural Strength (ASTM D790 - Modulus of Rupture): 6,300 psi minimum at 14 days.

4) Shear Strength (ASTM D732): 5000 psi minimum at 14 days.

5) Water Absorption (ASTM D570 - 2 hour boil): One percent maximum at 14 days.

6) Bond Strength (ASTM C882) Hardened to Plastic: 1500 psi minimum at 14 days moist cure.

7) Effective Shrinkage (ASTM C883): Passes Test.

8) Color: Gray.

3. Product shall be Sikadur 32, Hi-Mod by Sika Corporation, Lyndhurst, NJ; -; Concresive Liquid (LPL) by BASF, Shakopee, MN; or equal.

C. Epoxy Paste

1. General

a. Epoxy Paste shall be a two-component, solvent-free, asbestos free, moisture insensitive epoxy resin material used to bond dissimilar materials to concrete such as setting railing posts, dowels, anchor bolts and all-threads into hardened concrete and shall comply with the requirements of ASTM C881, Type I, Grade 3 and the additional requirements specified herein. It may also be used to patch existing surfaces where the glue line is 1/8-in or less.

2. Material

a. Properties of the cured material:

1) Compressive Properties (ASTM D695): 10,000 psi minimum at 28 days.

2) Tensile Strength (ASTM D638): 3,000 psi minimum at 14 days. Elongation at Break - 0.3 percent minimum.

3) Flexural Strength (ASTM D790 - Modulus of Rupture): 3,700 psi minimum at 14 days.

4) Shear Strength (ASTM D732): 2,800 psi minimum at 14 days.

5) Water Absorption (ASTM D570): 1.0 percent maximum at 7 days.

6) Bond Strength (ASTM C882): 2,000 psi at 14 days moist cure.

7) Color: Concrete gray.

3. Product shall be:

a. Overhead applications: Sikadur Hi-mod LV 31 by Sika Corporation, Lyndhurst, NJ; or equal.

b. Other applications; Sikadur Hi-mod LV 32 by Sika Corporation, Lyndhurst, NJ; or equal.

D. Non-Shrink Precision Cement Grout, Non-Shrink Cement Grout, Non-Shrink Epoxy Grout and Polymer Modified mortar are included in Section 03600.

E. Cement Crack Repair Compound

1. Cement crack repair compound shall be a non-shrink, high-bond-strength, hydraulic cement crystalline waterproofing compound for concrete patching and repair. It shall have a minimum compressive strength of 2,100 psi at 24 hours and 4,500 psi at 28 days.

F. Cementitious Repair Mortar

1. For shallow repairs of vertical or overhead surfaces, cementitious repair mortar shall be a two-component, polymer-modified, Portland cement, fast-setting, non-sag mortar. It shall contain a penetrating corrosion inhibitor. Repair mortar shall be Sikatop 123 PLUS by Sika Corp., Lyndhurst, NJ, or approved equal.

2. For deeper repairs of horizontal, vertical or overhead concrete surfaces, cementitious repair mortar shall be a two-component, polymer-modified, Portland cement, fast-setting, screed mortar. It shall contain a penetrating corrosion inhibitor. The repair mortar may be extended with 3/8-in coarse aggregate in accordance with manufacturer's recommendations, and may be used in a form and pour application. Repair mortar shall be Sikatop 111 PLUS by Sika Corp., Lyndhurst, NJ, or approved equal.

PART 3 EXECUTION

3.01 GENERAL

A. Modify and/or repair concrete as specified herein, or necessary to permit completion of the Work, and as directed by the ENGINEER. Finishes, joints, reinforcements, sealants, etc., are specified in respective Sections. All work shall comply with other requirements of this of Section and as shown on the Drawings.

B. All commercial products specified in this Section shall be stored, mixed and applied in strict compliance with the manufacturer's recommendations.

C. In all cases where concrete is repaired in the vicinity of an expansion joint or control joint the repairs shall be made to preserve the isolation between components on either side of the joint.

D. When drilling holes for dowels/bolts at new or existing concrete, drilling shall stop if rebar is encountered. As approved by the ENGINEER, the hole location shall be relocated to avoid rebar. Rebar shall not be cut without prior approval by the ENGINEER. Where possible, rebar locations shall be identified prior to drilling using "rebar locators" so that drilled hole locations may be adjusted to avoid rebar interference.

3.02 CONCRETE REMOVAL

A. Concrete designated to be removed to specific limits as shown on the Drawings or directed by the ENGINEER, shall be done by line drilling at limits followed by chipping or jack-hammering as appropriate in areas where concrete is to be taken out. Remove concrete in such a manner that surrounding concrete or existing reinforcing to be left in

place and existing in place equipment is not damaged. Sawcutting at limits of concrete to be removed shall only be done if indicated on the Drawings, or after obtaining written approval from the ENGINEER. When sawcutting is performed, do not overcut corners.

B. Where existing reinforcing is exposed due to saw cutting/core drilling and no new material is to be placed on the sawcut surface, a coating or surface treatment of epoxy paste shall be applied to the entire cut surface to a thickness of 1/4-in.

C. In all cases where the joint between new concrete or grout and existing concrete will be exposed in the finished work, except as otherwise shown or specified, the edge of concrete removal shall be a 1-in deep saw cut on each exposed surface of the existing concrete.

D. Concrete specified to be left in place which is damaged shall be repaired by approved means to the satisfaction of the ENGINEER.

E. The ENGINEER may from time to time direct the CONTRACTOR to make additional repairs to existing concrete. These repairs shall be made as specified or by such other methods as may be appropriate.

3.03 CONNECTION SURFACE PREPARATION

A. Connection surfaces shall be prepared as specified below for concrete areas requiring patching, repairs or modifications as shown on the Drawings, specified herein, or as directed by the ENGINEER.

B. Remove all deteriorated materials, dirt, oil, grease, and all other bond inhibiting materials from the surface by dry mechanical means, i.e. - sandblasting, grinding, etc, as approved by the ENGINEER. Be sure the areas are not less than 1/2-in in depth. Irregular voids or surface stones need not be removed if they are sound, free of laitance, and firmly embedded into parent concrete, subject to the ENGINEER's final inspection. Surfaces that will be in contact with freshly placed concrete shall be roughened to minimum Concrete Surface Profile (CSP) 9 per ICRI Guideline 03732 with minimum 1/4-in amplitude.

C. If reinforcing steel is exposed, it must be mechanically cleaned to remove all contaminants, rust, etc, as approved by the ENGINEER. If half of the diameter of the reinforcing steel is exposed, chip out behind the steel. The distance chipped behind the steel shall be a minimum of 1/2-in. Reinforcing to be saved shall not be damaged during the demolition operation.

D. Reinforcing from existing demolished concrete which is shown to be incorporated in new concrete shall be cleaned by mechanical means to remove all loose material and products of corrosion before proceeding with the repair. It shall be cut, bent or lapped to new reinforcing as shown on the Drawings and provided with 1-in minimum cover all around.

E. The following are specific concrete surface preparation "methods" to be used where called for on the Drawings, specified herein or as directed by the ENGINEER.

1. Method A: After the existing concrete surface at connection has been roughened and cleaned, thoroughly saturate and maintain saturation for a period of at least

12 hours. Brush on a 1/16-in layer of cement and water mixed to the consistency of a heavy paste. Immediately after application of cement paste, place new concrete or grout mixture as detailed on the Drawings.

2. Method B: After the existing concrete surface has been roughened and cleaned, apply epoxy bonding agent at connection surface. The field preparation and application of the epoxy bonding agent shall comply strictly with the manufacturer's recommendations. Place new concrete or grout mixture to limits shown on the Drawings within time constraints recommended by the manufacturer to ensure bond.

3. Method C: Install adhesive anchors or dowels strictly comply with the manufacturer's recommendations.

4. Method D: Combination of Method B and C.

3.04 GROUTING

A. Grouting shall be as specified in Section 03600.

3.05 CRACK REPAIR

A. All concrete cracks in non-liquid-containing structures greater than 0.020-in in width shall be repaired as directed by the ENGINEER.

B. All concrete cracks in liquid-containing structures greater than 0.010-in in width shall be repaired in the following manner:

1. Rout out crack by chiseling or chipping a square groove 1-in wide by a minimum depth of 1-in (do not use a vee-notch). Flush away loose materials and dirt from the cavity with water and stiff brush.

2. Mix cement repair compound in accordance with the manufacturer's recommendations.

3. Form cement plug with gloved hand, pressing firmly into groove until plug is hardened.

C. Should cracks in liquid-containing structures leak following cement-repair-compound repair, the cracks shall be repaired by pressure injecting crack sealant through valves sealed to surface with crack repair epoxy adhesive per manufacturer's recommendations. "Leaking" shall be defined as water flowing or seeping from the structure, or if moisture can be transferred from the exterior surface to a dry hand.

3.06 HONEYCOMBING / ROCK POCKETS

A. Defective and honeycombed areas as determined by the ENGINEER shall be repaired.

1. Chip down square and at least 1-in deep to sound concrete with hand chisels or pneumatic chipping hammers. If honeycomb exists around reinforcement, chip to provide a clear space at least 3/8-in wide all around the steel.

2. Roughen surface to minimum Concrete Surface Profile (CSP) 9 per ICRI Guideline 03732 with minimum 1/4-in amplitude.

3. Thoroughly clean the surface of loose or weakened materials by waterblasting (preferable) or sandblasting.

4. 12 hours before and again immediately prior to the concrete or mortar being deposited, saturate the joints and adjacent concrete surfaces to at least 12-in past the joint with water.

5. Pack the void with either 4,000 psi concrete using ½-in maximum rock size, SikaTop 123 PLUS (or approved equal), or SikaTop 111 PLUS (or approved equal) extended with aggregate as allowed per the Manufacturer's recommendations.

6. A form and pour application using a bird's mouth may be used pending written approval by the ENGINEER. Submit repair method for approval.

END OF SECTION

Division 4 Masonry

SECTION 04070

MASONRY GROUT AND MORTAR

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Mortar for masonry.

2. Grouting of masonry cells, bond beams, and lintels.

B. Related Sections. See Related Sections for additional requirements applicable to this Section (typical).

1. Section 03200 - Concrete Reinforcement.

2. Section 03250 – Concrete Joints and Joint Accessories.

3. Section 04080 – Masonry Anchorage and Reinforcement.

4. Section 04220 – Concrete Masonry Units and Masonry Assemblies.

5. Section 05500 – Metal Fabrications.

1.02 REFERENCES

A. American Concrete Institute (ACI)

1. ACI 530 – Building Code Requirement for Masonry Structures.

2. ACI 530.1 - Specification for Masonry Structures

B. American Society for Testing and Materials (ASTM)

1. ASTM C144 - Specification for Aggregate for Masonry Mortar

2. ASTM C150 - Specification for Portland Cement

3. ASTM C207 - Specification for Hydrated Lime for Masonry Purposes

4. ASTM C270 - Specification for Mortar for Unit Masonry

5. ASTM C404 - Specification for Aggregates for Masonry Grout

6. ASTM C476 - Specification for Mortar and Grout for Reinforced Masonry

7. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry

8. ASTM C1019 - Method of Sampling and Testing Grout

C. California Building Standards Commission (CBSC):

1. California Building Code (CBC) – 2010 Edition.

1.03 SUBMITTALS

A. All submittals shall be in accordance with Section 01300.

B. Product data: Submit product data including the following:

1. Sources of cement, hydrated lime, and aggregates.

2. Mix designs for mortar and grout.

C. Quality Assurance/Control

1. Test Reports. Reports by an independent testing laboratory engaged by the CONTRACTOR and acceptable to the ENGINEER shall be furnished prior to installation of mortar and grout.

a. Sieve analysis, mechanical properties, and deleterious substance content for fine aggregate for mortar and grout in accordance with ASTM C144 and C404, as applicable.

b. Mortar test results in accordance with ASTM C270.

c. Grout test results in accordance with ASTM C1019.

2. Certifications

a. Certify that the CONTRACTOR is not associated with the independent testing laboratory and that the CONTRACTOR or its officers have no beneficial intent in the laboratory.

3. Qualifications

a. Independent testing laboratory: Name, address, and qualifications. Laboratories affiliated with the CONTRACTOR or in which the CONTRACTOR or its officers have a beneficial interest are not acceptable.

4. Procedures

a. Cold weather construction procedures. Submit a description of procedures to be used when the ambient temperature or the temperature of masonry units falls below 40^{o}F.

b. Hot weather construction procedures. Submit a description of procedures to be used when the ambient temperature exceeds 100°F or 90°F with a wind velocity greater than 8 mph.

c. Review of hot and cold weather construction procedures will be for information only. The CONTRACTOR remains fully responsible for complying with the requirements of this Section and for the adequacy of procedures employed.

1.04 QUALITY ASSURANCE

A. Mortar and grout shall comply with the recommendations of ACI 530 and other stated requirements, codes and standards. The most stringent requirement of the codes, standards, and this Section shall apply when conflicts exist.

B. Testing services required to demonstrate that the materials proposed for incorporation into the work comply with this Specification Section and the stated ASTM standards shall be furnished by the CONTRACTOR. The cost of such testing, unless specifically stated otherwise, shall be paid by the CONTRACTOR.

C. All field testing and inspection services to confirm that the properties of the materials actually incorporated into the work conform to these specifications, and to satisfy the building code requirements for special inspection will be provided by the Independent Testing Agency. The cost of such work, unless specifically stated otherwise, will be paid for by the OWNER. The CONTRACTOR shall facilitate such testing and inspection as follows:

1. Advise the Independent Testing Agency's representative of planned work at least 7 days in advance to allow for assignment and scheduling of inspection and testing personnel.

2. Furnish any labor necessary to assist the Independent Testing Agency in obtaining and handling samples.

D. Methods of testing shall conform to ASTM or other standards as indicated. Include in reports for prisms or test specimens a description of the portion of construction represented by the specimen(s), and a summary of conditions under which the specimens were stored prior to testing.

E. Special Inspection

1. All field testing and inspection services and related laboratory tests required will be provided by the OWNER. Level 2 special inspection in accordance with CBC Table 1704.5.3 will be provided.

1.05 DELIVERY, STORAGE, AND HANDLING

A. All materials for the work of this Section shall be delivered, stored, and handled so as to preclude damage of any nature. Store materials off the ground and protected from weather. Prevent wetting by capillary action and rain. Manufactured materials, such as cement and lime, shall be delivered and stored in their original containers, plainly marked with identification of material and maker. Materials in broken containers, or in packages showing watermarks or other evidence of damage, shall not be used and shall be removed from the site.

PART 2 PRODUCTS

2.01 MATERIALS

A. General

1. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

2. Like items of materials shall be the end products of one manufacturer in order to provide standardization for appearance, maintenance, and manufacturer's service.

3. Materials shall conform to the standards listed herein and to any applicable state or local building code standards.

B. Cementitious materials

1. Cementitious materials for mortar and grout shall not contain epoxy resins and derivatives, phenols, asbestos fiber, or fireclays.

2. Portland cement shall conform to ASTM C150 Type II. Do not use masonry cements, mortar cements, and plastic cement.

3. Lime for masonry mortar shall be hydrated lime conforming to ASTM C207, Type S.

C. Aggregates

1. Sand shall be clean, durable particles, free from injurious amounts of organic matter, dust, lumps, shale, alkali, or surface coatings.

   a. Sand for mortar shall conform to ASTM C144.

   b. Sand for grout shall conform to ASTM C404, Size No. 2.

D. Water shall be from a potable water supply. Water shall be free from deleterious amounts of oils, acids, alkalis, or organic matter, and shall be clean and fresh.

E. Admixtures and Additives

1. Additives and admixtures to mortar or grout shall not be used unless approved by the ENGINEER.

2. Antifreeze Compounds. Antifreeze liquids, chloride salts, or other such substances shall not be used in mortar or grout.

3. Air Entrainment. Air entraining substances shall not be used in mortar or grout.

4. Integral Waterproofing. Integral waterproofing for use in all exterior mortar shall be metallic stearate type, and shall be Hydrocide Powder by Sonneborn Contech; Rheopel Plus Mortar Admixture by BASF; Integral Waterpeller by Euclid Chemical; or equal.

F. Grout and Mortar

1. Grout and Mortar used for Concrete Masonry Unit construction shall consist of normal weight aggregates in order to provide a maximum unit weight of 135 pcf, unless otherwise approved by the ENGINEER.

2.02 MIXES

A. Mortar

1. Mortar shall be Type S portland cement-lime mortar providing a minimum compressive strength of 1,800 psi at 28 days. Mortar proportions shall comply with ACI 530 except that increases in lime content may be permitted to adjust the mixture for initial rate of absorption of the masonry or for temperature if mortar strength tests are performed. Admixtures shall not be used in the mortar mix.

a. Mix mortar in accordance with the requirements of ACI 530.1, using a mechanically-operated mixer in which the quantity of water added can be accurately and uniformly controlled. Accurately measure mortar constituents by volume.

b. The consistency of the mortar shall be adjusted to the satisfaction of the mason with water added as necessary to produce a workable mix. Mortar may be re-tempered one time by adding water when needed to restore the required consistency. When water is added, it shall be mixed into the mortar, not splashed over the surface.

c. Mortar which has begun to "set" or which has not been used within 2-1/2 hours after initial mixing water was added to the dry ingredients shall be discarded.

d. Mortar shall be consistently tinted to match the color selected by the ENGINEER for all work.

e. Proportion mortar integral water repellant admixture in accordance with manufacturer’s recommendations.

f. Mortar color shall match masonry unit color.

B. Grout

1. Grout shall conform to ASTM C476. Grout shall attain a minimum compressive strength of 2,500 psi at 28 days when tested in accordance with ASTM C1019. Admixtures shall not be used without prior approval by the ENGINEER. Control grout materials and water content to provide adequate fluidity for placement without segregation. Grout shall be classified as “fine” and shall be manufactured with fine aggregates in accordance with ASTM C476.

a. Accurately measure all ingredients according to the proportions specified for the batch and mix in a mechanically-operated batch mixer. Mix grout for at least 5 minutes but not more than 10 minutes after all ingredients have been added. Add water as required to provide the desired workability.

b. Do not handle or pump grout using aluminum equipment.

c. Transit mixed grout may be used. Continually rotate transit mixed grout from the time the water is added until the grout is discharged.

d. Grout mixing drums shall be completely emptied before the succeeding batch of materials is introduced for mixing.

e. The consistency of grout shall be adjusted so that it will flow into place without segregation of ingredients. Water may be added to compensate for loss.

f. Grout that has begun final "set" and becomes harsh or which has not been used within 1-1/2 hours after initial mixing water was added to the dry ingredients shall not be used.

2.03 SOURCE QUALITY CONTROL

A. Test for material compression strength as follows.

1. Prior to construction, the Independent Testing Agency shall perform the following tests using samples of materials that will be incorporated in the work.

a. One mortar test consisting of one set of three 2-in diameter by 4-in cylindrical specimens constructed and tested in compliance with ASTM C780.

b. One grout test consisting of one set of three specimens constructed and tested in compliance with ASTM C1019.

c. Retesting of mortar and grout as required to demonstrate compliance with this Section.

2. During construction, the Special Inspector may also perform mortar and grout testing.

B. All masonry work shall conform to the CBC and ACI 530, except as modified herein.

PART 3 EXECUTION

3.01 GENERAL

A. Before beginning masonry construction, verify that tolerances of supporting members are within allowable limits, and that any required reinforcing dowels have been placed in accordance with the requirements of the Drawings.

1. Bearing surface for masonry shall be such that the thickness of the initial bed joint shall be not less than 1/4-in nor more than 3/4-in in thickness.

B. Before laying masonry, remove laitance, loose aggregate, or anything else that would interfere with bond between the mortar and substrate.

C. Cold Weather Construction. When the ambient temperature or the temperature of masonry units falls below 40°F, conform to approved cold weather construction procedures. Provide cold weather heating and protection for both mortar and grout.

D. Hot Weather Construction. Where the ambient temperature exceeds 100°F or 90°F with a wind velocity greater than 8 mph, conform to approved hot weather construction procedures.

3.02 MORTAR INSTALLATION

A. Placing of mortar and units shall conform to ACI 530.1. Tool joints dense and neat.

B. Sizes shall be as specified and called for on the Drawings. Where "splits" are used, the space between these members and the backup material shall be slushed full of mortar.

C. Mortar fins protruding from joints shall be removed before grout is placed. The minimum clear dimensions of vertical cores to be grouted shall be 2-1/2-in by 3-in.

D. Joints of all masonry shall be tooled in accordance with the following:

1. Wait until unit mortar is thumbprint hard before tooling joint. This may require as much as 3 hours in the shade and 1 hour in the sun.

2. The required personnel shall be kept on the job after hours, if necessary, to properly tool joints.

3. Both vertical and horizontal joints shall be maintained uniform in spacing.

4. Joints for all types of CMU shall be 3/8-in. and concave.

E. Head joints of open-end units with beveled ends need not be mortared.

F. Surfaces shall be brushed as work progresses and maintained as clean as is practicable. Any mortar in contact with the face of masonry shall be removed.

3.03 GROUTING

A. General

1. Walls shall be fully grouted unless otherwise indicated on the Drawings.

2. Prior to grouting, the grout space shall be clean and free of mortar projections greater than 1/2-in, mortar droppings, or other foreign materials.

3. Reinforcement shall be in place and adequately supported before commencing grouting operations. Reinforcement shall be clean and free of mortar droppings or other debris. Notify the ENGINEER at least 24 hours prior to any grouting operations so that reinforcement placement, support, and laps may be observed before grouting. Accurately set embedded bolts with templates and hold in place to prevent movement. Provide minimum 1-in grout space between any bolt and an adjacent masonry surface.

4. Control grout materials and water content during grouting to provide adequate fluidity for placement without segregation. Place grout within 1-1/2 hours after the introduction of water into the mix and prior to initial set.

5. Consolidate grout by mechanical vibration before loss of plasticity, in a manner which will solidly fill the grout space and minimize voids due to absorption of water into the masonry. Reconsolidate grout by mechanical vibration after initial water loss and settlement has occurred.

6. Complete grouting of lintels over openings in one continuous operation.

7. Use extreme care to prevent any grout from staining the face of masonry to be left exposed or unpainted. If any grout does contact the face of such masonry, it shall be removed immediately. Protect all sills, ledges offsets, etc. from grout droppings.

8. Limitations on grout pour heights based on least clear dimensions shall be as shown in Table 04070-1. Units may be laid to the maximum height of the grout pour before grouting unless otherwise noted on the Drawings or specified. Where this table or notes on the Drawing indicate that walls are to be grouted at intervals less than their final height, use "low-lift" grouting procedures. Where walls are grouted to their final height in one pour, use "high-lift" grouting procedures.

Table 04070-1
Grout and Pour Height Limitations

Grout Type	Grout Pour Max. Height (ft)	Least Clear Dimensions [1]
		Cell Dimensions [2] (in x in)
Fine	1 5 12 24	1-1/2 x 2 2 x 3 2-1/2 x 3 3 x 3

[1] The clear dimension is the cell width less mortar projections ignoring horizontal reinforcement.

[2] For grouted cells in hollow unit masonry.

B. Low-Lift Grouting Procedures

1. Between grout pours in vertical cells, form a horizontal construction joint "key" in walls by stopping all wythes at the same elevation, and stopping the grout lift a minimum of 12-in below the mortar joint, except at the top of a wall. Consolidate the grout and then continue the pour. For horizontal bond beams, grout cells below the bond beam and consolidate, then grout the bond beam itself stopping the grout pour 2-in below the top of the masonry. At the finished course of both walls and bond beams, bring the last pour flush with the top of the masonry during initial placing and again after consolidation.

C. High-Lift Grouting Procedures

1. Do not erect masonry to a height of more than 80 times the minimum clear cell or grout space dimension nor higher than 30-ft before grouting unless approval is obtained in writing from the ENGINEER.

2. Where grout pours exceed 5-ft in height, provide clean-outs in the bottom course of masonry. Clean-out openings shall be not less than 12-in^2 in area and the least dimension of any opening shall not be less than 3-in. In solid grouted masonry, space clean-outs at each vertical bar, but not more than 32-in on center.

3. Before grouting, clean cells and collar joints and close and seal clean-out openings. Brace closures to resist grout pressure. Pour grout at a rate which will minimize the potential for "blowouts" at the closed clean-out openings, but rapidly enough to allow consolidation before loss of plasticity.

END OF SECTION

SECTION 04080

MASONRY ANCHORAGE AND REINFORCEMENT

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Installation of deformed steel reinforcement provided under Section 03200.

2. Installation of Masonry Control Joints as shown and detailed on the Drawings.

B. Related Sections. See Related Sections for additional requirements applicable to this Section (typical).

1. Section 03200 - Concrete Reinforcement.

2. Section 03250 – Concrete Joints and Joint Accessories.

3. Section 04070 – Masonry Grout and Mortar.

4. Section 04220 – Concrete Masonry Units and Masonry Assemblies.

1.02 REFERENCES

A. American Concrete Institute (ACI)

1. ACI 530 – Building Code Requirement for Masonry Structures.

2. ACI 530.1 - Specification for Masonry Structures.

B. American Society for Testing and Materials (ASTM)

1. ASTM A153 - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

2. ASTM A615 - Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

3. ASTM A706 – Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.

C. California Building Standards Commission:

1. California Building Code (CBC) – 2010 Edition.

D. Where reference is made to one of the preceding standards, the revision in effect at the time of bid opening shall apply unless otherwise indicated.

1.03 SUBMITTALS

A. Product Data: Submit to the ENGINEER, in accordance with Section 01300, product data including the following:

1. Reinforcing steel mill certifications.

2. Masonry Control Joint Materials, including but not limited to smooth dowels and joint material.

B. Shop Drawings: Submit to the ENGINEER, in accordance with Section 01300, shop drawings showing details of installation for:

1. Reinforcing Steel Placement Drawings. Placement drawings shall conform to the recommendations of ACI 315 and shall not be copies of the Contract Drawings. New scaled drawings shall be prepared showing plans, all vertical structure elevations, sections, and details as required to clearly delineate the reinforcing. All reinforcement in a masonry wall shall be included on a single placement drawing or cross-referenced to the pertinent main placement drawing. The main drawing shall include bar lists, schedule, bending details, placing plans and elevations, clear cover, splice locations, splice length, and the additional reinforcement (around openings, at corners, etc.) shown on the standard detail sheets. Bars to be of special steel or special yield strength are to be clearly identified. Masonry control joints shall be accounted for on placement drawings.

1.04 QUALITY ASSURANCE

A. Masonry reinforcement shall comply with the CBC, the recommendations of ACI 530 and other stated requirements, codes and standards. The most stringent of the codes, standards, and this Section shall apply when conflicts exist.

B. Special Inspection

1. All special inspection services will be provided by the OWNER. Level 2 special inspection in accordance with CBC Table 1704.5.3 will be provided.

1.05 DELIVERY, STORAGE, AND HANDLING

A. All materials for the work of this Section shall be delivered, stored, and handled so as to preclude damage of any nature. Store materials off the ground and protected from weather. Prevent wetting by capillary action and rain.

PART 2 PRODUCTS

2.01 MATERIALS

A. General

1. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

2. Materials shall conform to the standards listed herein and to any applicable state or local building code standards.

B. Reinforcement

1. Deformed steel reinforcing bars conform to ASTM A615, Grade 60, unless otherwise noted on the Drawings, and shall be as specified in Section 03200.

a. Fabricate reinforcement for masonry in accordance with the provisions of Section 03200, except as amended by the following paragraphs.

b. Hooks. The term "standard hook" as used herein or as shown on the Drawings for masonry reinforcement shall be as defined in the following paragraphs. Inside diameter of the bend shall not be less than that shown in Table 04080-1.

(1) A 180-degree turn plus an extension of at least 4 bar diameters, but not less than 2-1/2-in at the free end of the bar.

(2) A 135-degree turn plus an extension of at least 6 bar diameters but not less than 4-in at the free end of the bar.

(3) Where ties are placed in the horizontal bed joints, a 90-degree bend having a radius of not less than 4 diameters plus an extension of at least 12 bar diameters at the end of the bar.

(4) For stirrups or ties, either a 90-degree or a 135-degree turn plus an extension of at least 6 bar diameters but not less than 2-1/2-in at the free end of the bar.

Table 04080-1
Reinforcement Bend Diameter

Bar		Minimum Inside Diameter
Stirrups & Ties:	#4 & smaller	4 diameters
Other:	#3 through #8	6 diameters
	#9 through #11	8 diameters

PART 3 EXECUTION

3.01 PREPARATION

A. Before beginning masonry construction, verify that tolerances of supporting members are within allowable limits, and that any required reinforcing dowels have been placed in accordance with the requirements of the Drawings.

3.02 REINFORCED MASONRY

A. Install reinforcement of the type, size, and spacing and at locations as indicated on the Drawings and specified herein.

B. Reinforcement shall be free of dirt, oil, and other materials that will adversely affect bond, and shall be straight except where bends or hooks are detailed on the plans. Reinforcement which, in the opinion of the ENGINEER, is bent or otherwise damaged so as to affect its structural capacity shall not be incorporated into the Work.

C. Bond beams shall be continuous with lapped splices as specified on the Drawings.

D. Reinforcing around Openings

1. Unless otherwise shown on the Drawings, at openings in masonry greater than or equal to 16-in in any direction, provide a minimum of two #5 in grouted cells or bond beams on all sides of the opening. Bars shall extend at least 48 bar diameters past the opening on each side.

2. See lintel schedules and miscellaneous details on the Drawings for additional requirements.

E. Reinforcing Details

1. Support and fasten masonry reinforcement to prevent displacement beyond the tolerances noted herein.

2. Position and accurately space reinforcement in units as shown on the Drawings. Maintain a clear distance between reinforcement and any masonry surface or adjacent bar of not less than 1/4-in for fine grout or 1/2-in for coarse grout.

3. Tolerances for placing reinforcement shall be as follows, where d equals distance from centerline of steel to the compression face of masonry.

a. Walls, beams, lintels, and bond beams:

"d" (in)	Tolerance (in)
d < 8	+1/2
8 < d < 24	+1
24 < d	+1-1/4

b. If it becomes necessary to move reinforcement to avoid interferences with other reinforcement, conduits, or embeds, bars shall not be moved beyond their specified tolerances nor more than one diameter without prior acceptance by the ENGINEER.

4. Splices for deformed reinforcing steel shall be as shown on the Drawings.

5. Clear spacing between vertical bars, except for bar splices, shall be not less than 2-1/2 times the bar diameter nor 1-1/2-in. Stagger adjacent splices vertically.

6. Completely embed all reinforcing bars in mortar or grout with minimum cover (measured from outside of face shell) as follows:

   Interior exposure: 1-1/2-in
   Exposed to soil or weather: 2-in

7. Provide masonry dowels cast into the supporting concrete at all corners of the structure, in the first adjacent cell in each direction from the corner, at cells requiring vertical reinforcement, and elsewhere as shown on the Drawings.

8. Hook horizontal reinforcement around vertical bars at the ends of walls and openings with standard hooks.

END OF SECTION

SECTION 04220

CONCRETE MASONRY UNITS AND MASONRY ASSEMBLIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Concrete Masonry Units (CMU):

a. Standard Smooth face masonry unit (Precision).

b. Split-face masonry unit.

2. Reinforced unit masonry assemblies.

3. Integral waterproofing.

4. Joint accessories.

5. Coordination and installation of items in masonry such as window, door, and louver frames, plus vent pipes, conduits, and other items furnished and installed by other trades.

B. Related Sections. See Related Sections for additional requirements applicable to this Section (typical).

1. Section 03200 – Concrete Reinforcement.

2. Section 03250 – Concrete Joints and Joint Accessories.

3. Section 04070 – Masonry Grout and Mortar.

4. Section 04080 – Masonry Anchorage and Reinforcement.

5. Section 05500 – Metal Fabrications.

6. Section 07901 – Joint Sealants.

7. Section 08110 – Hollow Metal Doors and Frames.

8. Section 08711 – Door Hardware.

9. Section 09902 –Painting.

10. Section 10200 –Louvers and Dampers.

1.02 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 530 – Building Code Requirement for Masonry Structures.

2. ACI 530.1 - Specification for Masonry Structures.

B. American Society for Testing and Materials (ASTM):

1. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

2. ASTM C33 - Specification for Concrete Aggregates.

3. ASTM C90 - Specification for Hollow Load-Bearing Concrete Masonry Units.

4. ASTM C140 - Sampling and Testing for Concrete Masonry Units.

5. ASTM C144 - Specification for Aggregate for Masonry Mortar.

6. ASTM C150 - Specification for Portland Cement.

7. ASTM C207 - Specification for Hydrated Lime for Masonry Purposes.

8. ASTM C270 - Specification for Mortar for Unit Masonry.

9. ASTM C331 - Specification for Lightweight Aggregates for Concrete Masonry Units.

10. ASTM C426 - Test for Drying Shrinkage of Concrete Block.

11. ASTM C1314 – Standard Method for Constructing and Testing Masonry Prisms Used to Determine Compliance with Specified Compressive Strength of Masonry.

12. ASTM D2000 - Classification System for Rubber Products in Automatic Applications.

C. California Building Standards Commission (CBSC):

1. California Building Code (CBC) – 2010 Edition.

D. Where reference is made to one of the preceding standards, the revision in effect at the time of bid opening shall apply unless otherwise indicated.

1.03 SUBMITTALS

A. All submittals shall be in accordance with Section 01300.

B. Product Data: Submit product data including the following:

1. Material properties and test results letters for each different masonry unit.

2. Documentation that masonry units meet the minimum required fire-resistance rating as indicated on the Drawings. Submit all certifications and test data as required to prove compliance with this Section and the California Building Code, 2010 Edition.

3. Miscellaneous items: Joint filler and accessories.

4. Integral waterproofing: Product data and test information for field-applied water repellent to be used at all exterior CMU.

C. Samples:

1. Concrete Masonry Units: Two samples each of smooth face and split face, 8-in thick units.

2. Masonry joint material: Two samples, each at least 6-inches long, of each type.

D. Quality Assurance/Control

1. Test Reports. Reports by an independent testing laboratory engaged by the CONTRACTOR and acceptable to the ENGINEER shall be furnished prior to installation of masonry units and prisms.

a. For each type of masonry unit, certified preconstruction test reports, including compressive strength, absorption, dimensional analysis, unit weight, and moisture content in accordance with ASTM C140.

b. Compression strength testing reports for masonry prisms before and during construction in accordance with ASTM C1314.

2. Certifications

a. Certify that the CONTRACTOR is not associated with the independent testing laboratory and that the CONTRACTOR or its officers have no beneficial intent in the laboratory.

3. Qualifications

a. Independent testing laboratory: Name, address, and qualifications. Laboratories affiliated with the CONTRACTOR or in which the CONTRACTOR or its officers have a beneficial interest are not acceptable.

b. Provide a list of not less than three projects utilizing integrally-colored units with integral water repellent manufactured by the same supplier.

4. Procedures

a. Cold weather construction procedures. Submit a description of procedures to be used when the ambient temperature or the temperature of masonry units falls below 40^{o}F.

b. Hot weather construction procedures. Submit a description of procedures to be used when the ambient temperature exceeds 100°F or 90°F with a wind velocity greater than 8 mph.

c. Review of hot and cold weather construction procedures will be for information only. The CONTRACTOR remains fully responsible for complying with the requirements of this Section and for the adequacy of procedures employed.

1.04 QUALITY ASSURANCE

A. Masonry shall comply with the recommendations of the 2010 CBC, ACI 530 and other stated requirements, codes and standards. The most stringent requirement of the codes, standards, and this Section shall apply when conflicts exist.

B. Testing services required to demonstrate that the materials proposed for incorporation into the work comply with this Specification Section and the stated ASTM standards shall be furnished by the CONTRACTOR. The cost of such testing, unless specifically stated otherwise, shall be paid by the CONTRACTOR.

C. All field testing and inspection services to confirm that the properties of the materials actually incorporated into the work conform to these Specifications, and to satisfy the building code requirements for special inspection will be provided by an Independent Testing Agency. The cost of such work, unless specifically stated otherwise, will be paid by the OWNER. The CONTRACTOR shall facilitate such testing and inspection as follows:

1. Advise the ENGINEER of installation far enough in advance to allow for assignment and scheduling of inspection and testing personnel.

2. Furnish any labor necessary to assist the OWNER's testing agency in obtaining and handling samples.

D. Methods of testing shall conform to ASTM or other standards as indicated. Include in reports for prisms or test specimens a description of the portion of construction represented by the specimen(s), and a summary of conditions under which the specimens were stored prior to testing.

E. Special Inspection

1. All reinforced masonry shall be inspected by an ICC certified special inspector in accordance with the following paragraphs. Costs of inspection described in these paragraphs will be paid by the OWNER.

2. The special inspector shall observe the work of this Section for conformance with the Drawings and specifications, and shall bring any discrepancies to the immediate attention of the CONTRACTOR and the ENGINEER.

a. The special inspector shall furnish three original copies of inspection reports on all inspections within 48 hours after the inspections are made.

b. The special inspector shall sign and submit three original copies of a final report stating whether the work was, to the best of his/her knowledge, performed in accordance with the Drawings and the applicable workmanship provisions of the governing building code.

c. The special inspector shall submit the original copy of the reports described in the preceding paragraphs to the ENGINEER.

3. ICC certified special inspector shall perform special inspections in accordance with the 2010 CBC, Table 1704.5.3, Level 2 Special Inspection. Items to be continuously and periodically inspected are defined in this table. In addition, the following item shall be inspected.

a. Observe site sampling of masonry prism for compression testing.

F. Cold and Hot Weather Construction: Masonry construction in cold and hot weather shall conform to the applicable requirements of the CBC and ACI 530 unless otherwise specified herein. Heat and enclosures will be the only protection method allowed for cold weather construction. No mortar additives shall be used for this purpose.

G. All masonry work shall conform to the CBC and ACI 530, except as modified herein.

1.05 DELIVERY, STORAGE, AND HANDLING

A. All materials for the work of this Section shall be delivered, stored, and handled so as to preclude damage of any nature. Store masonry units off the ground and protected from weather.

B. All masonry shall be shipped stacked with pallets, shrink wrap, banding, plastic, and/or cardboard protection or other suitable protective device, and shall be similarly protected and stacked off the ground on the site. Masonry shall be protected from the weather and staining with the use of tarpaulins or other plastic covering approved by the ENGINEER.

1. Units shall be well covered and protected during manufacture, storage, shipping, and while on the job site to prevent contamination which may lead to efflorescence in the finished work. If efflorescence occurs in the finished work, the ENGINEER may order the removal and replacement of areas so affected at no additional cost to the OWNER.

C. Store masonry accessories including metal items to prevent corrosion and the accumulation of dirt and oil.

PART 2 PRODUCTS

2.01 MATERIALS

A. General

1. Compression strength of masonry, f'_m, shall be equal to or exceed 1,500 psi. The ENGINEER has selected this compression strength based on the Unit Strength Method, in accordance with the CBC.

2. The use of a Manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

3. Like items of materials shall be the end products of one Manufacturer in order to provide standardization for appearance, maintenance, and Manufacturer's service.

4. Materials shall comply with this Section and to any applicable State or local Building Code standards.

5. Concrete masonry units shall have the finishes and fire-resistance ratings (e.g. 1-hour fire-rated, etc.) as shown on the Drawings.

B. Concrete Masonry Units:

1. Concrete masonry units shall be open end (single or double) units, conforming to ASTM C90, medium weight, Type I, hollow, load bearing units of 8-in by 16-in nominal face size as required for the project. Units shall have an integral water-repellent admixture at the time of manufacture.

   a. Materials. Cementitious and pozzolanic (or siliceous) materials, admixtures, and aggregates shall conform to their respective ASTM Specifications.

   b. Cure masonry units in an autoclave in a saturated steam atmosphere at an average temperature exceeding 350^{o}F (176^{o}C) for a period of time sufficient to assure that the units will meet the requirements for drying shrinkage.

   c. Dimensions. Nominal block dimensions shall be 8-in high, 16-in long, and of the thickness shown on the Drawings. Provide internal corner units, external corner units, and specials shown or required.

   d. Appearance. Surface texture and aggregate exposure shall be uniform within the normal range established by agreement between Manufacturer, CONTRACTOR, and the ENGINEER, and as represented by a protected sample wall panel erected at the job site.

   e. Color. Masonry units shall be Color #60B58904B for precision block and split-face block by AirVol Block, 1 Suburban Road, San Luis Obispo, (805) 543-1314 or approved equal, as selected by the Architect or ENGINEER from custom color palette available from block Manufacturer.

   f. Special Units. If required for uniform color and appearance, bond beam and other units shall be field cut from standard 8x16 units, as required to match the typical masonry wall thickness.

   g. Protection. Block units shall be delivered to the job site packaged in a manner so as to prevent damage to the faces in shipment and shall be additionally protected with polyethylene protective covers, so as to maintain their pre-dried, pre-shrunk condition.

2. Concrete masonry units shall be manufactured by AirVol Block, San Luis Obispo, California, (805) 543-1314, or equal. All units must be approved by ARCHITECT in writing prior to delivery to the job site.

   a. Split Face Wainscot: Color 403-B, standard split-face texture and finish.

   b. Wainscot Cap: Color 403-C, precision block, shape as indicated on construction drawings.

   c. Honed or Burnished: Color 402-A, with honed face as approved by ARCHITECT.

3. Provide special units required by the Drawings, corner, pilaster, lintels, bond beams, cap and jamb units.

4. Use formed "U" shaped units for reinforced masonry lintels.

5. Similar units shall be obtained from one Manufacturer to ensure even color and texture.

6. Units shall be sound and free of cracks or other defects that would interfere with the proper placing of the units or impair the strength or permanence of the construction. Minor cracks or defects incidental to the usual method of manufacture, or minor chipping resulting from customary methods of handling in shipment and delivery, shall not be deemed grounds for rejection except that not more than 5 percent of a shipment shall contain chips larger than 1-in from any edge or corner on the faces.

7. Provide UL approved units where required for fire-rated construction where designated.

8. Masonry units shall have integral colored pigment and integral water repellant, as specified below, added during manufacture. Amount used shall be as recommended by manufacturer, and as submitted and approved by the ENGINEER.

9. Integral water repellant shall be a liquid polymeric admixture resistant to water penetration with a class E rating in accordance with ASTM E514 and shall be: Dry-Block Water Repellant Admixture by W.R. Grace & Company, Connecticut; Rheopel Plus by BASF Construction Chemicals, Cleveland, Ohio; or approved equal. Integral water repellant shall be compatible with the water repellant admixture specified in Section 04070 and the externally applied masonry water repellant specified herein.

10. Externally applied masonry water repellant shall be Infiniseal DB by Grace Construction Products, Cambridge, MA; Enviroseal PBT by BASF Construction Chemicals, Cleveland, OH; or approved equal. Masonry water repellant shall be compatible with the water repellant mortar and masonry unit admixtures specified herein.

PART 3 EXECUTION

3.01 PREPARATION

A. Before beginning masonry construction, verify that tolerances of supporting members are within allowable limits, and that any required reinforcing dowels have been placed in accordance with the requirements of the Drawings.

1. Bearing surface for masonry shall be such that the thickness of the initial bed joint shall be not less than 1/4-in nor more than 3/4-in in thickness.

B. Before laying masonry, remove laitance, loose aggregate, or anything else that would interfere with bond between the mortar and substrate.

3.02 FIELD QUALITY CONTROL

A. Sample Panel: Before masonry work is begun, provide a sample panel for each work crew for the ENGINEER's or ARCHITECT's approval. Each panel shall be approximately 6-ft long by 4-ft high, and of the same construction as the walls shown for the buildings. One face shall show the workmanship, coursing, bond, thickness, and tooling of joints, range of color and texture of the masonry, and the color of the mortar, all of which shall be as specified. Include bond beam, half-blocks, and other special units in these sample panels. The accepted panels shall form the standard for acceptable finished work on the project. The panels shall be erected in locations as designated by the ENGINEER and, when directed, shall be completely removed from the respective job site.

B. The CONTRACTOR shall test for material compression strength as follows. Compression strength of masonry in each wythe shall equal or exceed the specified value of f'm.

1. Prior to construction, perform the following tests using samples of materials that will be incorporated in the work.

a. One prism test consisting of three test specimens. Construct and test prisms in accordance with ASTM C1314.

2. During construction, perform one prism test consisting of three test specimens for each building. Construct and test prisms in accordance with ASTM C1314.

3.03 MASONRY - INSTALLATION

A. Cold Weather Construction. When the ambient temperature or the temperature of masonry units falls below 40^{o}F, conform to approved cold weather construction procedures. Provide cold weather heating and protection for both mortar and grout.

B. Hot Weather Construction. Where the ambient temperature exceeds 100^{o}F or 90^{o}F with a wind velocity greater than 8 mph, conform to approved hot weather construction procedures.

C. Wetting Masonry Units

1. Do not wet concrete masonry units before laying unless prior approval is obtained from the ENGINEER.

D. Masonry units shall be laid in running bond. Placing of mortar and units shall conform to ACI 530.1. Tool joints dense and neat.

E. Sizes shall be as specified and called for on the Drawings. Where "soaps" and "splits" are used, the space between these members and the backup material shall be slushed full of mortar.

F. Joints of all masonry shall be tooled in accordance with the following:

1. Wait until unit mortar is thumbprint hard before tooling joint. This may require as much as 3 hours in the shade and 1 hour in the sun.

2. The required personnel shall be kept on the job after hours, if necessary, to properly tool joints.

3. Both vertical and horizontal joints shall be maintained uniform in spacing.

4. Joints for all types of CMU shall be 3/8-in and concave.

G. Install all frames required to be set in masonry, set masonry tightly against frames, build in all frame anchors, and fill frames with mortar.

H. Control joints shall be installed as detailed on the Drawings. The maximum length, horizontally, between vertical control joints shall be 30-feet, but joints shall be located only as shown or approved in writing. Joints shall be equal in width to the standard mortar joint. Extend control and expansion joints through bond beams and discontinue horizontal reinforcement across joint unless otherwise shown on the Drawings.

I. All masonry slots, chases, or openings required for the proper installation of the work of other Sections shall be constructed as indicated on the Drawings or in accordance with information furnished before the work is started at the points affected. No chase shall be cut into any wall constructed of hollow units after it is built, except as directed and approved by the ENGINEER.

J. Surfaces shall be brushed as work progresses and maintained as clean as is practicable. Protect sills, ledges, offsets, etc. from mortar droppings. Unfinished work shall be raked back where possible, and toothed only where acceptable to the ENGINEER. The top of partially completed work shall be covered at all times while work is not in progress. Before leaving fresh or unfinished work, walls shall be fully covered and protected against rain, wind, frost, or the elements. Covers of waterproof paper, tarpaulins, or other means acceptable to the ENGINEER, shall be draped over the wall, shall extend a minimum of 2-ft down both sides, and shall be firmly held in place.

K. Build in all miscellaneous items to be set in masonry for which placement is not specifically provided under separate Divisions, including reglets, lintels, ties, electrical panel boxes, process equipment, sleeves, vents, grilles, anchors, grounds, and exterior electric conduits and fixtures. Cooperate with other trades whose work is to be coordinated with the work under this Section.

1. Do not embed pipes or electrical conduits in masonry unless their location has been detailed on the structural drawings. Sleeves through masonry shall not be placed closer than 3 diameters, center to center, nor shall they be placed through reinforced courses or cells.

2. Do not place dissimilar metals in contact with each other.

3. Do not embed aluminum conduits, pipes, or accessories in masonry, grout, or mortar, unless they have been coated or covered with materials which will effectively prevent chemical reactions with cement or steel.

4. Do not insert through-wall flashing or other elements which stop bond in masonry joints unless approved by the ENGINEER.

L. All anchorage, attachment, and bonding devices shall be set so as to prevent slippage and shall be completely covered with mortar or grout.

M. All reinforcing for masonry shall be furnished and installed under Section 04080.

N. Furnish and place masonry lintels of the type and dimensions shown on the Drawings and specified. Extend lintels beyond the opening and firmly bed the bearing ends in mortar as shown on the Drawings.

O. Bed and grout items coming in contact with masonry where grouting is required, including, but not limited to, door bucks and frames set in masonry. Install all anchor bolts, base plates, and seats in masonry walls, and build in all items required for the completion of the building as they apply to masonry.

3.04 REINFORCED MASONRY

A. Install reinforcement of the type, size, and spacing and at locations as indicated on the Drawings and specified in Section 04080.

3.05 GROUTING

A. General

1. Walls shall be solid grouted as indicated on the Drawings. Grouting is specified in Section 04070.

3.06 REPAIR, POINTING, AND FINAL CLEANING

A. Exposed masonry shall be protected against staining by wall coverings, and excess mortar shall be wiped off the surface as the work progresses to reduce need for cleaning at completion of the work.

B. Where ordered, remove masonry units which are loose, chipped, broken, stained, or otherwise damaged, and units which do not match adjoining units and install new units in fresh mortar or grout, pointed to eliminate, as approved by the ENGINEER, evidence of replacement.

C. Pointing

1. During the tooling of joints, except for weep holes, enlarge any voids or holes, and completely fill with mortar matching the color of the surrounding work as approved by

the ENGINEER and tool to match. Point-up all joints at corners, openings and adjacent work to provide a neat, uniform appearance and properly prepare joints for application of sealants where required.

2. Before final cleaning, repoint all unsatisfactory joints as specified above and as required by the ENGINEER.

D. Final Cleaning of Masonry

1. After mortar has thoroughly set and cured (three weeks minimum during the summer; five weeks minimum during the winter), a sample wall area (approximately 20-ft^2), shall be cleaned, with an approved commercial masonry cleaner, diluted and mixed with potable water as recommended by the manufacturer and as approved. The sample area may be the sample wall panel specified above or an area in the finish work as approved by the ENGINEER.

2. The ENGINEER's acceptance of sample cleaning shall be obtained before proceeding to clean remainder of masonry work. A minimum of one week of dry weather is required to evaluate effectiveness of cleaning and effect on masonry and mortar. Upon acceptance by the ENGINEER, all masonry shall be cleaned by the same method to the satisfaction of the ENGINEER.

3. Acid solutions shall not be used for cleaning any CMU. Upon completion of the work, all surfaces of CMU shall be washed with soap powder and warm water, applied with a scrubbing brush, and then rinsed thoroughly with clear water. Other cleaning methods may be ordered to obtain required appearance.

4. Masonry areas not satisfactorily cleaned will be ordered to be replaced at no extra cost to the OWNER.

3.07 MASONRY WATER REPELLANT

A. Masonry water repellant shall be applied to any exterior (exposed to outdoor weather) surface only after joints have been caulked and properly cured. Surfaces shall be clean and free from excess dust. New masonry surfaces shall be allowed to cure 30 days prior to application. Surfaces shall receive two complete coats at rates recommended by the manufacturer. The complete installation shall be in strict compliance with the manufacturer’s recommendations.

END OF SECTION

Division 5 Metals

SECTION 05500

METAL FABRICATIONS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Anchors, bolts, and fastening devices.
2. Prefabricated access hatches.
3. Miscellaneous steel.
4. Miscellaneous stainless steel.
5. Miscellaneous aluminum.

B. Related Sections. See Related Sections for additional requirements applicable to this Section (typical).

1. Section 03250 – Concrete Joints and Joint Accessories.
2. Section 03300 – Cast-in-Place Concrete.
3. Section 04220 – Concrete Masonry Units and Masonry Assemblies.
4. Section 09902 – Painting.
5. Section 10200 – Louvers and Vents.

1.02 REFERENCES

A. Aluminum Association (AA):

1. ASD-1 Aluminum Standards and Data.
2. Specifications for Aluminum Structures.

B. American Institute of Steel Construction (AISC):

1. Steel Construction Manual – 13th Edition.

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

1. ASTM A36 - Standard Specification for Carbon Structural Steel.

2. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

3. ASTM A108 - Standard Specification for Steel Bars, Carbon, Cold Finished, Standard Quality.

4. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

5. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

6. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.

7. ASTM A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.

8. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.

9. ASTM A283 - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

10. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 Psi Tensile Strength.

11. ASTM A312 – Specification for Seamless and Welded Austenitic Stainless Steel Pipe.

12. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

13. ASTM A366 - Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.

14. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

15. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.

16. ASTM A992 – Standard Specification for Structural Steel Shapes.

17. ASTM F436 - Standard Specification for Hardened Steel Washers.

18. ASTM F594 - Standard Specification for Stainless Steel Nuts.

19. ASTM F1554 – Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

D. American National Standards Institute (ANSI):

1. ANSI B18.22.1 - Plain Washers.

E. American Welding Society (AWS):

1. AWS D1.1 - Structural Welding Code – Steel.

2. AWS D1.2 - Structural Welding Code – Aluminum.

3. AWS D1.6 - Structural Welding Code - Stainless Steel.

4. AWS A2.0 - Standard Welding Symbols.

F. Society for Protective Coatings (SSPC):

1. SSPC SP-1 - Surface Preparation Specification No. 1 Solvent Cleaning.

2. SSPC SP-2 - Surface Preparation Specification No. 2 Hand Tool Cleaning.

3. SSPC SP-3 - Surface Preparation Specification No. 3 Power Tool Cleaning.

4. SSPC SP-6 - Surface Preparation Specification No. 6 Commercial Blast Cleaning.

5. SSPC SP-10 - Surface Preparation Specification No. 10 Near-White Blast Cleaning.

1.03 SUBMITTALS

A. Prior to fabrication, submit to the ENGINEER, in accordance with Section 01300, shop drawings, erection or setting drawings, product data, etc, showing methods of assembly, anchorage and connection to other members. Indicate welded connections in accordance with AWS A2.0. Shop drawings are required for all items included under this Section.

B. Submit samples as requested by the ENGINEER during the course of construction.

1.04 QUALITY ASSURANCE

A. Coordinate completely the work of this Section with the work of other Sections. Verify at the site both the dimensions and work of other trades adjoining items of work before fabrication and installation of the items specified.

B. Furnish to the pertinent trades all items that are to be built into the work of other Sections.

C. Field welding shall be done by certified welders and shall be in accordance with the appropriate AWS Specification.

1. Qualify welders in accordance with the appropriate AWS for each process, position, and joint configuration.

2. WPS's for each joint type shall indicate proper AWS qualification and be available where welding is performed.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver items to be incorporated into the work of other trades in sufficient time to be checked prior to installation.

B. Delivery anchorage devices with setting drawings, templates and instructions for installation.

C. Store delivered items off the ground and protected from dirt and weather.

D. Repair items which have become damaged or corroded to the satisfaction of the ENGINEER prior to incorporating them into the work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel

1. Structural steel wide flange shapes: ASTM A992.

2. Other structural steel shapes, plates, bars and rods: ASTM A36.

3. Steel sheets: ASTM A366.

4. Welded and seamless steel pipe: ASTM A53, Type S, Grade B Schedule 40. Use standard malleable iron fittings, galvanized for exterior work.

5. Welded and seamless rectangular steel tubing: ASTM A500, Grade B.

6. Cast-in anchor bolts: ASTM F1554, Grade 36.

7. High strength bolts, nuts and washers for structural steel:

a. Elevated temperature exposures: ASTM A325, Type I.

b. General application: ASTM A325, Type I or II.

8. Headed Anchor Studs: Nelson Type H4L or S3L by Nelson Stud Welding Company or equal.

9. Welding Materials: AWS D1.1 with a minimum strength of 70 ksi.

10. Galvanizing:

a. General: ASTM A123.

b. Hardware: ASTM A153.

c. Assembled steel products: ASTM A123.

11. Shop and Touch-up Primer: SSPC Paint 15 Type I red oxide.

B. Stainless Steel

1. Plates, bars and structural shapes:

a. Exterior, submerged or industrial use: ASTM A167, Type 316.

b. Interior and architectural use: ASTM A167, Type 304.

2. Pipes: ASTM A312.

3. Bolts, nuts and washers ASTM: A276, Type 316 or Type 304.

C. Aluminum Framing

1. Aluminum structural shapes and plates: Alloy 6061-T6.

2. Extruded aluminum pipe: Alloy 6063-T6.

3. Stainless steel fasteners: ASTM A276, Type 316 or Type 304.

2.02 ANCHORS, BOLTS AND FASTENING DEVICES

A. Furnish anchors, bolts, fasteners, etc., as necessary for installation of the work or for securing the work of other Sections to in-place construction.

B. Unless otherwise noted, bolts for the connection of carbon steel or iron shall be steel machine bolts; bolts for the connection of galvanized steel or iron shall be galvanized steel or stainless steel machine bolts; and bolts for the connection of aluminum or stainless steel shall be stainless steel machine bolts. Attach aluminum or stainless steel to concrete or masonry by means of stainless steel anchors.

C. Bolt heads and nuts shall be hex type unless noted otherwise.

D. Cast-in anchors shall conform to the requirements of ASTM F1554, Grade 36 unless otherwise noted.

E. For structural purposes, unless otherwise noted, post-installed anchors shall be adhesive type or expansion type anchor bolts. Post-installed anchors shall have current ICC Evaluation Service Reports.

1. Adhesive anchors and dowels shall be a two-part stud and cartridge resin anchoring system. Stud assembly spacing and minimum embedment shall be as shown on the Drawings. The assembly shall include all-thread anchor rod with nut and washer, or deformed reinforcing steel complying with the requirements of Section 03200. Provide manufacturer's recommended drive units and adaptors for installing studs. Install anchors in full compliance with the manufacturer's recommendations. Adhesive anchors for use in concrete shall be Simpson SET-XP Epoxy Adhesive Anchors by Simpson Strong-Tie Company, Inc., Pleasanton, CA; Powers PE1000+ Epoxy Adhesive Anchor System by Powers Fasteners, Inc., Brewster, NY, or approved equal. Adhesive anchors for use in grouted masonry shall be Simpson SET Adhesive Anchor Systems by Simpson Strong-Tie Company, Inc., or approved equal.

2. Expansion anchors shall be drilled-in wedge type anchors of the sizes noted on the Drawings complete with nuts and washers. Unless otherwise noted, provide zinc plated carbon steel anchors. Stainless steel anchors, where required shall be all AISI Type 316 construction. When the length or embedment of the bolt is not noted on the Drawings, provide length sufficient to place the wedge and expansion sleeve portion of the bolt at least one inch behind the reinforcing steel within the concrete. Install anchors in full compliance behind the reinforcing steel within the concrete. Expansion anchors for use in concrete shall be Redhead Trubolt + Wedge Anchor by ITW Red Head, Addison, Illinois; or approved equal. Expansion anchors shall not be used for anchorage into masonry.

3. Headed anchor studs shall be flux ended, welded to plates or other embeds as shown on the Drawings. Studs shall be made from cold drawn steel Grades C-1010 through C-1020 per ASTM A108 and shall be welded per the manufacturer's recommendations. Headed anchor studs shall be Nelson Stud Welding Company, Loraine, OH - Type H4L or S3L, or equal.

2.03 PREFABRICATED ACCESS HATCHES

A. Prefabricated access hatches shall be a flush type mounted on a concrete slab with single or double leaf doors as indicated on the drawings.

B. Hatch door shall be a 1/4"-in minimum Type 316 stainless steel checkered plate with welded stiffeners as necessary. Hatches shall have a 1/4-in stainless steel channel frame with a perimeter anchor flange or strap anchors for concrete embedment around the perimeter. Hardware shall be Type 316 stainless steel.

C. Hatches shall be watertight and shall have a 1-1/2-in drainage coupling connect to the channel frame.

D. The door shall be designed to withstand H-20 wheel load.

E. Door shall open to 90 degrees and shall have a spring operator with automatic hold-open arm with release handle.

F. Provide a recessed hasp for a padlock that is covered by a hinged lid flush with the surface.

G. Access hatches shall be Type J or Type JD stainless steel hatches by Bilco Company, New Haven, CT, or equal.

2.04 FABRICATION

A. Form all miscellaneous metal work true to detail, with clean, straight, sharply defined profiles, and smooth surfaces of uniform color and texture. Provide fabrications free from defects impairing strength or durability. Drill or punch holes and smooth edges. Ease exposed edges to a small, uniform radius. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

B. Supply components required for anchorage of fabrications. Connections and accessories shall be of sufficient strength to safely withstand stresses and strains to which they will be subjected. Steel accessories and connections to steel or cast iron shall be steel, unless otherwise specified. Threaded connections shall be made so that the threads are concealed by fitting.

C. Welded joints shall be rigid and continuously welded or spot welded as specified or shown. Dress the face of welds flush and smooth. Continuously weld and grind smooth welds that will be exposed. Exposed joints shall be close fitting and jointed where least conspicuous. Conceal fastenings where practical. Punch or drill for temporary field connections and for attachment of the work of other trades.

D. Welding of parts shall be in compliance with the latest edition of the AWS structural welding code for steel (D1.1); aluminum (D1.2) or stainless steel (D1.6) as appropriate, and shall only be done where shown, specified, or permitted by the ENGINEER. Welding shall be performed only by welders certified to perform the required welding in compliance with the requirements of the AWS Code. Component parts of built-up members to be welded shall be adequately supported and clamped or held by other adequate means to hold the parts in proper relation for welding.

E. Castings shall be of good quality, strong, tough, even-grained, smooth, free from scale, lumps, blisters, sand holes and defects of any kind which render them unfit for the service for which they are intended. Thoroughly clean castings. Castings may be subjected to a hammer inspection in the field by the ENGINEER. All finished surfaces shown on the Drawings and/or specified herein shall be machined to a true plan surface allowing pieces to seat at all points without rocking. Make allowances in the patterns so that thicknesses specified or shown will not be reduced in obtaining finished surfaces. Castings will not be acceptable if the actual weight is less than 95 percent of the theoretical weight computed from the dimensions shown. Provide facilities for weighing castings in the presence of the ENGINEER and show true weights, certified by the supplier.

F. Shop painting will not be required for galvanized metal, stainless steel, aluminum, copper, brass and bronze unless specifically specified.

G. Thoroughly clean steel fabrications of all loose mill scale, rust, grease or oil, moisture, dirt, or other foreign matter.

1. Remove scale, rust and other deleterious materials before shop coat of paint is applied.

2. Clean off heavy rust and loose mill scale in accordance with SSPC SP-2, SSPC SP-3 or SSPC SP-6.

3. Remove oil, grease and similar contaminants in accordance with SSPC SP-1.

H. Fabricate miscellaneous aluminum shapes and plates as shown. Furnish welded and mitered angle frames and other fabrications complete with welded anchors attached. Structural shapes and extruded items shall comply with the dimensions on the Drawings within the tolerances published by the Aluminum Association. Weld aluminum work on the unexposed side when possible in order to prevent pitting or discoloration of exposed aluminum surfaces.

2.05 FINISHES

A. Steel

1. Items in areas which are not exposed to weather or moisture, shall have exposed surfaces painted with a shop coat of primer compatible with the finish coatings specified in Section 09902, after fabrication but before shipping. Apply two shop coats of primer to surfaces that will be inaccessible after erection.

a. Remove scale, rust and other deleterious material before shop coat of paint is applied. Clean off heavy rust and loose mill scale in accordance with SSPC-2, SSPC-3 or SSPC-6. Remove oil, grease and similar contaminants in accordance with SSPC SP-1.

b. Immediately after surface preparation, brush or spray on metal primer paint, applied in accordance with manufacturer's instructions and at rate to provide a uniform dry film thickness of 3.0 mils per coat applied. Use painting methods which will result in full coverage of joints, corner, edges and all exposed surfaces.

c. As soon as possible after erection, touch up any scraped, abraded or unpainted surfaces using primer as specified for shop coats.

2. Items exposed to weather, submerged in water or subject to splashing, or located in corrosive environments shall be hot dip galvanized after fabrication unless otherwise noted on the Drawings or specified.

a. Following all manufacturing operations, items to be galvanized shall be thoroughly cleaned, pickled, fluxed and completely immersed in a bath of molten zinc. The resulting coating shall be adherent and shall be the normal coating to be obtained by immersing the items in a bath of molten

zinc and allowing them to remain in the batch until their temperature becomes the same as the bath. Coating shall be not less than 2 oz/sq ft of surface.

b. Where field welding of galvanized material is necessary, welds shall be wire brushed clean and immediately regalvanized in the field using galvanizing compound or coating. Materials shall comply with local regulations controlling use of volatile organic compounds.

B. Stainless Steel

1. Mill Finish

C. Aluminum

1. All exposed aluminum surfaces shall have fabricator's standard mill finish unless otherwise specified.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Install all items finished except items to be embedded in concrete which shall be installed under Division 3.

B. Items to be attached to concrete after such work is completed shall be installed in compliance with the details shown. Furnish to appropriate trades all anchors, sockets, or fastenings required for securing work to other construction.

C. Set metal work level, true to line and plumb as indicated.

D. Weld field connections and grind smooth where practicable. Clean and strip primed, steel items to bare metal where site welding is required. Conceal fastenings where practicable.

1. Weld only in accordance with approved WPS's which are to be available to welders and inspectors during the production process.

E. Secure metal to wood with lag screws or bolts, of adequate size, with appropriate washers and nuts.

F. Touch-up abrasions to finish or primer coatings immediately after erection and prior to both final coating and final acceptance.

G. Break contact between dissimilar metals as shown on the Drawings or as specified in Paragraph 3.01H below.

H. Field-apply coatings for installation of metal fabrications according to the following schedule. (For embedded items, coat the embed.)

1. All steel surfaces in contact with exposed concrete shall receive a protective coating of an approved heavy bitumastic troweling mastic applied in compliance with the manufacturer's instructions prior to installation.

2. Where aluminum contacts a dissimilar metal, apply a heavy brush coat of zinc-chromate primer followed by two coats of aluminum metal and masonry paint to the dissimilar metal.

3. Where aluminum contacts concrete, apply a heavy coat of alkali resistant bituminous paint to the surface of the aluminum.

4. Where aluminum contacts wood, apply two coats of aluminum metal and masonry paint to the wood.

3.02 FIELD QUALITY CONTROL - INSPECTION

A. Notify the ENGINEER in writing 4 working days in advance of high strength bolting or field welding operations.

B. High strength bolting will be inspected visually. All high strength bolts shall have the turned portion marked with reference to the steel being connected after the nut has been made snug and prior to final tightening. Retighten rejected bolts or remove and provide new bolts. In cases of disputed bolt installations, the bolts in question shall be checked using a calibrated wrench certified by an independent testing laboratory approved by the ENGINEER. The certification shall be at no additional cost to the OWNER.

C. Field welding will be inspected visually and by non-destructive testing by AWS certified welding inspectors provided by an Independent Testing Agency. This work will be paid for by the OWNER. Testing procedures will include ultrasonic testing. CONTRACTOR shall comply with all requests of inspectors to correct deficiencies.

D. The fact that steel work has been accepted at the shop and mill will not prevent its final rejection at the site, before or after erection, if it is found to be defective.

E. Remove rejected steel work from the site within 10 working days after notification of rejection.

END OF SECTION

Division 6 Woods and Plastics

SECTION 06100

ROUGH CARPENTRY

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Labor, materials, equipment, and incidentals necessary to install all items of carpentry work complete as shown on the Drawings and as specified herein including nailers, grounds, and cants.

2. The following list of work items is intended only as a guide to that required, the full scope being determined by the actual job conditions:

a. Rough carpentry and framing, as indicated or required, including grounds, blocking, rough frames, nailing strips, and strapping.

b. Roof sheathing.

c. Rough hardware, anchors, and bolts not specifically included elsewhere.

d. Temporary closures.

e. Installation of metal doors.

f. Installation of louvers.

B. Related Sections:

1. Section 06170 – Wood Trusses

2. Section 07316 – Roof Tiles

1.02 REFERENCES

A. American Lumber Standard Committee (ALSC)

1. National Grading Rule for Dimensional Lumber

B. American Plywood Association (APA)

1. Standards

C. American Society for Testing and Standard Materials (ASTM)

1. ASTM E-96-90 - Standard Test Methods for Water Transmission of Materials

2. ASTM E-1677-95 - Standard Specification for an Air Retarder (AR) Material or System for Low-Rise Framed Building Walls

3. ASTM A153-04 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

4. ASTM C 1289 - Standard Specification For Faced Rigid board type roof insulation(s) for thermal protection as part of roofing assemblies.

5. AATCC-127 - Hydrostatic Head Test

D. American Wood Preservers Association (AWPA)

1. Standards

E. California State Insulation Quality Standards and Title 25 Foam Flammability Criteria.

F. California Building Standards Commission:

1. California Building Code (CBC) - 2010 Edition

G. National Fire Protection Association (NFPA)

H. National Lumber Grades Authority (NLGA)

I. Occupational Safety and Health Act (OSHA)

J. Southern Pine Inspection Bureau

1. Grading Rules

K. Western Wood Products Association

1. Grading Rules

L. Western Red Cedar Lumber Association (WRCLA)

M. Factory Mutual (FM)

1. FM 4470 – Approval Standard for Class 1 Roof Covers

N. Underwriters Laboratories, Inc.

1. UL 790 - Standard Test Methods for Fire Tests of Roof Coverings

2. UL 1256 - Fire Test of Roof Deck Constructions

O. Where reference is made to any of the above, the revision in effect at the time of bid opening shall apply, unless otherwise noted.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300:

1. Product data showing materials for:

a. Roof sheathing, rough carpentry framing members, and other roofing products.

b. Roof carpentry connectors and fasteners.

2. Shop drawings showing layout of roof sheathing, rough carpentry framing, connectors and fasteners.

1.04 QUALITY ASSURANCE

A. The roofing products, materials, and assemblies, including connectors and fasteners, proposed for the work of this Section, shall comply with the Code and shall be installed by a qualified roofing applicator.

B. Qualifications of Roofing Applicator:

1. The entire roofing system shall be installed by a licensed, authorized roofing subcontractor approved by the manufacturer providing the warranty. The roofing subcontractor shall be trained and qualified to install the roofing system in strict accordance with the manufacturer's details, specifications, and written recommendations and shall have at least 5 years experience installing the systems specified herein.

C. Grade and treatment markings shall appear on lumber with seal and stamp of the inspection agency or bureau having jurisdiction.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store lumber and plywood to prevent damage. Stack lumber off the ground in a manner to ensure ventilation and protection from the weather.

PART 2 PRODUCTS

2.01 MATERIALS

A. All lumber shall be of sound stock, delivered dry, and shall be fully protected at all times from injury and dampness. Split, broken, or otherwise damaged pieces will not be allowed in the work.

B. Exterior exposed closures shall be kiln dried, clear, all heart, 100 percent vertical grain redwood.

C. Lumber for blocking, bracing, grounds, and nailers shall be S4S, Douglas Fir-Larch No. 1 grade, with moisture content of not more than 19 percent at the time of placing.

D. Wood members, other than redwood, that will contact masonry or concrete or be incorporated in the permanent construction shall be pressure treated with a waterborne preservative in accordance with AWPA. Assume Use Category 3B for preservative selection. Minimum net retention of solid preservative shall be 0.40-lb/cu-ft.

E. All treatment shall be performed in accordance with the requirements of the Standard Specifications of the American Wood Preservers Association for treating wood. Apply a heavy coat of the same preservative used in treating to all surfaces cut after treatment.

F. Nails, where sizes are not indicated or specified, shall be of suitable size and number to securely fasten and hold members in place. Nails or bolts in contact with pressure treated wood shall be galvanized per ASTM A153.

G. Roof sheathing shall be APA-rated CDX sheathing plywood, exterior glue, and thickness as shown on Drawings.

H. Metal connectors shall be Simpson Strong-Tie or equal and shall be galvanized per ASTM A153.

I. Anchor and fasteners shall be as follows:

1. Bolts, nuts, and studs shall conform to the requirements of Section 05500.

2. Nails and staples shall conform to ASTM F1667. Nails shall be galvanized steel or stainless steel. Nails used for exterior (exposed to weather) shall be stainless steel.

3. Wood screws shall be galvanized where exposed to view or to weather.

J. Lumber for protection and temporary supports shall be the size and grades to meet the applicable requirements of OSHA.

PART 3 EXECUTION

3.01 INSTALLATION

A. All carpentry shall be accurately cut, fitted, and installed as detailed on the Drawings.

B. Anchors shall be installed, where indicated or required, to anchor carpentry or other items securely to masonry or concrete.

C. Forms for structural concrete work shall be as specified under Division 3. Provide all other miscellaneous wood formwork as may be required for the completion of the work.

D. Temporary wood doors and cloth or transparent plastic covered frames shall be provided for exterior wall openings during construction.

E. Provide wood members in lengths as long as practicable.

F. For bolted work, bore holes 1/16 inch to 1/32 inch larger than bolts and install bolts with washers between bolt head and wood surface. Make tight, at time of installation, bolts and lag screws and retighten just before being enclosed by other work or at completion of work. Length of bolts shall be length to suit the condition. Embed bolts in solid grout masonry where possible and use post-installed anchors where not possible.

G. Use number and size of nails to achieve rigid connections and prevent splitting. Bore holes at least one drill size smaller than nails to prevent splitting if necessary.

H. Anchor nailers to adjacent construction with bolts a minimum of 7 bolt diameters from ends and at intervals not more than 48-in on center between.

I. Install project sign where directed by the ENGINEER. Sign shall remain in position for the duration of construction.

J. Install, maintain, and remove all staging for all trades required to reach all work.

K. Installation of doors and door hardware:

1. Doors and door hardware will be furnished under Division 8 and shall be installed under the work in this Section, except where specifically designated otherwise.

2. As soon as the hardware is delivered to the job site, receive, verify, and check each set and report any defect or shortage to the ENGINEER. Give notice to the hardware supplier for all such items that are defective or missing. Provide a receipt to the hardware supplier for all such items as are found to be correct.

3. Door hardware, after checking, shall be the responsibility of the CONTRACTOR until it is installed and the project is accepted in its entirety by the OWNER.

4. Hardware shall be attached and placed by skilled mechanics in accordance with approved hardware templates provided with the hardware and shall be accurately fitted and adjusted. Lever handles shall be kept covered with heavy cloth, and other hardware shall be protected from damage until final acceptance of the entire project by the OWNER.

5. For fire-rated doors, provide clearances complying with NFPA and local fire marshal's limitations.

6. Set each edge and joint of thresholds in a seal strip of polysulfide sealant. Set remainder of thresholds in stiff grout.

7. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Lubricate moving parts with type lubrication recommended by manufacturer (graphite-type if no other recommended). Replace units that cannot be adjusted and lubricated to operate freely and smoothly as intended for the application made.

8. Wherever hardware installation is made more than 1 month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy and make a final check and adjustment of all hardware items in such space or area. Clean and relubricate operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

L. At completion, remove all excess materials and all resultant debris from the operations of work of this Section. Leave work in neat, clean condition, satisfactory for receipt of other related items of work that are to be installed under other Sections.

END OF SECTION

SECTION 06170

WOOD TRUSSES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and design, fabricate and install wood trusses and all temporary and permanent bracing of wood trusses as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Rough Carpentry is included in Section 06100.

1.03 SUBMITTALS

A. Submit to the ENGINEER all submittals, in accordance with Section 01300.

B. Shop Drawings and Product Data

1. Shop and erection drawings showing all important details of trusses including truss spacing, configuration and span; size, species and grade of all wood members; location of all splices; bearing and anchorage details; and details of all joints including number, size and type of all connector plates. Also show locations of all required compression web bracing and other member bracing. Drawings for the trusses shall be stamped and sealed by a licensed professional civil or structural engineer registered in the State of California.

2. Descriptive literature, bulletins and/or catalogs of the trusses, including photographs from at least three similar projects.

3. Product certificate, signed by officer of fabricating firm, certifying that metal-plate-connected wood trusses supplied comply with specified requirements.

C. Samples

1. Submit representative samples for each element of the truss, including samples of top and bottom chords and metal connector plates.

2. The Engineer may reject any item which does not meet the standards of the representative tested or submitted samples.

D. Submit for review and the project record, complete structural calculations, accounting for all loadings specified herein and on the Contract Drawings. The design calculations shall be stamped and sealed by a licensed professional civil or structural engineer registered in the State of California, experienced and knowledgeable in prefabricated metal-plate connected wood trusses.

1.04 REFERENCE STANDARDS

A. National Forest Products Association (NFPA)

1. National Design Specification for Wood Construction

2. Design Values for Wood Construction

B. Truss Plate Institute (TPI)

1. BWT-76 - Commentary and Recommendations for Bracing Wood Trusses

2. HET-80 - Commentary and Recommendations for Handling and Erecting Wood Trusses

3. QST-88 - Quality Standard for Metal Connector Plate Manufacture

4. TPI-85 - Design Specification for Metal Plate Connected Wood Trusses

C. United States Department of Commerce, National Institute of Standards and Technology

1. PS 20-70 - American Softwood Lumber Standard

D. American Society of Civil Engineers (ASCE)

1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures

E. American Society for Testing and Materials (ASTM)

1. ASTM A153 - Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.

2. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs 60,000 psi Tensile Strength.

3. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.

4. ASTM A591 - Standard Specification for Steel Sheet Electrolytic Zinc-Coated for Light Coating Mass Applications.

5. ASTM A653 - Specifications for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process.

6. ASTM A792 - Standard Specification for Steel sheet 55 percent Aluminum-Zinc Alloy-Coated by the Hot Dip Process.

F. American National Standards Institute (ANSI)

1. ANSI B18.2.1 - Square and Hex Bolts and Screw Inch Series

2. ANSI B18.6.1 - Wood Screws (Inch Series)

G. California Building Standards Commission (CBSC)

1. California Building Code (CBC) - 2010 Edition.

H. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. The truss system shall be furnished by a single manufacturer who is fully experienced, reputable and qualified in the production of wood truss systems having at least five years experience with similar installations. Submit proof of experience listing projects completed in the previous five years. Manufacturer shall be a member of the Truss Plate Institute and participate in a recognized quality assurance program that involves inspection by SPIB; American Institute of Timber Construction; Timber Products Inspection, Inc.; Truss Plate Institute; or other independent inspection and testing agency acceptable to ENGINEER.

B. The manufacturer shall submit documentation describing quality control procedures and practices which shall be used in the fabrication of products for this project. These practices shall include component product documentation, on-going and final shop inspection reports.

C. Provide trusses engineered to support superimposed loads indicated, with design prepared and sealed by a licensed professional civil or structural engineer registered in the State of California.

D. All materials and workmanship under this Section shall be subject to inspection in the mill, shop or field by the ENGINEER, or by qualified inspectors selected by the ENGINEER and paid directly by the OWNER. All trusses shall be visually inspected.

1. However, such inspection, wherever conducted, shall not relieve the manufacturer of responsibility to provide inspection, testing and quality control and to furnish materials and workmanship in accordance with Contract requirements, nor shall inspector's acceptance of materials or workmanship prevent later rejection of same by OWNER or ENGINEER if defects are discovered.

2. The manufacturer shall give proper notice to inspection agencies designated by the ENGINEER and shall allow access and full facilities as required for this inspection.

1.06 DELIVERY, STORAGE AND HANDLING

A. Handle and store trusses with care and comply with TPI recommendations to avoid damage from bending, overturning or other cause.

B. Store all trusses in the yard or the field so as to limit lateral bending of members and prevent damage to joints. Band trusses with steel strapping. Protect from the elements with a waterproof covering, ventilated to avoid condensation.

C. Throughout all phases of construction, care shall be taken to avoid excessive lateral bending of the trusses which can cause joint and lumber damage.

PART 2 PRODUCTS

2.01 MATERIALS

A. Lumber: Provide dressed lumber S4S, grade marked, complying with PS 20-70, of species and grade included in the NFPA Specification. Species and grades of wood to be used in trusses shall be No. 1 Douglas Fir Larch minimum, subject to the restrictions and requirements stated elsewhere in this Section, and subject to requirements of the appropriate referenced specifications. Deviations from the specified species and grade of wood shall require written approval by the ENGINEER.

B. All lumber used for trusses shall be identified with a grade mark of the appropriate grading authority as determined by the NFPA "National Design Specification for Wood Construction."

C. No warped, bowed, split or otherwise structurally defective members shall be used.

D. Lumber used for bracing shall comply with the requirements of Section 06100.

E. Metal Connector Plates: Metals and thickness not less than thickness indicated below:

1. Hot-Dipped Galvanized Sheet Steel: Galvanized by hot-dip process to comply with ASTM A653, minimum coated metal thickness of 0.036-in.

2. Electrolytic Zinc-Coated Steel Sheet: ASTM A591, Coating Class C, with minimum structural quality equivalent to ASTM A653, Grade A, minimum coated metal thickness of 0.047-in.

3. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792, Coating Designation AZ 50, with structural quality equivalent to ASTM A653, Grade A, minimum coated metal thickness of 0.036-in.

F. Fasteners: Of number, size and type required that meet paragraph 2.02, and comply with the following requirements. Provide hot-dipped zinc-coated fasteners per ASTM A153 or AISI Type 304 stainless steel fasteners.

1. Nails, Wire, Brads and Staples: FS FF-N-105

2. Power Driven Fasteners: National Evaluation Report NER-272

3. Wood Screws: ANSI B18.6.1

4. Lag Bolts: ANSI B18.2.1

5. Bolts: Steel bolts complying with ASTM A307, Grade A; with ASTM A563 hex nuts and where indicated, flat washers.

G. Metal Framing Anchors: Provide metal framing anchors of type, size, metal, and finish indicated that comply with requirements specified including the following:

1. Current Evaluation/Research Reports: Provide products for which model code evaluation/research reports exist that are acceptable to authorities having jurisdiction and that evidence compliance of metal framing anchors for application indicated with the California Building Code.

2. Allowable Design Loads: As published by manufacturer and determined from empirical data or by rational engineering analysis and verified through comprehensive testing by a qualified independent testing laboratory.

3. Galvanized Steel Sheet: Zinc-coated by hot-dipped process to comply with ASTM A653.

2.02 DESIGN LOADS

A. The design of the wood trusses shall comply with the requirements of the 2010 California Building Code and the following minimum loads:

1. Dead Load - total superimposed dead load of 15 psf.

2. Roof Live Load - minimum 20 psf (unreducible).

3. Bottom chord shall be designed for 250 lb concentrated load at any location between panel points.

3. Wind Load

a. Basic wind speed is 85 mph

b. Importance factor is 1.15

c. Exposure category is D

d. Allowable stress design level axial tension or compression from an out-of-plane wall anchorage load transferred to the bottom chord of trusses at wall connections shall be 600 pounds per truss.

e. Provide bridging/bracing as necessary for uplift condition.

4. Earthquake Load

a. Axial tension or compression from an out-of-plane wall anchorage load transferred to the bottom chord of trusses at wall connections shall be 1500 pounds (allowable stress design level) per truss from (2) Simpson clips as shown on the drawing details. Trusses shall be designed for this allowable stress design level axial load in addition to the loads described above. Provide lateral buckling restraint as required.

PART 3 EXECUTION

3.01 DESIGN AND FABRICATION

A. Trusses shall be designed to safely carry the specified design loads over the spans shown on the Drawings without exceeding the allowable stresses in members or connections as stipulated in the appropriate referenced specification.

B. Truss design loads shall be as stated in PART 2, but shall not be less than TPI recommend minimum design loads (TPI "Design Specification for Metal Plate Connected Wood Trusses," Appendix A).

C. Trusses shall be fabricated with configuration shown on the Drawings, of an appropriate species and grade of wood, such that the allowable stresses are not exceeded. The Engineer may, at his discretion, approve other configurations. Sizes of web members shall not be less than nominal 2 x 4. Top and bottom chords shall be 2x6 minimum. Bottom chord must be 2-1/2 in. minimum width total, which may be accomplished using two 2x nominal members. Note that all truss material connected to CMU wall via Simpson A35 connectors shall be 5 in. minimum width.

D. Stresses in members and forces in connections shall be determined for design purposes by a rational analysis, in accordance with accepted engineering practice. The analysis shall include the effects of stresses due to local eccentricities in the joints, unless connections are detailed such that such eccentricities do not exist.

E. In general, analysis shall assume all compression and bending members to be unbraced unless special bracing is detailed or unless continuous bracing can reasonably be inferred from the Drawings, in accordance with accepted engineering practice. Location and types of all bracing required by analysis or assumed in design shall be indicated on the shop drawings.

F. Trusses shall be fabricated only from approved shop drawings. Sizes, configurations, connector plates and other materials shall be exactly as shown on approved shop drawings.

G. Fabricate and assemble trusses to provide units of configuration indicated, with closely fitted joints and connector plates on each face securely fastened to wood members. Members meeting at a joint shall be accurately cut and fit to bear wood to wood. Connector plates shall be undamaged, and shall be well embedded and accurately aligned so as not to introduce eccentricities into the joint, unless such eccentricities are accounted for in the analysis and design.

H. Splices shall be located only where indicated on approved shop drawings.

3.02 ERECTION AND BRACING

A. Erect all trusses plumb, straight and true, and located accurately in place as shown on the Drawings. Install such temporary bracing as required to keep trusses plumb and accurately aligned under the action of wind or other forces as may occur during construction. As a minimum, comply with TPI "Bracing Wood Trusses: Commentary and Recommendation." Such temporary bracing shall remain in place until all permanent bracing and sheathing is in place.

B. Attach trusses with standard metal hurricane anchors each end of each truss, unless other connection is required by the Drawings.

C. Install all permanent truss bracing called for in the Drawings, as well as any compression web, or other member bracing as may be required by the manufacturer in accordance with the design.

END OF SECTION

Division 7 Thermal and Moisture Protection

SECTION 07100

BITUMINOUS DAMP PROOFING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Cold-applied, asphalt emulsion damp proofing.

1.03 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of product specified, including data substantiating that materials comply with requirements for each damp proofing material specified. Include recommended method of application, recommended primer, number of coats, coverage or thickness, and recommended protection course.

1. Certification by damp proofing manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed bituminous damp proofing similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Single-Source Responsibility: Obtain primary damp proofing materials and primers from one source and by a single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

1.05 PROJECT CONDITIONS

A. Substrate: Proceed with damp proofing only after substrate construction and penetrating work have been completed.

B. Weather Limitations: Proceed with damp proofing only when existing and forecasted weather conditions will permit work to be performed according to manufacturer's recommendations and warranty requirements.

C. Ventilation: Provide adequate ventilation during application of damp proofing in enclosed spaces. Maintain ventilation until damp proofing has thoroughly cured.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cold-Applied, Asphalt Emulsion Damp proofing:

a. ChemRex, Inc.; Sonneborn Building Products Div.
b. Euclid Chemical Co.
c. Karnak Chemical Corporation.
d. Koppers Industries, Inc.
e. Meadows: W.R. Meadows, Inc.

2.02 BITUMINOUS DAMP PROOFING

A. General: Provide products recommended by manufacturer for designated application.

1. Odor Elimination: For interior and concealed-in-wall uses, provide type of bituminous damp proofing material warranted by manufacturer to be substantially odor free after drying for 24 hours under normal conditions.

B. Cold-Applied, Asphalt Emulsion Damp proofing: Asphalt-based emulsions recommended by the manufacturer for damp proofing use when applied according to the manufacturer's instructions.

1. Trowel Grade: Emulsified asphalt mastic, prepared with mineral- colloid emulsifying agents suitable for application in a relatively thick film, complying with ASTM D 1187, Type I.

2. Semimastic Grade: Emulsified asphalt semimastic, prepared with mineral-colloid emulsifying agents and containing fibers other than asbestos, complying with ASTM D 1227, Type III or IV.

3. Spray Grade: Emulsified asphalt, prepared with mineral-colloid emulsifying agents without fibrous reinforcement, complying with ASTM D 1227, Type III.

2.03 MISCELLANEOUS MATERIALS

A. Primer: Asphalt primer complying with ASTM D 41, for asphalt-based damp proofing.

B. Protection Course, Board Type: Premolded, 1/8-inch- (3-mm-) thick, multi-ply, semirigid board, consisting of a mineral-stabilized asphalt core sandwiched between layers of asphalt-saturated felt, and faced on one side with polyethylene film.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Protection Course II; ChemRex, Inc.; Sonneborn Building Products Div.
b. Bituthene Asphaltic Hardboard; Grace: W.R. Grace & Co.
c. PC-2 Protection Course; Meadows: W.R. Meadows, Inc.

C. Protection Course, Roll Roofing Type: Smooth-surfaced roll roofing, complying with ASTM D 224, Type II.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean substrate of projections and substances detrimental to work; comply with recommendations of prime materials manufacturer.

B. Install cant strips and similar accessories as shown and as recommended by prime materials manufacturer even though not shown.

C. Fill voids, seal joints, and apply bond breakers, if any, as recommended by prime materials manufacturer, with particular attention at construction joints.

D. Install separate flashings and corner protection stripping, as recommended by prime materials manufacturer, where indicated to precede application of damp proofing. Comply with details shown and with manufacturer's recommendations. Pay particular attention to requirements at building expansion joints, if any.

E. Prime substrate as recommended by prime materials manufacturer.

F. Protection of Other Work: Do not allow liquid and mastic compounds to enter and clog drains and conductors. Prevent spillage and migration onto other surfaces of work by masking or otherwise protecting adjoining work.

3.02 INSTALLATION, GENERAL

A. Comply with manufacturer's recommendations except where more stringent requirements are indicated and where Project conditions require extra precautions to ensure satisfactory performance of work.

B. Application: Apply damp proofing to the following surfaces.

1. Exterior, below-grade surfaces of exterior concrete or masonry walls in contact with earth or other backfill and where space is enclosed on opposite side.

2. Back side of concrete or masonry retaining walls to prevent percolating of water through the wall or facing.

3. Where indicated on the Drawings.

C. Hot-Applied Asphalt Damp proofing: Apply on exterior surfaces only.

D. Cold-Applied Asphalt Damp proofing: For exterior surfaces, provide either emulsified or cut-back, asphalt damp proofing materials, at Contractor's option. For interior surfaces, provide only emulsified asphalt materials.

E. Reinforcement: At changes in plane or where otherwise shown as "reinforced," install lapped course of glass fabric in first coat of damp proofing compound before it thickens.

F. Bituminous Cant Strips: Install 2-by-2-inch (50-by-50-mm) cant strip of bituminous grout at base of vertical damp proofing where it meets horizontal surface.

G. Apply vertical damp proofing down walls from finished-grade line to top of footing, extend over top of footing, and down a minimum of 6 inches (150 mm) over outside face of footing. Extend 12 inches (300 mm) onto intersecting walls and footings, but do not extend onto surfaces exposed to view when the Project is completed.

3.03 COLD-APPLIED, ASPHALT EMULSION DAMP PROOFING

A. Spray Grade: Brush or spray apply a coat of asphalt emulsion damp proofing at a rate of 1.5 to 2.5 gal./100 sq. ft. (0.6 to 1 L/sq. m), depending on substrate texture, to produce a uniform, dry-film thickness of not less than 15 mils (0.4 mm). Apply in 2 coats, if necessary, to obtain required thickness, allowing time for complete drying between coats.

B. Semimastic Grade: Brush or spray apply a coat of asphalt emulsion damp proofing at a rate of 5 gal./100 sq. ft. (2 L/sq. m), to produce a uniform, dry-film thickness of not less than 30 mils (0.8 mm).

C. Trowel Grade: Trowel apply a coat of mastic asphalt emulsion damp proofing onto substrate at a minimum rate of 7 gal./100 sq. ft. (2.8 L/sq. m), to produce an average, dry-film thickness of 60 mils (1.5 mm) but not less than 30 mils (0.8 mm) at any point.

3.04 PROTECTION AND CLEANING

A. Protect exterior, below-grade damp proofing membrane from damage until backfill is completed. Remove overspray and spilled materials from surfaces not intended to receive damp proofing.

3.05 INSTALLATION OF PROTECTION COURSE

A. General: Install protection course of type indicated over completed-and-cured damp proofing treatment. Comply with damp proofing materials manufacturer's recommendations for method of support or attaching of protection materials. Support with spot application of trowel-grade mastic where not otherwise indicated.

END OF SECTION

SECTION 07210

BUILDING INSULATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Building insulation in batt form.

1.03 DEFINITIONS

A. Thermal Resistivity: Where the thermal resistivity of insulation products are designated by "r-values," ("rSI-values,") they represent the reciprocal of thermal conductivity (k-values). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch (25.4 mm) thick. Thermal resistivities are expressed by the temperature difference in degrees F (Kelvins) between the two exposed faces required to cause one BTU (one Watt) to flow through one square foot (one sq. m) per hour at mean temperatures indicated.

1.04 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of insulation product specified.

C. Product test reports from and based on tests performed by qualified independent testing laboratory evidencing compliance of insulation products with requirements including r-values (aged values for plastic foam insulations), fire performance characteristics, perm ratings, water absorption ratings, and other properties, based on comprehensive testing of current products.

1.05 QUALITY ASSURANCE

A. Fire Performance Characteristics: Provide insulation materials identical to those whose indicated fire performance characteristics have been determined per the ASTM test method indicated below, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing and inspecting organization.

1. Surface Burning Characteristic: ASTM E 84.

2. Fire Resistance Ratings: ASTM E 119.

3. Combustion Characteristics: ASTM E 136.

B. Single-Source Responsibility for Insulation Products: Obtain each type of building insulation from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide insulation products of one of the following:

1. Manufacturers of Glass or Slag Fiber Insulation:

a. CertainTeed Corp.

b. Manville: Building Insulations Div., Manville Sales Corp.

c. Owens/Corning Fiberglas Corp.

2.02 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.

1. Preformed Units: Sizes to fit applications indicated, selected from manufacturer's standard thicknesses, widths, and lengths.

B. Foil-faced Mineral Fiber Blanket/Batt Insulation: Thermal insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665 for Type III, Class A.

1. Mineral Fiber Type: Fibers manufactured from glass or slag.

2. Surface Burning Characteristics: Maximum flame spread and smoke developed values of 25 and 50, respectively.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions with Installer present, for compliance with requirements of the Sections in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation of insulation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's instructions applicable to products and application indicated. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with installation of insulation.

B. Extend insulation full thickness as indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections that interfere with placement.

C. Apply a single layer of insulation of required thickness, unless otherwise shown or required to make up total thickness.

3.03 INSTALLATION OF PERIMETER AND UNDER-SLAB INSULATION

A. On vertical surfaces, set units in adhesive applied in accordance with manufacturer's instructions. Use type of adhesive recommended by manufacturer of insulation.

3.04 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrate by method indicated, complying with manufacturer's recommendations. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Seal joints between closed-cell (nonbreathing) insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

3.05 PROTECTION

A. General: Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 07316

ROOF TILES

PART 1 GENERAL

1.01 WORK INCLUDED

Work includes, but is not necessarily limited to:

A. Barrel Clay roof tile system.

B. Flat Clay roof tile system.

C. Mortar set ridge and random tiles.

D. Booster tiles at starter course, hip, and ridge.

E. All attachments and accessories as required for a complete installation.

F. Underlayment and flashing as required.

G. Pre-finished metal bird stop at eave.

1.02 RELATED WORK DESCRIBED ELSEWHERE

A. Rough Carpentry is included in Section 06100.

B. Sheet Metal Flashing and Trim is included in Section 07620.

C. Roof Accessories is included in Section 07720.

D. Joint Sealants is included in Section 07900.

E. Paints and Coatings are included in Section 09902.

1.03 QUALITY ASSURANCE

A. Manufacturer – Roofing tiles to be installed per manufacturer's installation procedures.

B. Installer – Work to be performed only by workers with a minimum of five (5) years' experience and specially trained in the techniques of laying roof tile, and who are completely familiar with the published recommendations of the manufacturer of the roofing tile material being used.

C. Pre-installation conference to be held prior to the start of work.

1.04 SUBMITTALS

A. Product Data – Submit material specifications, manufacturer's installation, and maintenance instructions under provisions of Section 01300.

B. Samples under provisions of Section 01300 to include:

1. Submit three (3) sample-roofing tiles to Architect for approval of color range representing the lightest and darkest in the range; all roofing tiles subsequently installed shall be within this color range.

C. Shop drawing under provisions of Section 01300.

1. Ridge, valley, and eave details

2. Attachment details

1.05 PRODUCT HANDLING

A. Protection

1. Roofing tile to be stored at the job site in a safe, dry place with all labels intact and legible at time of installation.

2. Use all means to protect roofing tile before, during, and after installation.

B. Replacements – In the event of damage, including water intrusion, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

1.06 WARRANTY

Under provisions of Section 01740:

A. Manufacturer Warranty on Products: 50 years.

B. Installation Warranty: Protection against all damages caused by incorrect installation. Provide a written 5-year well-crafted installation warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. The design of the roof tiles are based on the products of MCA as a standard of quality. Substitutions shall be considered under provisions of Section 01630.

2.02 ROOF MATERIAL

A. Manufacturer: MCA, or approved equal prior to bidding

B. Type:

1. Corona Tapered Mission, color to be selected from manufacturer standard colors

2. MF 108 Flat Interlocking, color to be selected from manufacturer standard colors

C. Approvals: ICBO Evaluation Report #4202

D. Mortar Set Ridge and Eaves

E. Booster tile (2 – 3 random) at starter course, hip and ridge condition.

F. Mortar type "O"

2.03 UNDERLAYMENT

A. Two layers of 30# asphaltic impregnated building paper. 1 additional underlayment layer shall be used at ridge.

2.04 NAILS AND FASTENERS

A. All nails, fastener types, and number of fasteners are to be installed per UBC Section 1507.7 and Tables 15-D-1 and Tables 15-D-2 and manufacturer's specifications. All nails and fasteners are to be stainless steel.

2.05 OTHER MATERIALS

A. All other materials, not specifically described, but required for a complete and proper installation of tile roofing, shall be as selected by the Contractor subject to the approval of the Architect.

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection

1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

2. Verify that tile roofing may be installed in complete accordance with all pertinent codes and regulations, the original design, and the manufacturer's current recommendations.

B. Discrepancies

1. In the event of discrepancy, immediately notify the Architect.

2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 COORDINATION

A. Coordinate tile installation to minimize roof deck to weather exposure.

3.03 INSTALLATION

A. General: Install all components of the tile roofing in strict accordance with the current recommendations of the manufacturer.

B. Underlayment

1. Install underlayment under all tile roofing, using roofing nails of adequate length and design to hold the membrane in place.

2. Install all underlayment in full accordance with UBC Section 1507.

C. Tiles

1. Provide headlap at all tile per manufacturer's recommendations.

2. Each tile to be fastened to roof surface with specified nail per UBC Section 1507.7 and Tables 15-D-1 and Tables 15-D-2.

3. Secure all accessory tiles in place by nailing.

4. Perform all cutting of tiles in a manner to provide neat edges and a uniformly straight line.

5. Finish tile roofs as a completely weatherproof and waterproof system requiring only normal maintenance.

6. Cut all exposed nail "shiners" at roof plywood eaves flush with underside of deck surface.

7. Install with battens if required by manufacturer.

3.04 CLEANING UP

A. Promptly upon completion of this portion of the work, remove from the site all tools, equipment, surplus materials of this section, tile-ends, and debris resulting from the tile roofing installation.

3.05 EXTRA STOCK

A. Provide Owner with extra tile, as specified, sufficient to re-roof 100 square feet of surface, in addition to any extra ridge pieces or stock paid for. Deliver tile to owner as directed at time of substantial completion.

END OF SECTION

SECTION 07620

FLASHING AND SHEET METAL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Metal flashings, counter flashing and base flashing.

2. Pre-finished perforated metal soffit material.

3. Miscellaneous sheet metal accessories.

B. Integral masonry flashings are specified as masonry work in sections of Division 4.

C. Roofing accessories installed integral with roofing membrane are specified in roofing system sections as roofing work.

D. Roof accessory units of premanufactured, set-on type are specified in Division 7 Section "Roof Accessories."

1.03 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data, Flashing, Sheet Metal, and Accessories: Manufacturer's technical product data, installation instructions and general recommendations for each specified sheet material and fabricated product.

C. Samples of the following flashing, sheet metal, and accessory items:

1. 8-inch (200-mm) square samples of specified sheet materials to be exposed as finished surfaces.

2. 12-inch (300-mm) long samples of factory-fabricated products exposed as finished work. Provide complete with specified factory finish.

D. Shop drawings showing layout, profiles, methods of joining, and anchorages details, including major counterflashings, trim/fascia units, skylights and expansion joint systems. Provide layouts at 1/4 inch equals 1 foot (1:50) scale and details at 3 inch equals 1 foot (1:4) scale.

1.04 PROJECT CONDITIONS

A. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

PART 2 PRODUCTS

2.01 SHEET METAL FLASHING AND TRIM MATERIALS

A. Sheet Aluminum: ASTM B 209 (ASTM B 209M), alloy 3003, temper H14, 0.032-inch (0.8-mm) thick except as otherwise indicated.

B. Finish:

1. Metal Fascia, Soffits, Flashing Trim Accessories and exposed metal work: Manufacturers standard two-coat, thermo-cured, full strength, Kynar 500 Fluorocarbon Coating with 30 percent reflecting gloss in accordance with ASTM D 523. Color as selected by Architect, from standard colors.

2. All other non-exposed metal work: Aluminum, ASTM B 209, alloy 3003, temper H14, AA-C22A41 clear anodized finish; 0.032- inch thick, except as otherwise indicated.

3. Perforated soffit panels as noted on details

C. Miscellaneous Materials and Accessories:

1. Fasteners: Same metal as flashing/sheet metal or other non- corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.

2. Bituminous Coating: SSPC - Paint 12, solvent-type bituminous mastic, nominally free of sulfur, compounded for 15-mil (0.4 mm) dry film thickness per coat.

3. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, non- drying, nonmigrating sealant.

4. Elastomeric Sealant: Generic type recommended by manufacturer of metal and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 7 Section "Joint Sealers."

5. Epoxy Seam Sealer: 2-part noncorrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior nonmoving joints including riveted joints.

6. Adhesives: Type recommended by flashing sheet manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet.

D. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage required for performance.

E. Elastic Flashing Filler: Closed-cell polyethylene or other soft closed-cell material recommended by elastic flashing manufacturer as filler under flashing loops to ensure movement with minimum stress on flashing sheet.

2.02 FABRICATED UNITS

A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.

B. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. For metal other than aluminum, tin edges to be seamed, form seams, and solder. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.

C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in work cannot be used or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

D. Sealant Joints: Where movable, nonexpansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.

E. Separations: Provide for separation of metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.

PART 3 EXECUTION

3.01 INSTALLATION REQUIREMENTS

A. General: Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations and with SMACNA "Architectural Sheet Metal Manual." Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.

C. Install reglets to receive counterflashing in manner and by methods indicated. Where shown in concrete, furnish reglets to trades of concrete work for installation as work of Division 3 sections. Where shown in masonry, furnish reglets to trades of masonry work, for installation as work of Division 4 sections.

D. Install counterflashing in reglets, either by snap-in seal arrangement or by welding in place for anchorage and filling reglet with mastic or elastomeric sealant, as indicated and depending on degree of sealant exposure.

E. Nail flanges of expansion joint units to curb nailers, at maximum spacing of 6 inches (150 mm) o.c. Fabricate seams at joints between units with minimum 3-inch (75-mm) overlap, to form a continuous, waterproof system.

3.02 CLEANING AND PROTECTION

A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

B. Protection: Advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or deterioration other than natural weathering at time of Substantial Completion.

END OF SECTION

SECTION 07720

ROOF ACCESSORIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Low Profile Roof Vents.

1.03 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of product specified. Submit manufacturer's detailed technical product data, installation instructions and recommendations, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.

C. Shop drawings showing fabrication and installation of each roof accessory specified including fully dimensioned plans, elevations, sections, details of components, and attachments to other units of Work. Also show layout, anchorage details, rough-in requirements, and conditions on the roof or for other accessories.

D. Samples for verification purposes in full-size units or representative section of each type of roof accessory indicated for each color, texture, shape, and sizes specified.

1.04 QUALITY ASSURANCE

A. Standards: Comply with the following:

1. SMACNA "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap-flashing to coordinate with type of roofing indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Low-Profile Gravity Ventilators:

   (a) O'Hagin's Inc.
   (b) or ENGINEER approved equal

2.02 MATERIALS, GENERAL

A. Structural-Quality Galvanized Steel Sheet: ASTM A 446 (ASTM A 446M) with G90 (Z275) coating complying with ASTM A 525 (ASTM A 525M), Grade C, or to suit manufacturer's standards.

2.03 LOW-PROFILE ROOF VENTS

A. General: Provide units of sizes, style, and profile indicated, fabricated from the following materials and including the following features:

1. Material: Aluminum sheet, prime painted.

2. Insect Screens: 14-by-18 (1.5-by-1.1 mm) mesh with 0.0123-inch (0.3-mm) diameter anodized aluminum wire in removable, rewirable frames.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Comply with manufacturer's instructions and recommendations. Coordinate with installation of roof deck and other substrates to receive accessory units, vapor barriers, roof insulation, roofing and flashing, as required, to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight. Anchor units securely to supporting structural substrates, adequate to withstand lateral and thermal stresses, as well as inward and outward loading pressures.

B. Isolation: Where metal surfaces of units are to be installed in contact with incompatible metal or corrosive substrates, including wood, apply bituminous coating on concealed metal surfaces, or provide other permanent separation.

C. Operational Units: Test operate units with operable components. Clean and lubricate joints and hardware. Adjust for proper operation.

3.02 CLEANING AND PROTECTION

A. Clean exposed metal and plastic surfaces according to manufacturer's instructions. Touch up damaged metal coatings.

END OF SECTION

SECTION 07901

JOINT SEALANTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes joint sealants for the following locations:

1. Exterior Vertical of building: Joints and cracks around windows, aluminum entrances, door frames, columns, louvers, wall penetrations, connections, both sides and other joints necessary to seal off building from outside air and moisture. Perimeter edges of exterior insulation and finish system.

2. Exterior Horizontal Surface

a. Sidewalk/pavement joints.
b. Other joints as indicated.

3. Interior Vertical and Horizontal of building:

a. Joints and cracks around wall, ceiling, and floor penetrations.
b. Both sides of exterior and interior hollow metal door frames.
c. Inside corners of gypsum board and concrete block walls.
d. Other joints as indicated.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 7 Section "Flashing and Sheet Metal" for sealing joints related to flashing and sheet metal for roofing.

2. Division 8 "Standard Steel Doors and Frames" for sealants used in door frames.

3. Division 9 Section "Gypsum Drywall" for sealing concealed perimeter joints of gypsum board partitions to reduce sound transmission.

1.03 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide joint sealants for interior applications that have been produced and installed to establish and maintain airtight continuous seals that are water resistant and cause no staining or deterioration of joint substrates.

1.04 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data from manufacturers for each joint sealant product required.

1. Certification by joint sealant manufacturer that sealants plus the primers and cleaners required for sealant installation comply with local regulations controlling use of volatile organic compounds.

C. Samples for initial selection purposes in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view.

D. Samples for verification purposes of each type and color of joint sealant required. Install joint sealant samples in 1/2-inch (13-mm) wide joints formed between two 6-inch (150-mm) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

E. Certificates from manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use indicated.

F. Product test reports for each type of joint sealants indicated, evidencing compliance with requirements specified.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance, total of 3 years or more.

B. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.

C. Preconstruction Compatibility and Adhesion Testing: Submit to joint sealant manufacturers samples of materials that will contact or affect joint sealants for compatibility and adhesion testing as indicated below:

1. Use test methods standard with manufacturer to determine if priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

a. Perform tests under normal environmental conditions that will exist during actual installation.

2. Testing will not be required when joint sealant manufacturer is able to submit joint preparation data required above that are acceptable to Architect and are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

D. Preconstruction Field Testing: Prior to installation of joint sealants, field-test their adhesion to joint substrates as follows:

1. Locate test joints where indicated or, if not indicated, as directed by Architect.

2. Conduct field tests for each application indicated below:

3. Notify Architect one week in advance of the dates and times when mock-ups will be erected.

E. Pre-Installation Conference: Conduct conference at Project site to comply with requirements of the Division 1 Section covering this activity.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.07 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.

B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

B. Colors: Provide color of exposed joint sealants to comply with the following:

1. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.

2.02 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing elastomeric sealants that comply with ASTM C 920 and other requirements indicated on each Elastomeric Joint Sealant Data Sheet at end of this Section, including those requirements referencing ASTM C 920 classifications for Type, Grade, Class, and Uses.

B. Products: Subject to compliance with requirements, provide one of the products specified in each Elastomeric Joint Sealant Data Sheet.

1. Vertical

a. Silca ZC N/S: Silca Corp.
b. Vulkem A22: Mameco, Inc.
c. N.P. II: Sonneborn.

2.03 JOINT SEALANTS

1. Traffic

a. Silca 2C S/L: Silca Corp.
b. Vulkem 245: Mameco, Inc.
c. N.R. 200: Pecora.

A. Acrylic Sealant: Manufacturer's standard one-part, nonsag, solvent-release-curing acrylic terpolymer sealant complying with AAMA 808.3 or FS TT-S-00230 or both, with capability when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the following percentage change in joint width existing at time of application and remain adhered to joint substrates indicated for Project without failing cohesively:

1. 7-1/2 percent movement in both extension and compression for a total of 15 percent.

2. 12-1/2 percent movement in both extension and compression for a total of 25 percent.

B. Butyl Sealant: Manufacturer's standard one-part, nonsag, solvent-release-curing, polymerized butyl sealant complying with ASTM C 1085 and formulated with minimum of 75 percent solids to be nonstaining, paintable, and have a tack-free time of 24 hours or less.

C. Pigmented Narrow Joint Sealant: Manufacturer's standard, solvent-release-curing, pigmented synthetic rubber sealant complying with AAMA 803.3 and formulated for sealing joints 3/16 inch (5 mm) or smaller in width.

2.04 JOINT SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Open-cell polyurethane foam.

2. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.

3. Any material indicated above.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.05 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming in any way joint substrates and adjacent nonporous surfaces, and formulated to promote optimum adhesion of sealants with joint substrates.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

3. Remove laitance and form release agents from concrete.

4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:

1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

   a. Do not leave gaps between ends of joint fillers.
   b. Do not stretch, twist, puncture, or tear joint fillers.
   c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.

2. Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.

D. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.

E. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

1. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.04 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so that and installations with repaired areas are indistinguishable from original work.

END OF SECTION

Division 8 Doors and Windows

SECTION 08110

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following products manufactured in accordance with SDI Recommended Standards:

1. Doors: Seamless, hollow or composite construction standard steel doors for interior and exterior locations.

2. Frames: Pressed steel frames for doors, transoms, sidelights, mullions, interior glazed panels, and other interior and exterior openings of following type:

a. Welded unit type.

3. Assemblies: Provide sound rated standard steel door and frame assemblies:

a. Door and Frame shall be sound rated assembly with minimum STC rating of 43.

b. Door assembly shall include manufacturer-approved frame and hardware (perimeter seals, drop seals, etc.) as necessary to maintain the STC rating.

c. Perimeter of door frame shall be sealed to the exterior wall construction with a weather resistant sealant.

B. Painting for factory primed doors and frames is specified in Division 9 Section "Painting."

C. Door hardware is specified in Division 8.

D. Building in of anchors and grouting of frames in masonry construction is specified in Division 4.

1.03 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of door and frame specified, including details of construction, materials, dimensions, hardware preparation, core, label compliance, sound ratings, profiles, and finishes.

C. Shop drawings showing fabrication and installation of standard steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.

1. Provide schedule of doors and frames using same reference numbers for details and openings as those on contract drawings.

2. Indicate coordinate of glazing frames and stops with glass and glazing requirements.

D. Samples for verification purposes of each type of exposed finish required, prepared on samples not less than 3 x 5 inches (75 x 125 mm) and of same thickness and material indicated for final unit of Work. Where finishes involve normal color and texture variations, include sample sets showing full range of variations expected.

1.04 QUALITY ASSURANCE

A. Provide doors and frames complying with Steel Door Institute "Recommended Specifications Standard Steel Doors and Frames" ANSI/SDI-100 and as herein specified.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

B. Inspect doors and frames upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged items as directed.

C. Store doors and frames at building site under cover. Place units on minimum 4-inches (100-mm) high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4-inch (6-mm) spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide standard steel doors and frames by one of the following:

1. Standard Steel Doors and Frames:

a. Amweld Building Products, Inc.

b. Ceco Corp.

c. Fenestra Corp.

d. Mesker Door Co.

e. Republic Builders Products.

f. Steelcraft Manufacturing Co.

2.02 MATERIALS

A. Hot-Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled and oiled, complying with ASTM A 569 and ASTM A 568 (ASTM A 568M).

B. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366 (ASTM A 366M) and ASTM A 568 (ASTM A 568M).

C. Galvanized Steel Sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 526 (ASTM A 526M), or drawing quality, ASTM A 642 (ASTM A 642M), hot dipped galvanized in accordance with ASTM A 525 with A60 or G60 (ASTM A 525M with ZF180 or Z180) coating designation, mill phosphatized.

D. Supports and Anchors: Fabricate of not less than 0.05-inch (3-mm) sheet steel; galvanized where used with galvanized frames.

E. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where items are to be built into exterior walls, hot-dip galvanize in compliance with ASTM A 153, Class C or D as applicable.

F. Shop Applied Paint: Apply after fabrication.

1. Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints complying with ANSI A224.1, "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames."

2.03 DOORS

A. Provide metal doors of SDI grades and models specified below or as indicated on drawings or schedules:

1. Exterior Doors: ANSI/SDI-100, Grade III, extra heavy-duty, Model 4, minimum 0.06-inch (1.5-mm) galvanized steel faces.

2.04 FRAMES

A. Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, of types and styles as shown on drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames of minimum 16-gage cold-rolled steel.

1. Fabricate frames with mitered, coped, or welded corners.

2. Form exterior frames from 0.06-inch (1.5-mm) galvanized steel.

2.05 FABRICATION

A. Fabricate steel door and frame units to be rigid, neat in appearance and free from defects, warp or buckle. Wherever practicable, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory-assembled before shipment, to assure proper assembly at project site. Comply with ANSI/SDI-100 requirements.

1. Internal Construction: Manufacturer's standard honeycomb, polyurethane, polystyrene, unitized steel grid, vertical steel stiffeners, or rigid mineral fiber core with internal sound deadener on inside of face sheets where appropriate in accordance with SDI standards.

2. Clearances: Not more than 1/8 inch (3 mm) at jambs and heads except between non-fire-rated pairs of doors not more than 1/4 inch (6 mm). Not more than 3/4 inch (19 mm) at bottom.

B. Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from only cold-rolled steel.

C. Tolerances: Comply with SDI 117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Fabricate frames, concealed stiffeners, reinforcement, edge channels, louvers and moldings from either cold-rolled or hot-rolled steel.

E. Fabricate exterior doors, panels, and frames from galvanized sheet steel in accordance with SDI-112. Close top and bottom edges of exterior doors as integral part of door construction or by addition of minimum 14-gage inverted steel channels.

F. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.

G. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal insulating door and frame assemblies and tested in accordance with ASTM C 236 or ASTM C 976 on fully operable door assemblies.

1. Unless otherwise indicated, provide thermal-rated assemblies with U factor of 0.41 Btu/hr x sq. ft. x deg F (2.3 W/sq. m x K) or better.

H. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware in accordance with final Door Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115 Series Specifications for door and frame preparation for hardware.

I. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at project site.

J. Locate hardware as indicated on final shop drawings or, if not indicated, in accordance with "Recommended Locations for Builder's Hardware on Standard Steel Doors and Frames," published by Door and Hardware Institute.

K. Shop Painting: Clean, treat, and paint exposed surfaces of steel door and frame units, including galvanized surfaces.

1. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.

2. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint.

L. Glazing Stops: Minimum 0.04-inch (1.0-mm) steel or .040-inch (1.0- mm) thick aluminum.

1. Provide non-removable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.

2. Provide screw applied removable glazing beads on inside of glass, louvers, and other panels in doors.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install standard steel doors, frames, and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified.

B. Placing Frames: Comply with provisions of SDI-105 "Recommended Erection Instructions For Steel Frames," unless otherwise indicated.

1. In masonry construction, locate 4 wall anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry Tee anchors.

C. Door Installation: Fit hollow metal doors accurately in frames, within clearances specified in ANSI/SDI-100.

3.02 ADJUST AND CLEAN

A. Prime Coat Touch-up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

B. Final Adjustments: Check and readjust operating hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.

END OF SECTION

SECTION 08711

DOOR HARDWARE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.

B. Acceptable Manufacturers/Products: Acceptable manufacturers for various types of products are listed below. An asterisk (*) following a manufacturers name designates manufacturer whose products are indicated in Finish Hardware Schedule. Such products are listed in the schedule by specific reference to manufacturers catalog numbers. Except as otherwise indicated, products of equivalent quality, design and function by other listed manufacturers may be used, subject to approval of Architect.

C. Submit final hardware schedule organized by "hardware sets", to indicate specifically the product to be furnished for each item required on each door.

1. Furnish templates to each fabricator of doors and frames, as required for preparation to receive hardware.

D. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 8 Section "Standard Steel Doors and Frames" for silencers integral with hollow metal frames.

1.03 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification sections.

B. Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.

C. Final hardware schedule coordinated with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:

    a. Type, style, function, size, and finish of each hardware item.
    b. Name and manufacturer of each item.
    c. Fastenings and other pertinent information.
    d. Location of each hardware set cross referenced to indications on Drawings both on floor plans and in door and frame schedule.
    e. Explanation of all abbreviations, symbols, and codes contained in schedule.
    f. Mounting locations for hardware.
    g. Door and frame sizes and materials.
    h. Keying information.

2. Submittal Sequence: Submit final schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work that is critical in the Project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by door hardware, and other information essential to the coordinated review of schedule.

D. Samples of each type of exposed hardware unit in finish indicated and tagged with full description for coordination with schedule. Submit samples prior to submission of final hardware schedule.

E. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.04 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer.

B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the Project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that employs an experienced architectural hardware consultant (AHC) who is available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation.

1. Require supplier to meet with Owner to finalize keying requirements and to obtain final instructions in writing.

1.05 PRODUCT HANDLING

A. Tag each item or package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.

B. Packaging of door hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.

C. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.

D. Deliver individually packaged door hardware items promptly to place of installation (shop or Project site).

1.06 MAINTENANCE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Products:

1. Finish: Shall be US 626, unless otherwise noted.

2. Manufacture Standard:

a.	Butts:	Bommer*, McKinney, Hager, Stanley
b.	Locksets:	Schlage*, Best, Yale
c.	Trim & Accessories:	Quality*, BBW
d.	Weatherstrip:	NG* Pemko

2.02 SCHEDULED HARDWARE

A. Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of finish hardware are indicated in the "Hardware Schedule" at the end of this Section. Products are identified by using hardware designation numbers of the following:

1. Manufacturer's Product Designations: The product designation and name of one manufacturer are listed for each hardware type required for the purpose of establishing minimum requirements. Provide either the product designated or, where more than one manufacturer is specified under the Article "Manufacturers" in Part 2 for each hardware type, the comparable product of one of the other manufacturers that complies with requirements.

2. ANSI/BHMA designations used elsewhere in this Section or in schedules to describe hardware items or to define quality or function are derived from the following standards. Provide products complying with these standards and requirements specified elsewhere in this Section.

   a. Butts and Hinges: ANSI A156.1.
   b. Bored and Preassembled Locks and Latches: ANSI/BHMA A156.2.
   c. Template Hinge Dimensions: ANSI A156.7.
   d. Materials and Finishes: ANSI A156.18.

2.03 MATERIALS AND FABRICATION

A. Base Metals: Produce hardware units of basic metal and forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units by applicable ANSI/BHMA A156 series standards for each type of hardware item and with ANSI/BHMA A156.18 for finish designations indicated. Do not furnish "optional" materials or forming methods for those indicated, except as otherwise specified.

B. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated.

C. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.

D. Provide concealed fasteners for hardware units that are exposed when door is closed except to the extent no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless their use is the only means of reinforcing the work adequately to fasten the hardware securely. Where thru-bolts are used as a means of reinforcing the work, provide sleeves for each thru-bolt or use sex screw fasteners.

2.04 LOCK CYLINDERS AND KEYING

A. Review the keying system with the Owner and provide the type required (master or grandmaster), either new or integrated with Owner's existing system.

B. Metals: Construct lock cylinder parts from brass or bronze, stainless steel, or nickel silver.

C. Comply with Owner's instructions for masterkeying and, except as otherwise indicated, provide individual change key for each lock that is not designated to be keyed alike with a group of related locks.

   1. Permanently inscribe each key with number of lock that identifies cylinder manufacturer's key symbol, and notation, "DO NOT DUPLICATE."

D. Key Material: Provide keys of nickel silver only.

E. Key Quantity: Furnish 3 change keys for each lock, 5 master keys for each master system, and 5 grandmaster keys for each grandmaster system.

1. Deliver keys to Owner with copy of transmittal to Architect.

2.05 KEY CONTROL SYSTEM

A. Provide a key control system including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 200 percent of the number of locks required for the Project.

1. Provide complete cross index system set up by key control manufacturer, and place keys on markers and hooks in the cabinet as determined by the final key schedule.

2. Provide hinged-panel type cabinet for wall mounting.

2.06 LOCKS, LATCHES, AND BOLTS

A. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set, unless otherwise indicated.

B. Lock Throw: Provide 5/8-inch (16-mm) minimum throw of latch on pairs of doors. Comply with UL requirements for throw of bolts and latch bolts on rated fire openings.

C. Flush Bolt Heads: Minimum of 1/2-inch- (13-mm-) diameter rods of brass, bronze, or stainless steel with minimum 12-inch- (300-mm-) long rod for doors up to 84 inches (2100 mm) in height. Provide longer rods as necessary for doors exceeding 84 inches (2100 mm) in height.

2.07 WEATHERSTRIPPING AND SEALS

A. General: Provide continuous weatherstripping on exterior doors and smoke, light, or sound seals on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.08 THRESHOLDS

A. General: Except as otherwise indicated, provide standard metal threshold unit of type, size, and profile as shown or scheduled.

2.09 HARDWARE FINISHES

A. Match items to the manufacturer's standard color and texture finish for the latch and lock sets.

B. Provide finishes that match those established by BHMA or, if none established, match the Architect's sample.

C. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

D. The designations used in schedules and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18, "Materials and Finishes," including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.

1. Rust-Resistant Finish: For iron and steel base metal is required for exterior work, provide 0.2-mil- (0.005-mm-) thick copper coating on base metal before applying brass, bronze, nickel, or chromium plated finishes.

PART 3 EXECUTION

3.01 INSTALLATION

A. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Architect.

1. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.

2. NWWDA Industry Standard I.S.1.7, "Hardware Locations for Wood Flush Doors."

B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.

C. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

D. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

E. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in Division 7 Section "Joint Sealants."

F. Weatherstripping and Seals: Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.

3.02 ADJUSTING, CLEANING, AND DEMONSTRATING

A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.

1. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

B. Clean adjacent surfaces soiled by hardware installation.

C. Six-Month Adjustment: Approximately six months after the date of Substantial Completion, the Installer, accompanied by representatives of the manufacturers of latchsets and locksets and of door control devices, and of other major hardware suppliers, shall return to the Project to perform the following work:

1. Examine and re-adjust each item of door hardware as necessary to restore function of doors and hardware to comply with specified requirements.

2. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures.

3. Replace hardware items that have deteriorated or failed due to faulty design, materials, or installation of hardware units.

4. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.03 HARDWARE SCHEDULE

A. General: Provide hardware for each door to comply with requirements of Section "Door Hardware," hardware set numbers indicated in door schedule, and in the following schedule of hardware sets.

1. Hardware Groups: The following groups are listed to indicate type and quality of hardware required. This supplier is responsible to furnish all hardware to complete each opening. See plans for hardware set indication by each door opening.

Group 1

1.5 PAIR	BUTTS	BB5001 4.5 X 4.5 NRP	26D BOMMER
1 EACH	LOCKSET	D92PD RHO	26 SCHLAGE
1 EACH	THRESHOLD	425	NG
1 EACH	WEATHERSTRIP	160	NG
1 EACH	SWEEP	200	NG

END OF SECTION

Division 9 Finishes

SECTION 09250

GYPSUM BOARD

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Gypsum board attached to wood or steel framing.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 06100 – Rough Carpentry

2. Section 09710 – Acoustical Wall and Ceiling Panels

1.03 DEFINITIONS

A. Gypsum Board Construction Terminology: Refer to ASTM C 11 and GA-505 for definitions of terms related to gypsum board assemblies not defined in this Section or in other referenced standards.

1.04 SUBMITTALS

A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of product specified.

C. Product certificates signed by manufacturers of gypsum board assembly components certifying that their products comply with specified requirements.

1.05 QUALITY ASSURANCE

A. Single-Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.

B. Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum panels flat to prevent sagging.

C. Handle gypsum board to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner beads and trim.

1.07 PROJECT CONDITIONS

A. Environmental Conditions, General: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 and with gypsum board manufacturer's recommendations.

B. Room Temperatures: For nonadhesive attachment of gypsum board to framing, maintain not less than 40 deg F (4 deg C). For adhesive attachment and finishing of gypsum board, maintain not less than 50 deg F (10 deg C) for 48 hours prior to application and continuously after until dry. Do not exceed 95 deg F (35 deg C) when using temporary heat sources.

C. Ventilation: Ventilate building spaces, as required, for drying joint treatment materials. Avoid drafts during hot dry weather to prevent finishing materials from drying too rapidly.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Gypsum Board and Related Products:

a. Georgia-Pacific Corp.
b. Gold Bond Building Products Div., National Gypsum Co.
c. United States Gypsum Co.

2.02 GYPSUM BOARD PRODUCTS

A. General: Provide gypsum board of types indicated in maximum lengths available to minimize end-to-end butt joints.

1. Thickness: Provide gypsum board 5/8 inch (16 mm) thicknesses to comply with ASTM C 840 for application system and support spacing indicated.

B. Gypsum Wallboard: ASTM C 36 and as follows:

1. Type: Type X or C as required for fire-resistive-rated assemblies.

2. Edges: Tapered.

3. Thickness: 5/8 inch (16 mm) unless otherwise indicated.

4. Products:

a. SHEETROCK Brand Gypsum Panels, FIRECODE C Core, United States Gypsum Co.

2.03 TRIM ACCESSORIES

A. Accessories for Interior Installation: Corner beads, edge trim, and control joints complying with ASTM C 1047 and requirements indicated below:

1. Material: Formed metal, plastic, or metal combined with paper, with metal complying with the following requirement:

a. Sheet steel coated with zinc by hot-dip or electrolytic processes.

2. Shapes indicated below by reference to Fig. 1 designations in ASTM C 1047:

a. Cornerbead on outside corners, unless otherwise indicated.

b. LC-bead with both face and back flanges; face flange formed to receive joint compound. Use LC-beads for edge trim unless otherwise indicated.

2.04 JOINT TREATMENT MATERIALS

A. General: Provide joint treatment materials complying with ASTM C 475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.

B. Joint Tape for Gypsum Board: Paper reinforcing tape, unless otherwise indicated.

C. Setting-Type Joint Compounds for Gypsum Board: Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.

1. For prefilling gypsum board joints, use formulation recommended by gypsum board manufacturer for this purpose.

D. Drying-Type Joint Compounds for Gypsum Board: Factory-packaged vinyl-based products complying with the following requirements for formulation and intended use.

1. Ready-Mixed Formulation: Factory-mixed product.

2. Taping compound formulated for embedding tape and for first coat over fasteners and face flanges of trim accessories.

3. Topping compound formulated for fill (second) and finish (third) coats.

2.05 MISCELLANEOUS MATERIALS

A. General: Provide auxiliary materials for gypsum board construction that comply with referenced standards and recommendations of gypsum board manufacturer.

B. Laminating Adhesive: Special adhesive or joint compound recommended for laminating gypsum panels.

C. Spot Grout: ASTM C 475, setting-type joint compound recommended for spot grouting hollow metal door frames.

D. Corrosion-resistant-coated steel drill screws of size and type recommended by board manufacturer for fastening to wood framing members. ASTM C 514.

2.06 TEXTURE FINISH PRODUCTS

A. Primer: Of type recommended by texture finish manufacturer.

1. Fine textured finish.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, cast-in-anchors, and structural framing with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Ceiling Anchorages: Coordinate installation of ceiling with installation of overhead structural assemblies to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers that will develop their full strength and at spacing required to support ceilings.

3.03 APPLYING AND FINISHING GYPSUM BOARD, GENERAL

A. Gypsum Board Application and Finishing Standards: Install and finish gypsum panels to comply with ASTM C 840 and GA-216.

B. Install sound attenuation blankets and insulation where indicated prior to installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

C. Install ceiling board panels across framing to minimize the number of abutting end joints and avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

D. Install wall/partition board panels to minimize the number of abutting end joints or avoid them entirely. Stagger abutting end joints not less than one framing member in alternate courses of board. At stairwells and other high walls, install panels horizontally with end abutting joints over studs and staggered.

E. Install gypsum panels with face side out. Do not install imperfect, damaged, or damp panels. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

F. Locate both edge or end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Position adjoining panels so that tapered edges abut tapered edges, and field-cut edges abut field-cut edges and ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions. Avoid joints at corners of framed openings where possible.

G. Attach gypsum panels so that the leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

H. Attach gypsum panels to framing provided at openings and cutouts.

I. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments. Provide 1/4-to-1/2-inch- (6-to-13-mm-) wide spaces at these locations and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

J. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's recommendations.

3.04 GYPSUM BOARD APPLICATION METHODS

A On ceilings, apply gypsum panels prior to wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.

B. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated, and provide panel lengths that will minimize end joints.

C. Fasten with corrosion-resistant screws.

3.05 INSTALLING TRIM ACCESSORIES

A. General: For trim accessories with back flanges, fasten to framing with the same fasteners used to fasten gypsum board. Otherwise, fasten trim accessories according to accessory manufacturer's directions for type, length, and spacing of fasteners.

B. Install corner beads at external corners.

C. Install edge trim where edge of gypsum panels would otherwise be exposed or semi-exposed. Provide edge trim type with face flange formed to receive joint compound except where other types are indicated.

1. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.

2. Install L-bead where edge trims can only be installed after gypsum panels are installed.

D. Install control joints at locations indicated, and where not indicated according to ASTM C 840, and in locations approved by Architect for visual effect.

3.06 FINISHING GYPSUM BOARD ASSEMBLIES

A. General: Apply joint treatment at gypsum board joints (both directions); flanges of corner bead, edge trim, and control joints; penetrations; fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration and levels of gypsum board finish indicated.

B. Prefill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.

C. Apply joint tape over gypsum board joints except those with trim accessories having concealed face flanges not requiring taping to prevent cracks from developing in joint treatment at flange edges.

D. Levels of Gypsum Board Finish: Provide the following levels of gypsum board finish per GA-214.

E. For level 4 gypsum board finish, embed tape in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads, and accessories. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration. Use one of the following joint compound combinations:

1. Fill (Second) Coat: Job-mixed, drying-type topping compound.

2. Finish (Third) Coat: Job-mixed, drying-type topping compound.

3. Embedding and First Coat: Job-mixed, drying-type, all-purpose compound.

4. Fill (Second) Coat: Job-mixed, drying-type, all-purpose compound.

5. Finish (Third) Coat: Job-mixed, drying-type, all-purpose compound.

6. Embedding and First Coat: Setting-type compound.

7. Fill (Second) Coat: Setting-type compound.

8. Finish (Third) Coat: Job-mixed, drying-type, all-purpose compound.

3.07 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes according to texture finish manufacturer's instructions. Apply primer only to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish to gypsum panels and other surfaces indicated to receive texture finish according to texture finish manufacturer's directions. Using powered spray equipment acceptable to texture finish manufacturer, produce a uniform texture matching approved field samples and free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray as recommended by texture finish manufacturer to prevent damage.

3.08 CLEANING AND PROTECTION

A. Promptly remove any residual joint compound from adjacent surfaces.

B. Provide final protection and maintain conditions, in a manner suitable to Installer, that ensures gypsum board assemblies remain without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 09710

ACOUSTICAL WALL & CEILING PANELS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section.

1.02 SUMMARY

A. Section Includes:

1. Acoustical wall panels and installation components.

B. Related Sections:

1. Plaster and Gypsum Board is included in Section 09200.

2. Electrical Work is included in Division 16 Sections.

1.03 REFERENCES

A. Test Methods:

1. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

2. ASTM E 84/CAN/ULC S102 Standard Test Method for Surface Burning Characteristics of Building Materials.

3. CAN/ULC S102 Standard Test Method for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's technical data for each type of acoustical wall panel required.

B. Samples: Minimum 3 inch x 3 inch samples of specified acoustical wall substrate; minimum 4 inch long samples of attachment method including trim and decorative accents.

C. Shop Drawings: Submit shop drawings showing how panels are to be laid out on the walls, details of attachment and width of panels.

1.05 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide acoustical panel units and installation components by a single manufacturer.

B. Coordination of Work: Coordinate acoustical wall work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical wall panels to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Handle acoustical wall panels carefully to avoid chipping edges or damaged units in any way.

1.07 PROJECT CONDITIONS

A. Space Enclosure:

1. Soundsoak Fiberglass Panels: All wet work must be complete and dry prior to installation. Installation shall be carried out where the temperature is between 40 degrees F and 120 degrees F. These temperature conditions must be maintained throughout the life of the warranty.

1.08 WARRANTY

A. Acoustical Wall Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace acoustical panels that fail within the warranty period. Failures include, but are not limited to:

1. Acoustical Wall Panels: Manufacturer’s defects

B. Warranty Period:
1. Acoustical wall panels: One (1) year from date of substantial completion.

1.09 MAINTENANCE

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.

1. Acoustical Wall Panels: Furnish quantity of full-size units equal to 5.0 percent of amount installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustical Wall Panels:

1. Armstrong World Industries, Inc.

2. A/E approved equal

2.02 ACOUSTICAL WALL PANELS

A. Acoustical Wall Panels: Type AWP-1:

1. Surface Texture: Fabric

2. Composition: Fiberglass with resin-hardened edges. Impact-resistant panels available.

3. Fabric Finish: Guilford FR-701, color as selected from manufacturer's standard offering.

4. Thickness: 1 inch

5. Width: Up to 4 feet

6. Panel Heights: Up to 10 feet

7. Edge Profile: Standard - Fabric wrapped (square) (beveled) (mitered) (radiused) edges on two long panel sides.

8. Noise Reduction Coefficient (NRC): ASTM C 423; A Mounting: 1 inch (0.80).

9. Flame Spread: ASTM E84; with FR-701 Fabrics - composite Class A rating.

10. Dimensional Stability: Standard – space must be enclosed with HVAC systems operating at all times.

B. Acoustical Wall Panel Accessories:

1. Impaling clips

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations.

3.02 PREPARATION

A. Measure each wall area and establish layout of acoustical units to balance border widths at opposite edges of each wall. Coordinate panel layout with mechanical and electrical fixtures.

3.03 INSTALLATION

A. Install wall panels by attaching the panels to an existing wall per the manufacturer's instructions, LA-297301, and in accordance with the authorities having jurisdiction.

B. For installation instructions with internal H spline, refer to installation instructions for standard Soundsoak, LA-295818.

3.04 ADJUSTING AND CLEANING

A. Replace damaged and broken panels.

B. Routine maintenance of Soundsoak wall panels should consist of frequent vacuuming to minimize dirt accumulation. A dry or wet shampoo can be used on Soundsoak fabric. Work in with a damp sponge and vacuum to remove residue.

END OF SECTION

SECTION 09901

SURFACE PREPARATION AND SHOP PRIME PAINTING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required for the surface preparation and application of shop primers on ferrous metals, excluding stainless steels, as specified herein.

1.02 SUBMITTALS

A. Submit, in accordance with Section 01300, shop drawings, manufacturer's specifications and data on the proposed primers and detailed surface preparation, application procedures and dry mil thicknesses.

B. Submit representative physical samples of the proposed primers, if required by the ENGINEER.

1.03 REFERENCE STANDARDS

A. The Society for Protective Coatings (SSPC)

1. SSPC-SP 6/NACE No. 3 - Joint Surface Preparation Standard SSPC-SP 6/NACE No. 3: Commercial Blast Cleaning

2. SSPC-SP 10/NACE No. 2 - Joint Surface Preparation Standard SSPC-SP 10/NACE No. 2: Near-White Blast Cleaning.

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

PART 2 PRODUCTS

2.01 MATERIALS

A. Non-Submerged Surfaces: Shop primer for ferrous metals which will not be in contact with water, not submerged and not subject to splash action shall be shop primed with the following:

1. Shop Prime Coat: (Zinc Micaceous Iron Oxide Polyurethane Aromatic Shop Primer)

a. TNEMEC: Series 1 Omnithane

b. Carboline: Carboguard 561

c. Sherwin-Williams Company (The): Corothane I Zinc Primer 1K Mio-Zinc.

d. PPG PMC Durathane MCZ 97-679 Series or PPG PMC Amercoat 68HS

e. Or equal.

B. Submerged Surfaces - Shop primer for ferrous metals which will be in contact with water, either submerged or which are subject to splash action or which are specified to be considered submerged service shall be shop primed with the following

1. Shop Prime Coat for Ductile Iron Pipe: (Epoxy, Polyamidoamine Shop Primer)

a. TNEMEC: Series N140 Pota-Pox-Plus

b. Carboline: Carboguard 561

c. Sherwin-Williams Company (The): Macropoxy 846 NSF Winter Grade Epoxy Mill White

d. PPG PMC Aquapon HB Potable Water Epoxy Coating 95-132 Series or PPG PMC Amerlock 2 Epoxy.

e. Or equal.

2. Shop Prime Coat for Ferrous Metal Surfaces: (Zinc Micaceous Iron Oxide Polyurethane Aromatic Shop Primer)

a. TNEMEC: Series 1 Omnithane

b. Carboline: Carboguard 561

c. Sherwin-Williams Company (The): Corothane I Zinc Primer 1K Mio-Zinc.

d. PPG PMC Durathane MCZ 97-679 Series

e. Or equal.

C. Non-Primed Surfaces - Gears, bearings surfaces and other similar surfaces obviously not to be painted shall be given a heavy shop coat of grease or other suitable rust-resistant coating. This coating shall be maintained as necessary to prevent corrosion during all periods of storage and erection and shall be satisfactory to the ENGINEER up to the time of the final acceptance test.

D. Compatibility of Coating Systems - Shop priming shall be done with primers that are guaranteed by the manufacturer to be compatible with their corresponding primers and finish coats specified in Section 09902 for use in the field and which are recommended for use together.

PART 3 EXECUTION

3.01 APPLICATION

A. Surface Preparation and Priming

1. Non-submerged components scheduled for priming, as defined above, shall be blast cleaned in accordance with SSPC-SP 6/NACE No. 3, immediately prior to priming. Submerged components scheduled for priming, as defined above, shall be blast cleaned in

accordance with SSPC-SP 10/NACE No. 2 , immediately prior to priming. Consult manufacturer regarding required surface profiles.

2. Surfaces shall be dry and free of dust, oil, grease and other foreign material before priming.

3. Shop prime in accordance with approved manufacturer's recommendations.

B. Non-Primed Surfaces

1. Apply approved coating per manufacturer's recommendations.

3.02 FABRICATED ITEMS

A. All items to be shop primed shall be blast cleaned as specified for applicable service prior to priming. If, in the opinion of the ENGINEER, any prime coating that has been improperly applied or if material contrary to this Section has been used, that coating shall be removed by abrasive blasting to white metal and reprimed in accordance with this Section.

B. All shop prime coats shall be of the correct materials and applied in accordance with this Section. Remove any prime coats not in accordance with this Section by blast cleaning and apply the specified prime coat at no additional cost to the OWNER.

C. Shop primed surfaces shall be cleaned thoroughly and damaged or bare spots prepared as approved and retouched with the specified primer before the application of successive paint coats in the field.

D. Shop finish coats, if proposed and allowed, shall be equal in appearance and protection quality to a field applied finish coat. If, in the opinion of the ENGINEER, a shop finish coat system does not give the appearance and protection quality of other work of similar nature, prepare the surfaces and apply the coat or coats of paint as directed by the ENGINEER to accomplish the desired appearance and protection quality. Submit to the ENGINEER substantial evidence that the standard finish is compatible with the specified finish coat.

E. Properly protect the shop prime and finish coats against damage from weather or any other cause.

F. Wherever fabricated equipment is required to be blast cleaned, protect all motors, drives, bearings, gears, etc, from the entry of grit. Equipment found to contain grit shall be promptly and thoroughly cleaned.

END OF SECTION

SECTION 09902

PAINTING

PART 1 GENERAL

1.01 WORK INCLUDED

Work includes, but is not necessarily limited to:

A. Interior and Exterior protective clear coating of Concrete Block Masonry

B. Exterior and interior unfinished louvers and vents

C. All doors and frames

D. Concrete floor sealer

E. Interior gypsum drywall ceilings

F. Interior wall finishes including but not limited to: Concrete Block, gypsum board, exposed wood framing elements and trim.

G. Exposed piping

H. All other exterior and interior attachments and accessories adjacent to painted surfaces

1.02 RELATED WORK DESCRIBED ELSEWHERE

A.	Division 03	Cast-in-Place Concrete
B.	Division 04	Concrete Block Masonry
C.	Division 05	Miscellaneous Metals and Fabrications
D.	Division 06	Rough Carpentry
E.	Division 07	Sheet Metal Flashing and Trim
F.	Division 07	Joint Sealers and Caulking
G.	Division 08	Standard Steel Doors and Frames
H.	Division 08	Finish Hardware
I.	Division 09	Gypsum Drywall
J.	Division 15	Plumbing and Mechanical
K.	Division 16	Electrical

1.03 QUALITY ASSURANCE

A. Manufacturer – As approved by Architect. Colors selected are from a single manufacturer.

B. Installer – Work to be performed only by workers thoroughly skilled and specially trained in the techniques of painting, and who are completely familiar with the published recommendations of the manufacturer of the paint material being used.

C. Single-Source Responsibility – Provide primers and undercoat paint produced by the same manufacturer as the finish coats.

1.04 REFERENCES

In addition to complying with all pertinent codes and regulations:

A. Woodworking Institute of California (WIC).

B. Specification manual of selected manufacturer

C. Air Pollution Control District regulations and federal lead content laws.

D. VOC Compliance regulations

1.05 SUBMITTALS

A. Product Data – Submit material specifications, manufacturer's installation, and maintenance instructions under provisions of Section 01300.

B. Samples under provisions of Section 01300 to include:

1. Two (2) 8" x 8" brush-outs of each color and finish specified.

C. Sample of quality control log

1.06 PRODUCT HANDLING

A. Protection

1. Paints to be stored at the job site in a safe, dry place with all labels intact and legible at time of installation.

2. Use all means to protect paint before, during and after installation.

B. Replacements – In the event of damage, including water intrusion, immediately make all repairs and replacements necessary to the approval of the ENGINEER and at no additional cost to the OWNER.

1.07 WARRANTY

Under provisions of Section 01740.

1.08 EXTRA STOCK

Provide ENGINEER with extra stock of two one-gallon containers of each paint type and color used. All containers are to be tightly sealed and clearly marked.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Exterior

1. No exterior painting shall be undertaken if air or surface temperature is below 50 degrees F, or is anticipated to be below 50 degrees F within 24 hours.

2. No coating is to be applied if the temperature is less than 5 degrees F above the dew point and rising.

3. No coating is to be applied immediately following rain, power washing, or until frost, dew, or condensation has evaporated.

4. Surfaces must always be tested with a moisture meter and surface temperature gauge before proceeding. Do not apply finishes unless moisture is below:

a. Exterior Masonry : 17%

b. Exterior Wood: 15%

5. Record moisture test result and location of tests in daily work log.

6. Newly applied coatings, which are damaged by the elements, shall be replaced by the CONTRACTOR at no additional charge.

7. No exterior painting shall be done under windy or dusty conditions.

8. Avoid painting surfaces while they are exposed directly to the hot sun.

B. Interior

1. Interior temperature must be above 50 degrees F for 24 hours before, during, and for 48 hours after application of finishes or longer to obtain full cure as indicated by manufacturer's instructions.

2. Provide temporary lighting to achieve a well-lit surface with a level of at least 80-foot candles measured mid-height.

3. Provide continuous ventilation and heating to prevent accumulation of hazardous fumes and to maintain surface and ambient temperatures.

4. Surfaces must always be tested with a moisture meter and surface temperature gauge before proceeding. Do not apply finishes unless moisture is below:

   a. Interior Plaster and Wallboard: 12%

   b. Interior Wood: 12%

5. Record moisture test result and location of tests in daily work log.

PART 2 PRODUCTS

2.01 PAINT MATERIALS

A. Manufacturer

1. All paint materials selected for coating systems for each type of surface shall be the product of a single manufacturer.

2. Paints listed herein, unless otherwise designated in the "Painting Schedule", are based on the products of Benjamin Moore and/or Sherwin Williams Co. (Epoxy Coatings) as a basis of specification, Other manufacturers listed below are approved, provided they meet the quality and intent of the specified item, material or product.

   (a) The Sherwin-Williams Company

   (b) Fuller O'Brien

   (c) PPG Industries, Pittsburgh Paints

   (d) Frazee Paint

B. Compatibility

1. All paint materials and equipment shall be compatible in use: finish coats shall be compatible with prime coats; prime coats shall be compatible with the surface to be coated; all tools and equipment shall be compatible with the coating to be applied.

2. Thinners, when used, shall be only those thinners recommended for that purpose by the manufacturer of the material to be thinned.

C. Color

1. Color of all paints and products shall be per approved samples, as prepared from manufacturer's standard color line.

2. All primers and undercoats are to be tinted to the approximate shade of the selected finish coat. Where the color schedule calls for the use of DEEP TONES, it is the responsibility of the painting contractor to utilize appropriate DEEP BASE PRIMER as manufactured by BENJAMIN MOORE & CO. for use on the surface for which they are intended.

D. Work Quality

1. All materials shall be applied free from runs, sags, wrinkles, streaks, shiners, holidays, and brush marks.

2. All materials shall be applied uniformly. If any reduction on the coating's viscosity is necessary, it shall be done in accordance with the manufacturer's label directions.

3. Carry all finish coats to natural breaks and transitions.

4. Allow each coat to dry before re-coating, adjusting manufacturer's MINIMUM time recommendations between coats to job conditions.

5. Apply each coat to achieve the specified dry film thickness per coat. Achieving the total system recommended dry mil thickness with application rates in excess of those recommended and fewer coats than specified will not be accepted.

6. Apply each coat of paint slightly darker (or lighter depending on the finish color) than the preceding coat unless otherwise approved.

7. Enamels and undercoats are to be sanded smooth prior to topcoating.

8. Tops, bottoms, and sides of doors and garage doors are to be finished with the same number of coats as the face.

9. Where spray application is used, backrolling should immediately follow. Spraying alone without backrolling is unacceptable. Wet film gauges are to be used after backrolling to insure acceptable wet film thickness.

10. A quality control log, recording weather and surface conditions must be completed each day prior to beginning painting. Paint batches are to be recorded as used showing which building each is applied to and when.

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection

1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

2. Verify that all paint finishes may be applied in strict accordance with all pertinent codes and regulations and the requirements of these specifications.

B. Discrepancies

1. In the event of discrepancy, immediately notify the architect.

2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 SITE PREPARATION

A. Exterior

1. Trench all ground contact surfaces down to the foundation prior to power washing. Pay special attention to wood surfaces coming into ground contact.

2. Remove spider webs by brush prior to power washing.

3. All existing surfaces are to be cleaned by power washing with a commercial mildew wash. Remove all mildew and chalking by scrubbing or power washing. Power washing alone without mildew wash is not acceptable. Chalk deposits must be removed, down to a sound substrate.

4. Surfaces under caves, or other areas protected from weathering, must be carefully washed. Crystalline deposits that develop on these areas are a major cause of peeling.

5. Any plant residue on surfaces is to be completely removed. If for any reason a surface cannot be cleaned, this condition shall be promptly reported to the ENGINEER.

6. Remove attached light fixtures electrical plates, hardware, and other fittings before preparing, priming, or finishing surfaces.

7. Exercise care not to deface adjoining work. Use suitable cover cloths or other protection materials to cover adjoining work, and surfaces not to be painted. Avoid wind carried overspray.

8. The CONTRACTOR will be liable for any and all claims arising from overspray or otherwise misapplied paint.

9. Where rust, water, or bleeding stains are present, the source of these stains must be identified and corrected. Surfaces should then be cleaned and spot primed with a stain sealer.

B. Interior

1. Remove attached light fixtures electrical plates, hardware, and other fittings before preparing, priming, or finishing surfaces.

2. Exercise care not to deface adjoining work. Use suitable cover cloths or other protection materials to cover adjoining work, and surfaces not to be painted.

3. The CONTRACTOR will be liable for any and all claims arising from overspray or otherwise misapplied paint.

4. Where rust, water, or bleeding stains are present the source of these stains must be identified and corrected. Surfaces should then be cleaned and spot primed with a stain sealer.

3.03 PREPARATION OF SURFACES, GENERAL

A. Protection – Prior to all surface preparation and painting operations, completely mask, remove, or otherwise adequately protect all hardware, accessories, machined surfaces, plates, lighting fixtures, and similar items in contact with painted surfaces but not schedule to receive paint.

B. Spot prime all exposed nails and other exposed metals.

C. Cleaning

1. Before applying paint or other surface treatment, thoroughly clean all surfaces involved.

2. Schedule all cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

D. Prime coat should be applied soon after the surface preparation has been completed to prevent contamination of the substrate.

3.04 PREPARATION OF WOOD SURFACES FOR PAINT OR STAIN APPLICATION

A. Cleaning – Clean all wood surfaces until they are free from dirt, oil, and all other foreign substance.

B. Smoothing

1. Unless specifically noted to be left rough, smooth all finished wood surfaces exposed to view, using the proper sandpaper.

2. Where so required, use varying degrees of coarseness in sandpaper to product uniformly smooth and unmarred wood surfaces.

3. Smooth planed clapboards or siding must be sanded thoroughly to break the “mill glaze” to allow proper penetration and adhesion.

C. Knots

1. On small, dry, seasoned knots, thoroughly scrape and clean the surface and apply one coat of compatible knot-sealer before application of the priming coat.

2. On large, open, unseasoned knots, scrape off all pitch and thoroughly clean the area, followed by an application of one coat of compatible knot-sealer.

3. Remove and treat all pitch surfaces as required for large knots.

D. Dryness

1. Unless specifically approved by the architect, do not proceed with the painting of wood surfaces until the moisture content of the wood is 15 percent or less.

2. Pressure Treated Wood (PTW) must be tested prior to coating to determine proper penetration of coating. Surface must be sprinkled with water to determine absorption into substrate. If water drops remain on PTW surface, do not paint. If water drops penetrate immediately into surface, prepare surface as you would any wood and then prime.

E. Trim

1. Trim must be re-primed on all sides.

2. Thorough caulking of horizontal applications or any areas where water may collect is essential.

3. Fill all joints, nail holes, cracks, and blemishes after undercoater has been applied.

4. Countersink, prime, and fill all nails or screws to retard rust stains.

F. Primer

1. Cedar and Redwood are bleeding woods, they must be primed to help retard bleed.

2. Prime and countersink all nails or screws to retard rust stains.

3. If nails are rusted, coat with RUST CONVERTER.

4. Fill all joints, nail holes, cracks, and blemishes after undercoater has been applied.

3.05 PREPARATION OF MASONRY, PRECAST CONCRETE, CONCRETE BLOCK, AND FIBER CEMENT SURFACES

A. Precast concrete must be allowed to cure for 60 – 90 days; block and fiber cement surfaces must be allowed to cure for 30 – 60 days.

B. New fiber cement or other masonry surfaces shall not be primed until it has been determined these surfaces have dried sufficiently to safely accept paint.

C. Alkalinity must be approved prior to priming.

D. Form release agents are to be removed with appropriate solvents.

E. All surfaces must be thoroughly brushed with a stiff fiber brush to remove loose particles, with particular emphasis on stucco surfaces and mortar courses.

F. Laitance deposits must be removed by hand or power wire brushing, or other appropriate means.

G. If efflorescence is present, first dampen the wall with water, then scrub the surface with a 10% solution of muriatic acid. Caution: Wear rubber boots and gloves, work goggles, and protective clothing. After treatment, thoroughly flush the surface with clean water to remove all acid and allow to dry thoroughly before painting.

H. Prime all bare surfaces and opened cracks.

I. Cracks, joints, and large voids are to be filled by repointing, caulking, or other approved means.

J. Care must be taken to blend patches into surrounding texture and minimize their appearance in the finished project.

K. Cracks over ¼ inch are defined as structural cracks and must be reviewed by a structural engineer prior to painting.

L. Spot prime surface repairs after they have been patched, sandwiching repairs between two layers of primer.

3.06 PREPARATION OF METAL SURFACES

A. Galvanized Metal

1. Clean all surfaces thoroughly with solvent until they are completely free from dirt, oil, grease, and contaminants per SSPC-SP1-63.

2. Thoroughly treat the cleaned surface with phosphoric acid etch.

3. Remove all excess etching solution and allow to dry completely before application of paint.

4. Abraded surfaces should be sanded smooth and spot primed.

5. Weathered, unpainted galvanized metal surfaces must be wire brushed or power washed to remove deposits of "white rust", then primed.

6. Note: Some galvanized surfaces have stabilizers. Many of which are not soluble in solvents. These must be removed by either brush blasting or chemical treatment.

B. Other structural steel, miscellaneous metals, doors, exposed ducting, exposed piping, louvers, and miscellaneous metals

1. All metal surfaces shall be washed with solvent to remove extraneous dirt, grease, oil, and contaminants per SSPC-SP1-63 before painting.

2. Allow to dry thoroughly before application of paint.

3. Shop primed doors, vents, access panels and miscellaneous or structural metals surfaces are to be dulled by sanding prior to application of specified prime coat.

4. Where shop coat has abraded and rust developed, remove by sanding and spot prime immediately, prior to full prime coat indicated in the product application section.

C. Aluminum

1. All surfaces must be free of residual deposits of grease and oil, and shall be cleaned in accordance with SSPC-SP1-63, "solvent cleaning".

2. Weathered, unpainted aluminum surfaces must be wire brushed or power washed to remove deposits of "white rust", then primed.

3.07 PAINT APPLICATION

A. General

1. Paint all surfaces except glass, flat concrete, and similar items, unless otherwise noted.

2. Prime and paint all grilles and other pre-finished items where the factory pre-finish is not in accordance with the painting schedule and color selection. Unless otherwise scheduled, all grilles, frames, roof penetrations and other items shall be painted to match the color of the adjacent surface.

B. Drying

1. Allow sufficient drying time between coats.

2. Modify the period as recommended by the material manufacturer to suit adverse weather conditions.

3. Oil-base and oleo-resinous solvent-type paints shall be considered dry for recoating when the paint feels firm, does not deform or feel sticky under moderate pressure of the thumb, and the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

C. Environmental Conditions

1. Comply with the manufacturer's recommendations as to environmental conditions under which the coating system may be applied.

2. Do not apply paint in areas where dust is being generated.

D. Defects – Sand and dust between coats to remove all dust defects visible to the unaided eye from a distance of five (5) feet.

3.08 DRYWALL

A. All surfaces must be free of sanding dust, and joint treatment cement should be thoroughly dry.

B. Damaged or defective surfaces are to be repaired by spackling or by other appropriate measures.

C. Steel corner beading is to be coated with rust retardate primer prior to a general prime coat being applied.

3.09 REINSTALLATION OF REMOVED ITEMS

Following completion of painting in each space, promptly re-install all items removed for painting, using only workmen skilled in the particular trade.

3.10 CLEANING UP

A. General

1. During progress of the work, do not allow the accumulation of empty containers or other excess items except in areas specifically set aside for that purpose.

2. Prevent accidental spilling of paint materials and in event of such spill, immediately remove all spilled material and the waste or other equipment used to clean up the spill and return the surfaces to their original undamaged condition, all at no additional cost to the OWNER.

B. Prior to Final Inspection – Upon completion of this portion of the work, visually inspect all surfaces and remove all paint and traces of paint from surfaces not schedule to be painted.

3.11 PAINT APPLICATIONS

A. Exterior

1. Galvanized Metal – Flat

(a) Primer: Ironclad Galvanized Metal Latex Primer (155)

(b) Finish: Two coats Moore's Flat Exterior Latex House Paint (105)

2. Galvanized Metal – Medium Gloss

(a) Primer: Ironclad Galvanized Metal Latex Primer (155)

(b) Finish: Two coats MoorGlo Latex House and Trim Paint (170)

3. Unfinished Aluminum – Medium Gloss

(a) Finish: Two coats MoorGlo Latex House and Trim Paint (170)

4. Ferrous Metal – Flat

(a) Primer: Ironclad Retardo Rust Inhibitive Paint (163)

(b) Finish: Ironclad Retardo Rust Inhibitive Paint (105)

5. Ferrous Metal – High Gloss (doors, jambs, bollards, exposed metals, etc.)

(a) Primer: Ironclad Retardo Rust Inhibitive Paint (163)

(b) Finish: Two coats Urethane Alkyd Gloss Enamel (CM22)

6. Exposed Wood Framing and Trim –

(a) Two (2) coats Moorwood semi-transparent stain and wood preservative (081)

7. Exterior Concrete Block and Masonry (Satin Sheen)

(a) Primer: Acrylic masonry sealer (066) (1 coat min.)

(b) Finish: Moorlastic Acrylic Elastomeric Waterproof Coating (2 coats min.)

B. Interior

1. Drywall Ceiling – Eggshell

(a) Primer: Regal First Coat (216)

(b) Finish: Two coats Regal Aqua Velvet (319)

2. Ferrous Metal – Semi-Gloss

(a) Primer: Moorecraft Alkyd Enamel Underbody and Primer Sealer (245)

(b) Finish: Moorecraft Alkyd Semi-Gloss Enamel (271)

3. Galvanized Metal – Semi-Gloss

(a) Primer: Ironclad Galvanized Metal Latex Primer (155)

(b) Finish: Two coats Regal AquaGlo (333)

4. Concrete Block Masonry – Semi-Gloss

(a) Epoxy Coating – NO SUBSTITUTIONS

i. First Coat: Macropoxy Primer (B58)

ii. Second Coat: Macropoxy 646 (B58-600)

iii. Third Coat: Macropoxy 646 (B58-600)

5. Interior Concrete Floors (Clear EPOXY Sealer):

   (a) Epoxy Coating – NO SUBSTITUTIONS

      i. First Coat: ArmorSeal Rexthane I Floor Coating (B65-60) w/o grit

      ii. Second Coat: ArmorSeal Rexthane I Floor Coating (B65-60) w/ grit

6. COLORS: As selected by ENGINEER; doors and frames shall be one color; interior walls and other structure shall have one field color and one trim color.

3.12 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted, or provide surface-applied protection prior to surface preparation and painting. Remove these items, if necessary, to completely paint the items and adjacent surfaces. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease prior to cleaning. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

1. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen, as required, to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

   (a) Use abrasive blast-cleaning methods if recommended by the paint manufacturer.

   (b) Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.

   (c) Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.

2. Ferrous Metals: Clean ungalvanized ferrous metal surfaces that have not been shop-coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of the Steel Structures Painting Council (SSPC).

   (a) Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.

C. Materials Preparation: Carefully mix and prepare paint materials according to manufacturer's directions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.

2. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

3. Use only thinners approved by the paint manufacturer and only within recommended limits.

D. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.13 APPLICATION

A. General: Apply paint according to manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.

(a) Paint colors, surface treatments, and finishes are indicated in the schedules.

(b) Provide finish coats that are compatible with primers used.

(c) The number of coats and the film thickness required are the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce a smooth even surface according to the manufacturer's directions.

(d) Apply additional coats if undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.

(e) The term exposed surfaces includes areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.

(f) Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

(g) Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, nonspecular black paint.

(h) Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

2. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

   a. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

3. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to the manufacturer's directions.

   a. Brushes: Use brushes best suited for the material applied.

   b. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.

   c. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

4. Minimum Coating Thickness: Apply materials no thinner than the manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

5. Mechanical and Electrical Work: Painting mechanical and electrical work is limited to items exposed in mechanical equipment rooms and in occupied spaces.

6. Mechanical items to be painted include, but are not limited to, the following:

   (a) Piping, pipe hangers, and supports.
   (b) Supports.
   (c) Motors and mechanical equipment.
   (d) Accessory items.

7. Electrical items to be painted include, but are not limited to, the following:

   (a) Conduit and fittings.
   (b) Switchgear.

8. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime-coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

3.14 CLEANING

A. Cleanup: At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.15 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION

Division 10 Specialties

SECTION 10200

LOUVERS AND VENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Fixed pre-finished metal wall louvers.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Joint Sealants are included in Section 07901.

2. Hollow Metal Doors and Frames are included in Section 08110.

3. Field painting is in Division 9.

1.03 DEFINITIONS

A. Louver Terminology: Refer to Air Movement and Control Association (AMCA) 501 for definitions of terms for metal louvers not otherwise defined in this Section or in referenced standards.

1.04 PERFORMANCE REQUIREMENTS

A. Structural Performance: Engineer, fabricate, and install exterior metal wall louvers to withstand the effects of loads and stresses from wind and normal thermal movement without evidencing permanent deformation of louver components including blades, frames, and supports; noise or metal fatigue caused by louver blade rattle or flutter; or permanent damage to fasteners and anchors.

1. Wind Load: Uniform pressure (velocity pressure) of 20 lbf per sq. ft. (960 Pa), acting inwards or outwards.

2. Wind Load: Uniform pressures (velocity pressures) indicated on Drawings, acting inwards or outwards.

3. Normal thermal movement is defined as that resulting from the following maximum change (range) in ambient temperature. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.

a. Temperature Change (Range): 100 deg F (56 deg C).

B. Air-Performance, Water-Penetration, and Air-Leakage Ratings: Provide louvers complying with performance requirements indicated as demonstrated by testing manufacturer's stock units of height and width indicated. Test units according to AMCA 500.

1. Perform testing on unpainted, cleaned, degreased units.

2. Perform water-penetration testing on louvers without screens.

3. Equivalent Air-Performance Ratings: Louvers having less free area than that specified or having a lower free area velocity at the static pressure loss specified may be considered for the Work provided their total air performance is equivalent to that specified. The burden of proof of equivalency is on the Contractor. For louvers to be considered equivalent, the product of their free area, for the size specified, and their free area velocity at the static pressure loss specified must be at least equal to the product of the specified free area and velocity. Also, their free area velocity at the static pressure loss specified must not result in water penetration of more than 0.01 oz. per sq. ft. (3.1 g/sq. m) of free area, and they must meet all other requirements.

1.05 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of product specified.

C. Shop drawings of louver units and accessories. Include plans, elevations, sections, and details showing profiles, angles, and spacing of louver blades; unit dimensions related to wall openings and construction; free areas for each size indicated; profiles of frames at jambs, heads, and sills; and anchorage details and locations.

D. Samples for initial selection in the form of manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes.

E. Samples for verification of each type of metal finish required, prepared on samples of same thickness and material indicated for final unit of Work. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

F. Product test reports evidencing compliance of units with performance requirements indicated.

G. Product certificates signed by louver manufacturers certifying that their products comply with the specified requirements and are licensed to bear the AMCA seal based on tests made according to AMCA 500 and complying with the AMCA Certified Ratings Program.

H. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience.

1.06 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain louvers and vents from one source and by a single manufacturer where alike in one or more respects regarding type, design, and factory-applied color finish.

B. Welding Standards: Comply with applicable provisions of D1.2 "Structural Welding Code--Aluminum," and D1.3 "Structural Welding Code--Sheet Steel."

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

C. SMACNA Standard: Comply with SMACNA "Architectural Sheet Metal Manual" recommendations for fabrication, construction details, and installation procedures.

1.07 PROJECT CONDITIONS

A. Field Measurements: Check actual louver openings by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Louvers:

a. Airline Products Co.
b. Airolite Co.
c. Airstream Products Div., Penn Ventilator Co., Inc.
d. All-Lite Louver Co.
e. American Warming and Ventilating, Inc.
f. Arrow United Industries.
g. Construction Specialties, Inc.
h. Greenheck Fan Corp.
i. Industrial Louvers, Inc.
j. Reliable Metal Products, Div. of Hart & Cooley, Inc.
k. Ruskin Mfg., Tomkins Industries, Inc.

2.02 MATERIALS

A. Anchors and Inserts: Of type, size, and material required for type of loading and installation indicated. Use nonferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or expansion bolt devices for drilled-in-place anchors.

B. Fasteners: Of same basic metal and alloy as fastened metal or 300 series stainless steel, unless otherwise indicated. Do not use metals that are corrosive or incompatible with joined materials

C. Galvanized-Steel Sheet: ASTM A 526 (ASTM A 526M) or ASTM A 527, G90 (ASTM A 527M, Z 275) zinc coating, mill phosphatized.

D. Fasteners: Of same basic metal and alloy as fastened metal or 300 series stainless steel, unless otherwise indicated. Do not use metals that are corrosive or incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.

2. Use Phillips flat-head screws for exposed fasteners, unless otherwise indicated.

E. Anchors and Inserts: Of type, size, and material required for type of loading and installation indicated. Use nonferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or expansion bolt devices for drilled-in-place anchors.

F. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 except containing no asbestos fibers.

2.03 FABRICATION, GENERAL

A. General: Fabricate louvers and vents to comply with requirements indicated for design, dimensions, materials, joinery, and performance.

B. Assemble louvers in shop to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

D. Provide vertical mullions of type and at spacings indicated but not more than recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less. At horizontal joints between louver units, provide horizontal mullions except where continuous vertical assemblies are indicated.

E. Provide sill extensions and loose sills made of same material as louvers where indicated or required for drainage to exterior and to prevent water penetrating to interior.

2.04 FIXED, FORMED-METAL ACOUSTICAL WALL LOUVERS

A. Horizontal, Drainable, Fixed-Blade Louvers: Roll formed steel frames and louver blades, designed to collect and drain water to exterior at sill by means of gutters in front edges of blades and channels in jambs and mullions, complying with the following requirements:

1. Louver Depth: 6 inches (153 mm), unless otherwise indicated

2. Frame Thickness: 18 gage, unless otherwise indicated.

3. Blade Thickness: 18 gage, unless otherwise indicated.

4. Blade Angle: 37.5 degrees.

5. Performance Requirements: As follows, determined by testing units 48 inches (1220 mm) wide by 48 inches (1220 mm) high per AMCA 500:

   a. Free Area: Not less than 8.64 sq. ft. (0.8 sq. m).
   b. Static Pressure Loss: Not more than 0.10 inch wg at an airflow of 900 fpm (4.57 m/s) free area intake velocity.
   c. Water Penetration: Not more than 0.01 oz. per sq. ft. (3.1 g/sq. m) of free area at an airflow of 900 fpm (4.57 m/s) free area velocity when tested for 15 minutes.

6. AMCA Seal: Mark units with the AMCA Certified Ratings Seal.

2.05 LOUVER SCREENS

A. General: Provide louvers with screens at locations indicated.

B. General: Provide each exterior louver with louver screens complying with the following requirements:

1. Screen Location for Fixed Louvers: Interior face, unless otherwise indicated.

2. Screening Type: Insect and Bird screening.

C. Secure screens to louver frames with stainless-steel machine screws, spaced 6 inches (150 mm) maximum from each corner and at 12 inches (300 mm) o.c. between.

D. Louver Screen Frames: Fabricate screen frames with mitered corners to louver sizes indicated and to comply with the following requirements:

1. Metal: Same kind and form of metal as indicated for louver frames to which screens are attached.

   a. Reinforce extruded-aluminum screen frames at corners with clips.

2. Finish: Same finish as louver frames to which louver screens are attached.

2.06 GALVANIZED-STEEL SHEET FINISHES

A. Finish louvers after assembly.

B. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to

be applied over it. Clean welds, mechanical connections, and abraded areas and repair according to ASTM A 780.

C. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard 2-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.

1. Color and Gloss: semi-gloss finish, submit manufacturer's standard pre-finished color chart for selection by ENGINEER.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.02 INSTALLATION

A. Locate and place louver units plumb, level, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Repair finishes damaged by cutting, welding, soldering, and grinding operations required for fitting and jointing. Restore finishes so there is no evidence of corrective work. Return items that cannot be refinished in the field to the shop, make required alterations, and refinish entire unit, or provide new units.

F. Protect galvanized- and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

G. Install concealed gaskets, flashings, joint fillers, and insulation, as louver installation progresses, where required to make louver joints weathertight. Comply with Division 7 Section "Joint Sealants" for sealants applied during installation of louver.

3.03 ADJUSTING AND PROTECTION

A. Protect louvers and vents from damage of any kind during construction period including use of temporary protective coverings where needed and approved by louver manufacturer. Remove protective covering at time of Substantial Completion.

B. Restore louvers and vents damaged during installation and construction period, so that no evidence remains of correction work. If results of restoration are unsuccessful, as judged by Architect, remove damaged units and replace with new units.

1. Clean and touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

C. Test operation of adjustable wall louvers and adjust as needed to produce fully functioning units that comply with requirements.

3.04 CLEANING

A. Periodically clean exposed surfaces of louvers and vents that are not protected by temporary covering to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Rinse surfaces thoroughly and dry.

END OF SECTION

Division 11 Equipment

SECTION 11257

ACTIVATED CARBON ODOR CONTROL SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install the activated carbon adsorption odor control system, including all piping as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Earthwork is included in Section 02200.

B. Small Diameter PVC Pressure Pipe is included in Section 02624.

C. Valves and appurtenances are included in Section 15100.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, shop drawings and schedules. Submittals shall include the following:

1. Certified shop and erection drawings showing all details of construction, dimensions and anchor bolt locations.

2. Descriptive literature, bulletins and/or catalogs of each item of equipment.

3. All information required by Section 01170.

4. The weight of each major item of equipment (include weight of vessel when filled with caustic solution during regeneration).

5. A complete total bill of materials for all equipment.

6. A list of the manufacturer's recommended spare parts. Include gaskets, seals, etc on the list.

7. Complete data on the activated carbon showing it to be in conformance with this Section. Include a complete analysis of the capacity of the activated carbon to adsorb hydrogen sulfide. Also include a complete description of the methods required to regenerate the carbon.

8. Complete description of shop painting of painted surfaces.

B. All details on shop drawings submitted for approval shall show clearly the relations of the various parts to the main members and lines of the structure and where correct fabrication of the work depends upon field measurements, such measurements shall be made and noted on the drawings before being submitted for approval.

C. In the event that it is impossible to conform with certain details of this Section, describe completely all non-conforming aspects.

D. Samples of the fiberglass laminate shall be submitted. These samples shall be from plant production and shall be representative of the quality and hardness of the vessel to be furnished. If the vessel does not meet the standard of the samples, it may be rejected.

E. Operation and Maintenance Data

1. Operating and maintenance instructions shall be furnished to the ENGINEER as provided in Section 01730. The instructions shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, maintenance schedule, carbon replacement, etc, that are required to instruct operating personnel that are unfamiliar with such equipment.

2. A factory representative who has a complete knowledge of proper operation and maintenance shall be provided for 1 day to instruct representatives of the OWNER on proper operation and maintenance of the equipment. If there are difficulties in operation of the equipment due to the manufacturer's design or fabrication, additional service shall be provided at no additional cost to the OWNER.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride)(PVC) Compounds and Chlorinated Poly (Vinyl Chloride (CPVC) Compounds.

2. ASTM D6646 – Standard Test Method for Determination of the Accelerated Hydrogen Sulfide Breakthrough Capacity of Granular and Pelletized Activated Carbon

B. American National Standards Institute (ANSI)

1. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

C. Occupational Safety and Health Administration (OSHA)

D. National Electrical Manufacturers Association (NEMA)

E. National Electrical Code (NEC)

F. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. All carbon adsorption equipment specified in this Section shall be furnished by a single manufacturer who is fully experienced reputable and qualified in the design, construction and operation of odor control systems incorporating activated carbon. Provide evidence of successful operation of such units in commercial application for a period of at least 1 year.

B. The manufacturer shall furnish certified test results indicating H_2S adsorption capacity in pounds per pound of dry carbon for the carbon actually furnished.

C. Should equipment which differs from this Section or as shown on the Drawings be offered and determined equal to that specified and shown, such equipment shall be acceptable only on the basis that any revisions to the design and/or construction of the structure, piping, appurtenant equipment, etc, required to accommodate such a substitution shall be made at no additional cost to the OWNER.

1.06 SYSTEM DESCRIPTION

A. Air shall be discharged from the Air and Vacuum Release Valves (AVRV), through the carbon adsorption filter.

B. Odor Control System on Forcemain

1. Max. Capacity: 20 lbs

2. Source: Sewer Forcemain odors at AVRV

3. Number of Units: 1 per AVRV

C. The carbon shall be suitable for continually removing concentrations of hydrogen sulfide and organic compounds resulting from septage containing nitrogen and sulfur compounds such as mercaptans, indole, skatole and organic acids.

1.07 MAINTENANCE

A. Tools and Spare Parts

1. One set of all special tools required for normal operation and maintenance shall be provided.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. General

1. Activated Carbon Odor control system must exchange air every half hour to an hour for optimal operation.

B. Activated Carbon

1. Type: Product shall be Calgon Carbon Corporation CENTAUR HSV type carbon, or equal.

2. A 10-inch carbon filter shall be of slip-on or flanged type device connected near AVARs in sewer forcemain.

3. The activated carbon manufacturer and producer shall be certified for ISO 9001:2000 quality standards.

4. The activated carbon shall be of a granular, non-impregnated, agglomerated bituminous coal base. Direct activated, broken pellet, pelleted and mixed media carbon shall not be acceptable.

5. The activated carbon can be thermally reactivated by the manufacturer, thus eliminating carbon disposal problems.

6. The carbon supplied shall be of a type that does not require chemicals to be regenerated in-place. Carbons which require hydroxide, permanganate, chlorine, organic, or other solutions, except clean water, to regenerate the material, will not be accepted.

7. The carbon filter, as outlined on the Drawings, consists of a slip-on or flanged device mounted on the vent of the forcemain.

8. Sufficient activated carbon shall be provided to fill each carbon filter. The activated carbon shall be virgin granular activated carbon, derived from bituminous coal. The activated carbon shall be suitable for the vapor phase adsorption of sewage treatment odors. No chemical impregnation of the activated carbon is permitted. The activated carbon shall have the following specifications:

a.	Iodine No., mg/g	800	min
b.	Butane Activity, weight %	15.6	min
c.	Ash, weight %	7	max
d.	Moisture, weight %	4	max
e.	Hardness No.	97	min
f.	Apparent Density, g/ml	0.56	min
g.	Mean Particle Diameter, mm	3.7	min
h.	H_2S Breakthrough Capacity, g H_2S removed/cc Carbon*	0.09	min

*The determination of H_2S breakthrough capacity will be made by passing a moist (85% R.H.) air stream containing 1% H_2S at a rate of 1,450 cc/min. through a 1-inch diameter by 9-inch deep bed of uniformly packed activated carbon and monitored to 50 ppm breakthrough. Results are expressed in grams H_2S removed per cc of carbon.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the location as shown on the Drawings.

3.02 INSPECTION AND TESTING

A. Furnish the services of a manufacturer's representative who has complete knowledge of proper installation, operation, and maintenance of the equipment to inspect the final installation, supervise test runs of the equipment and instruct representatives of the OWNER in the proper operation and maintenance.

B. The system shall be operated and checked to assure that no leaks are present in the system. The system shall also be checked for its ability to remove H_2S in accordance with Paragraph 1.06. Furnish all labor, materials and power required for the test. Furnish an H_2S analyzer complete with all accessories required to take inlet and outlet samples. All testing shall be supervised by a factory representative and shall be in the presence of the ENGINEER. The manufacturer's representative shall correct any defective workmanship and perform the test again to assure the system is tight and free from leaks.

END OF SECTION

SECTION 11258

ODOR CONTROL SYSTEMS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install the activated carbon adsorption odor control system, including all connection ductwork, vessel, fan (if required), grease filter/mist eliminator and incidentals, as shown on the Drawings and as specified herein.

1. One active carbon adsorption system shall be provided on the Mid-Town pump station wet well as shown on the Drawings. The system consists of one skid-mounted fan and vessel.

1.02 RELATED WORK

A. Electrical motors are included in Section 16460.

B. PVC pipe is included in Division 2.

C. Concrete work is included in Division 3.

1.03 SUBMITTALS

A. Submit to the ENGINEER, in accordance with Section 01300, shop drawings and schedules. Submittals shall include the following:

1. Certified shop drawings showing all details of equipment and dimensions.

2. Descriptive literature, bulletins and/or catalogs of equipment including the last five installations of similar equipment.

3. All information required by Section 01300.

4. The weight of each major item of equipment.

5. A complete total bill of materials for equipment.

6. A list of the manufacturer's recommended spare parts. Include gaskets, seals, etc, on the list.

7. Complete data on the head loss for the air flow through the vessel at the design air flow rate and at the maximum head loss prior to carbon change-out.

8. Complete data on the activated carbon showing it to be in conformance with this Section. Include a complete analysis of the capacity of the activated carbon to adsorb hydrogen sulfide and expected life of the carbon (months) based on anticipated inlet conditions.

9. Data on equipment noise as specified in Section 01060.

B. In the event that it is impossible to conform with certain details of this Section, describe completely all non-conforming aspects.

C. Operation and Maintenance Data

1. Operating and maintenance instructions shall be furnished to the ENGINEER as provided in Section 01730. The instructions shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc, that are required to instruct operating personnel that are unfamiliar with such equipment.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride (CPVC) Compounds.

B. Occupational Safety and Health Administration (OSHA)

C. National Electrical Manufacturers Association (NEMA)

D. National Electrical Code (NEC)

E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. All carbon adsorption equipment specified in this Section shall be furnished by a single manufacturer who is fully experienced reputable and qualified in the design, construction and operation of odor control systems incorporating activated carbon. Provide evidence of successful operation of such units in commercial application for a period of at least five years.

B. The manufacturer shall furnish certified test results indicating H_2S adsorption capacity in pounds per pound of dry carbon for the carbon actually furnished.

C. Should equipment which differs from this Section or as shown on the Drawings be offered and determined equal to that specified and shown, such equipment shall be acceptable only on the basis that any revisions to the design and/or construction of the structure, piping, appurtenant equipment, etc, required to accommodate such a substitution shall be made at no additional cost to the OWNER and be as approved by the ENGINEER.

D. Provide services of a manufacturer's service representative, as required in Section 01730, specifically trained on the type of equipment specified in this Section. Submit qualifications of service representative for approval. The number of required days listed below are exclusive of travel time, and do not relieve the Subcontractor of obligation to provide sufficient service to place equipment in satisfactory operation.

1. Operation and maintenance instructions. One 8-hour day

1.06 SYSTEM DESCRIPTION

A. Active carbon adsorption systems shall be installed on the wet well exhaust as shown on the Drawings. Air shall be drawn from the wet well, through the grease filter/mist eliminator, through the fan and discharged through the carbon vessel. Grease filter/mist eliminator location may vary with Manufacturer.

B. The carbon vessel(s) shall have the capability of operating under the following conditions:

1. Maximum Design Capacity: 400 cfm with 20 ppm hydrogen sulfide,

2. Average Design Capacity: 400 cfm with 5 ppm hydrogen sulfide,

C. The carbon shall be suitable for continually removing concentrations of hydrogen sulfide and organic compounds resulting from raw wastewater containing nitrogen and sulfur compounds such as mercaptans, indole, skatole and organic acids.

D. The carbon odor control system shall have an H2S removal efficiency of 99% and a maximum outlet odor concentration of 100 D/T.

E. All equipment furnished under this Section shall conform to the noise limitations specified in Section 01060.

1.07 MAINTENANCE

A. Tools and Spare Parts

1. One set of all special tools required for normal operation and maintenance shall be provided.

2. One complete supply of replacement carbon.

3. All tools and spare parts shall be packaged and labeled as provided in Section 01170.

1.08 WARRANTY

A. Upon completion of installation and start-up of the equipment specified herein and acceptance by ENGINEER, provide Manufacture/Supplier warranty in accordance with Section 01740, Warranties and Bonds.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Carbon Vessels and Fan

1. The carbon system manufacturer shall be responsible for furnishing a complete operational system including the carbon vessel, carbon, and accessories. The carbon adsorption vessels

shall include inlet and outlet flanged openings, sufficient activated carbon to fill the vessels and access ports to remove and replace the carbon. The system shall be under positive pressure with either an ARV pushing air through the vessel or a fan pushing through the vessel and discharging to the atmosphere.

2. Vessels shall be fire retardant, chemically resistant to corrosive fumes, acidic and basic solutions, and ultraviolet degradation.

3. Vessels color shall be white or ENGINEER approved color.

4. Vessels shall be constructed of corrosion resistant FRP or equal. Alternate materials of construction shall be submitted to the ENGINEER prior to approval for review.

5. The active carbon adsorption system shall be skid mounted including the fan. Fan shall be centrifugal type, corrosion resistant, flanged suction, direct drive, with 3450 RPM and TEFC explosion proof motor. Motor shall be 3 HP maximum, 3 phase and 460 volt. Fan shall be equipped with sound enclosure.

6. Carbon vessel manufacturer shall provide connection ductwork between the fan and the carbon vessel.

7. Carbon vessels shall be supplied with a single drain and ball valve.

B. Activated Carbon

1. Sufficient activated carbon shall be provided to fill the vessels as required. The activated carbon shall be virgin granular activated carbon. The activated carbon shall be suitable for the vapor phase adsorption of sewage treatment odors. No chemical impregnation of the activated carbon is permitted. The activated carbon shall have the following specifications:

a.	Moisture, weight %	5	max
b.	Hardness No.	90	min
c.	Apparent Density, g/ml	0.4 to 0.5	min
d.	Mean Particle Diameter, mm	3.7	min
e.	H_2S Breakthrough Capacity, g H_2S removed/cc Carbon*	0.20	min

* The determination of H_2S breakthrough capacity will be made by passing a moist (85% R.H.) air stream containing 1% H_2S at a rate of 1,450 cc/min. through a 1-in diameter by 9-in deep bed of uniformly packed activated carbon and monitored to 50 ppm breakthrough. Results are expressed in grams H_2S removed per cc of carbon.

The carbon supplied shall be of a type that does not require chemicals to be regenerated in-place. Carbons which require hydroxide, permanganate, chlorine, organic, or other solutions, to regenerate the material, will not be accepted.

C. Grease Filter/Mist Eliminator

1. A grease filter/mist eliminator shall be supplied. This unit shall consist of a Type 304L stainless steel pad for grease filtration in front of a PPL pad with Type 316 stainless steel grid for mist elimination, housed inside an FRP enclosure. The pads shall be removable for

cleaning and the housing shall have two doors, to allow removal and replacement of the filter pads.

2. A Dwyer Series 2000 Magnehelic gauge shall be installed on the housing to indicate pressure drop through the unit. This unit shall ship loose and be ready for installation into the odor control system supply ductwork.

3. Grease filter/mist eliminator shall be provided with a drain and ball valve.

3. The FRP housing shall be flanged and drilled per PS 15-69 and come complete with gaskets, ready for installation. The filter/eliminator unit shall be manufactured by Diamond Fiberglass Fabricators, Inc.; Kimre Inc., Miami, FL; Ceilcote Air Pollution Control, Strongsville, OH or equal.

4. Location of the grease filter/mist eliminator shall be coordinated with the carbon system Manufacturer and the ductwork Manufacturer. Location shall be approved by the ENGINEER prior to fabrication and installation.

D. All metal surfaces shall be factory finish painted with a corrosion resistant paint.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the location as shown on the Drawings.

3.02 INSPECTION AND TESTING

A. Furnish the services of a manufacturer's representative who has complete knowledge of proper installation, operation, and maintenance of the equipment to inspect the final installation, supervise test runs of the equipment and instruct representatives of the OWNER in the proper operation and maintenance.

B. Installation of the carbon bed support systems and activated carbon shall be done under the direction of the manufacturer's representative in order to assure proper placement of the activated carbon. The manufacturer's representative shall instruct personnel in the proper safety precautions concerning handling of activated carbon.

C. Once the system installation has been approved by the manufacturer and the ENGINEER, it shall be run for 24 hours and all necessary adjustments shall be made to air flow rate (if required), alignment and calibration of all instrumentation as directed by the manufacturer's representative.

D. The performance tests shall be conducted at such time as all anticipated odorous air streams are present in the carbon adsorption system inlet. The time of the tests and detailed test procedure shall be submitted for approval prior to the testing period. The testing should occur during peak odor season, typically in the summer months.

Testing for the active system shall be as follows:

1. During testing, carbon adsorption system air flow rate shall be held constant. Changes in system operating conditions shall not be permitted. All fine-tuning of operating conditions shall be performed prior to testing.

2. Design operating conditions shall be maintained for a minimum of 6 hours. During this time, all pertinent operating parameters shall be monitored and recorded, sufficient sampling and analysis shall be conducted to demonstrate that flow rates is at design condition.

3. Hydrogen sulfide concentration shall be measured in the carbon inlet and outlet. As a minimum, the test shall be conducted continuously for 24 hours utilizing a logging instrument such as an OdaLog.

4. An odor performance test shall be performed as follows:

    a. Two separate samples shall be drawn for odor performance testing at each of the following locations:

        1) Inlet odorous air to the odor control system.
        2) Outlet treated air from the odor control system.

        Odor concentration samples will be taken in the morning and in the afternoon. A total of four odor concentration samples will be taken for the performance testing.

    b. Samples shall be collected, marked, transported and tested offsite in a controlled laboratory environment by the independent testing staff using EN13725 - Committee European Normalisation (CEN) standard method for "Determination of odor threshold by dynamic olfactometry. The odor panel tests shall not exceed 200 dilutions to threshold (D/T) at the outlet of the odor control system.

E. Results: A description of the performance tests shall be submitted. Should carbon adsorption system performances not meet any of the above removal requirements specified in Paragraph 1.06, system shall have failed the performance tests. The manufacturer shall make any additions or modifications to the carbon adsorption system that may be necessary, at no additional cost to the OWNER, and the performance tests for that system shall be repeated in its entirety.

END OF SECTION

SECTION 11306

SUBMERSIBLE SOLIDS-HANDLING WASTEWATER PUMPS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install, place in operation and field test the submersible solids-handling wastewater pumps shown on the Drawings and specified herein. The equipment to be furnished and installed for each station shall be as shown on the Drawings and shall include pumps, motors, pump accessories, electrical controls, weatherproof enclosure and appurtenances, all tested and ready for operation.

B. These Specifications are intended to give a general description of what is required, but do not cover all details which will vary in accordance with the requirements of the equipment as offered. It is, however, intended to cover the furnishing, the shop testing, the delivery and complete installation and field testing of all materials, equipment and appurtenances for the complete pumping units as herein specified, whether specifically mentioned in these Specifications or not.

C. Pump motors, cables and appurtenances shall be capable of operation in a Class I Division I Hazardous Environment.

1.02 RELATED WORK

A. Submittals are included in Section 01300.

B. Operation and maintenance is included in Section 01730.

C. Warranties are included in Section 01740.

D. Yard piping is included in Division 2.

E. Concrete work is included in Division 3.

F. Field painting is included in Section 09902.

G. Instrumentation and control work and equipment are included in Division 13.

H. Mechanical piping, valves, pipe hangers and supports are included in the respective Sections of Division 15.

I. Electrical work and equipment is included in Division 16.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, copies of all materials required to establish compliance with the Specifications. Submittals shall include at least the following:

1. Shop and erection drawings showing all important details of construction, dimensions and anchor bolt locations.

2. Descriptive literature, bulletins, and/or catalogs of the equipment. Sufficient data shall be submitted to document previous production of each pump model proposed for use on this Contract.

3. Data on the characteristics and performance of each pump. Data shall include guaranteed performance curves, based on actual shop tests of similar units, which show that they meet the specified requirements for head, capacity, efficiency, NPSHR, submergence and horsepower. Curves shall be submitted on 8-1/2-inch by 11-inch sheets, at as large a scale as is practical. Curves shall be plotted from zero flow at Shut Off Head to Pump Capacity at minimum specified TDH. Catalog sheets showing a family of curves will not be acceptable.

4. The total weight of the equipment including the weight of the single largest item.

5. Drawings showing the layout of the Control Panels. The layout shall show front and side elevations and shall indicate every device mounted on the inner or exterior door and subpanel with complete identification.

6. Complete wiring diagrams and schematics of all power and control systems showing wiring requirements between all system components, motors, sensors, control panels, starters and related systems.

7. A complete total bill of materials of all equipment.

8. A list of the manufacturer's recommended spare parts to be supplied in addition to those specified in Paragraph 1.08, with the manufacturer's current price for each item. Include gaskets, seals, etc. on the list. List bearings by the bearing manufacturer's numbers only.

9. All submittal data required by the General Conditions.

10. Complete motor data, including, but not limited to: type of enclosure design, rated horsepower, rated voltage, FLA, Starting Current, LRA, LR KVA, NEMA Code Letter, rpm, input power in kw at nameplate rating, starting calculations, cable size, efficiency at 50%, 75% & 100% load, and power factor at 50%, 75% & 100% load.

11. Certified agreement to the conditions of the warranty.

B. In the event that the equipment offered does not conform to all of the detailed requirements of the Specifications, describe completely all nonconforming aspects. Failure to describe any and all deviations from the specifications will be cause for rejection.

1.04 REFERENCE STANDARDS

A. Design, manufacturing and assembly of elements of the equipment herein specified shall be in accordance with, but not limited to, published standards of the following, as applicable:

1. American Gear Manufacturers Association (AGMA).

2. American Institute of Steel Construction (AISC).

3. American Iron and Steel Institute (AISI).

4. American Society of Mechanical Engineers (ASME).

5. American National Standards Institute (ANSI).

6. American Society for Testing Materials (ASTM).

7. American Welding Society (AWS).

8. American Bearing Manufacturers Association (ABMA).

9. Hydraulic Institute Standards (current edition).

10. Institute of Electrical and Electronics Engineers (IEEE).

11. National Electric Code (NEC).

12. National Electrical Manufacturers Association (NEMA).

13. Occupational Safety and Health Administration (OSHA).

14. Steel Structures Painting Council (SSPC).

15. Underwriters Laboratories, Inc. (UL).

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. All pumps furnished under this Section shall be the product of a single manufacturer.

B. To assure unity of responsibility, the pumps, motors, local control panels and other auxiliary equipment, and materials specified in this Section shall be furnished and coordinated by the pump manufacturer (MANUFACTURER) who shall assume responsibility for the satisfactory operation of the entire pumping system including pumps, motors, controls, local control panel, and accessories.

C. The pumps and other equipment covered by these Specifications shall be standard production units of the manufacturers, currently available and listed in the respective manufacturer's catalog. The pumps furnished shall be in accordance with the Hydraulic Institute Standards and shall be designed, constructed and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed.

D. The pump manufacturer shall have an authorized warranty center within a 300-mile radius of the job site, fully staffed with factory-trained mechanics, and equipped with a stock of all necessary spare parts for each model of pump furnished under this contract. The service facility shall be an established entity prior to delivery of equipment for this project.

E. The control system shall have an established record of successful performance for similar service.

F. All equipment furnished under this Specification shall be new and unused, shall be the standard product of manufacturers having a successful record of manufacturing and servicing similar equipment and systems to that specified herein for a minimum of five (5) years.

G. The pumping equipment shall be furnished complete with controls, and accessories required and shall meet the detailed requirements of the Specifications.

1.06 SYSTEM DESCRIPTION

A. The equipment to be furnished under this section shall include submersible wastewater pumps, motors, controls, local control panel and accessories, all as specified herein and as shown on the Drawings. The pumps will be used to pump raw wastewater within the Los Osos collection system that is being constructed under separate contract. The pump arrangement (spacing and back wall dimensions), shall be based on the units to be furnished and shall be approved by the ENGINEER if different than shown in the Drawings.

1.07 OPERATING INSTRUCTIONS

A. Operating and Maintenance Manuals shall be furnished. The manuals shall be prepared specifically for equipment furnished and installed under this contract and shall include all required cut sheets, drawings, equipment lists, descriptions, etc. that are required to instruct operating and maintenance personnel unfamiliar with such equipment. The number and special requirements shall be as specified in the Section 01730.

B. A factory representative of all major component manufacturers, who has complete knowledge of proper operation and maintenance, shall be provided to instruct representatives of the OWNER on proper operation and maintenance.

C. The cost of training programs to be conducted with MANUFACTURER'S personnel shall be included in the Contract price. The training and instruction, insofar as practicable, shall be directly related to the System being supplied.

D. The MANUFACTURER shall provide detailed manuals to supplement the training courses. The manuals shall include specific details of equipment supplied and operations specific to the project.

E. The MANUFACTURER shall make use of teaching aids, manuals, slide/video presentations, etc. After the training services, such materials shall be delivered to OWNER.

1.08 TOOLS AND SPARE PARTS

A. The MANUFACTURER shall furnish a complete list of recommended spare parts necessary for the first 5 years operation of each pumping system.

B. Additional spare parts requirements are included in the respective paragraphs of Part 2 - PRODUCTS.

1.09 PRODUCT HANDLING

A. All equipment and parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of fabrication until final delivery to the job site.

B. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the ENGINEER.

C. Finished surfaces of all exposed pump openings shall be protected by wooden blanks, strongly built and securely bolted thereto or by other approved means.

D. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

E. After hydrostatic or other tests, all entrapped water shall be drained prior to shipment and proper care shall be taken to protect parts from the entrance of water during shipment, storage and handling.

F. Each box or package shall be properly marked to show its net weight in addition to its contents.

1.10 WARRANTY

A. All equipment supplied under this section shall be warranted for a period of one (1) year by the CONTRACTOR and the MANUFACTURER. Warranty period shall commence on the date of OWNER acceptance, as outlined in Division 1 and in Division 0.

B. The equipment shall be warranted to be free from defects in workmanship, design and materials. If any part of the equipment should fail during the warranty period, it shall be replaced and the unit(s) restored to service at no expense to the OWNER.

C. The MANUFACTURER's warranty period shall run concurrently with the CONTRACTOR's warranty period. No exception to this provision shall be allowed.

D. Refer to Section 01740 for additional warranty requirements.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. The pumping units required under this Section shall be complete including pumps and motors with proper alignment and balancing of the individual units. Ample room shall be provided for inspection, repairs, and adjustments.

B. Each base elbow for each pump shall be designed to be rigidly and accurately anchored into position. All necessary foundation bolts, plates, nuts, and washers shall be furnished and installed by the CONTRACTOR.

C. Stainless steel nameplates giving the name of the manufacturer, the rated capacity, head, speed, and all other pertinent data shall be permanently attached to each pump and/or motor.

2.02 PUMPING SYSTEM - GENERAL

A. The pumps shall be totally submersible, solids-handling centrifugal pumps with submersible close coupled motors designed to pump raw, unscreened wastewater. The design shall be such that the pumping units shall be automatically connected to the discharge piping when lowered into place on the discharge connection. The pumps shall be designed to be easily removed from their discharge connections and the wet well for inspection or service. Lifting the pumps from their discharge connections or the wet well shall not require the removal of any bolts, nuts or other fastenings and shall not require personnel to enter the pump well. The pumps shall be as manufactured by Flygt, ABS or pre-approved equal. All products must meet the detailed requirements of these specifications.

B. The pump manufacturer shall factory test all pumps prior to shipment in accordance with the ANSI/HI 11.6 (latest) Hydraulic Institute Standard for Submersible Pump Tests. Flow, Total Head and Input KW shall be tested and recorded for at least 5 points on the pump performance curve. The five points shall include the points specified on the pump data table. Certified copies of the test report shall be furnished to the ENGINEER for approval prior to shipment.

C. Lower guide holders shall be integral with the discharge connection. Guide bars shall be of Schedule 40, welded 2-inch minimum diameter, 316 stainless steel pipe of the length required by the Drawings.

D. Intermediate guide brackets shall be furnished and installed so that the maximum length of unsupported guide bars will be no longer than 15 feet, and shall be fabricated of 316 stainless steel.

E. Stainless steel cable holders including the cable hooks shall be fabricated from type 316 stainless steel plate. Sharp corners and edges shall be ground smooth to prevent abrasion and cutting of electrical cable insulation. The cable holder shall be of sufficient length and strength to provide support for each separate cable, except that the pump power and

lift cables may use the same hook position, provided the cables do not foul one another and the lift cable is easily accessed from the hatch opening.

F. See the Pumping Station Data Table 11306-1 at the end of this section for the pump performance requirements.

2.03 PUMP CONSTRUCTION

A. Impellers shall be constructed of ASTM A 48 Class 40B gray cast iron. The impeller shall be a semi-open or vortex non-clog design, capable of passing fibrous material.

B. All external pump and motor parts shall be of close grained cast iron, ASTM A48 Class 40B, or 300 series stainless steel construction, with all parts coming into contact with wastewater protected by corrosion resistant coatings. All external bolts and nuts shall be of 316 stainless steel.

C. A sliding guide bracket shall be an integral part of the pumping unit and shall fit the base elbows. The pump casing shall have a machined connection system to attach to the ASTM A48, Class 40 cast iron discharge connection. The sealing system shall consist of two machined metal to metal flanges or flanges with a replaceable rubber seal, form fitted to the machined discharge coupling to insure and guarantee a positive leak proof system and to provide ease of pump removal. The bracket shall be rated at non-sparking.

D. The discharge connection shall be bolted to the floor of the sump with 316 stainless steel anchor bolts and so designed as to receive the pump connection without the need of any bolts or nuts. The pump shall be tightly sealed against the discharge connection and shall be accomplished by a simple linear downward motion of the pump with the pumping unit guided by a 2-inch minimum diameter, Schedule 40, 316 stainless steel guide. No portion of the pump shall bear directly on the sump floor. The minimum discharge size for the pumps is listed in Table 11306-1.

E. Each pump shall be fitted with a 3/8 inch (minimum) diameter 316 stainless steel lifting cable. The lifting cable's combined length shall be equal to the wet well depth (top slab finished grade to wet well bottom) plus six feet to permit raising the pump for inspection and removal. The lifting cable shall be rated a minimum of 4 times the lifted weight.

F. The lifting cable shall be attached to a stainless steel bail on the pump. Eyebolts will not be considered as an acceptable alternate to a lifting bail.

2.04 SUBMERSIBLE MOTORS

A. Pump motors shall be housed in an air or oil filled water-tight casing, and shall have Class H Non-Hygroscopic insulated windings which shall be moisture resistant. The motors shall be suitable for use with the either conventional electromechanical or solid-state starters as detailed on the electrical Drawings. The motor stator shall be dipped and baked three times in Class H varnish and heat shrunk fitted into the stator housing. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable. Motors shall be NEMA Design B with a 1.15 service factor based upon the nameplate horsepower rating. De-rating the motors to achieve the specified service factor will not be acceptable. The motor shall be rated at 140^{o} C or better while operating in an ambient temperature of 40^{o} C. The motor shall be NEMA Code Letter G or H, or

better. Motors shall be non-overloading over the entire pump curve and capable of sustaining a minimum of 10 starts per hour. Motors shall be provided as IE3 rated premium efficient with the following minimum efficiency and power factor at full load:

HP	EFFICIENCY	PF
2-4	73%	.82
5	87%	.82
7 1/2 - 15	90%	.82
20 - 30	90%	.82
40 - 50	94%	.82
60 - 100	94%	.82

B. Pump motors shall have cooling characteristics suitable to permit continuous operation in a totally-submerged condition and permit operation for up to 15 minutes in a partially or non-submerged condition. Each motor shall incorporate three ambient temperature compensated overheat sensing devices, one in each motor winding. These devices shall trip at 135^{o} C for Class H Insulation. The sensing device shall be wired into the pump controls in a manner such that if the device operates, the pump will shut down. The temperature device shall be self-resetting.

C. Unless otherwise noted or shown on the Electrical Drawings, motors shall be rated at 460 volts, three phase, 60HZ.

D. The pump/motor shaft shall be constructed of Type 420 Stainless Steel. When operating at the pump design point, the shaft shall have a maximum deflection of 0.2 mm at the lower seal face and a maximum deflection of 0.45 mm at the wear ring area. The shaft shall rotate on permanently lubricated ball bearings properly sized to withstand the axial and radial forces. The ABMA Minimum L-10 bearing life shall be at least 50,000 hours.

E. Each pump shall be provided with a tandem mechanical shaft seal system. The upper of the tandem set of seals shall operate in an oil chamber located just below the stator housing. This set shall contain one stationary tungsten carbide and one positively driven rotating carbon ring and shall function as an independent secondary barrier between the pumped liquid and the stator housing. The lower of the tandem set of seals shall function as the primary barrier between the pumped liquid and the stator housing. This set shall consist of a stationary ring and a positively driven rotating ring, both of which shall be either tungsten carbide or silicon carbide. Each interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment, but shall be easily inspected and replaceable. Shaft seals without positively driven rotating members or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower units are not acceptable or equal to the dual independent seal specified.

F. The pump motor with its appurtenances and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet. All mated surfaces shall be machined, fitted with O-rings for watertight sealing.

G. The pumps shall be provided with a cable entry design that shall preclude specific torque requirements to insure a water tight and submersible seal. The cable entry shall be comprised of a single cylindrical elastomer grommet flanked by stainless steel washers, all having a close tolerance fit against the cable outside diameter and the entry inside

diameter and compressed by the entry body containing a strain relief function separate from the function of sealing the cable. The assembly shall bear against the shoulder in the pump motor top. The cable entry junction chamber and motor shall be separated by a stator lead, sealing gland or terminal board, which shall isolate the motor interior from foreign material gaining access to the pump motor top. The cable entry system shall be field serviceable. The power and control cable entry into the lead connection chamber may also be epoxy encapsulated for positive moisture sealing. A BUNA-N cable grommet shall be provided in addition to the epoxy sealed leads. On pumps sized 4" or smaller, a quick disconnect shall be provided to allow easy removal of the pump without having to disconnect the motor leads in the control panel. Motor housings shall have a seal failure detection and alarming system. Motor mounted sensing devices, interconnecting cables and panel mounted sensor controller device (power supply, output contact, etc) shall be furnished. The sensor controller shall be mounted in the control panel.

H. The pumps shall be supplied with power and sensor conductors encapsulated in a single cable. Pump motor cables shall be sized to meet applicable NEC requirements. The cable shall consist of a type SPC or SEOW insulated cable with a double jacketed protection system. The cable shall have a neoprene or chlorinated polyethylene outside and synthetic rubber inside, and shall exceed industry standards for oil, gas and sewage resistance. Individual conductors shall be of type RUW. If more than one cable is required by the MANUFACTURER, the MANUFACTURER shall furnish and provide for the installation of the additional conduits required for the cables proposed. Only one pump's cable(s) per conduit will be allowed at the pump station:

1. Conduit sized per manufacturers recommendations, but not smaller than 1-1/2 - inch.

2. All require stainless steel conduit hardware and fittings.

3. Water tight connectors (equal to Crouse-Hinds Type "CGB")

4. Conduit seals (equal to Crouse-Hinds Type "EYS")

5. Coordinate the installation of the above materials with the CONTRACTOR.

I. Watertight connectors, equal to Crouse Hinds Type CGB, with neoprene lands shall be furnished with and installed in the control panel enclosure or disconnect to terminate each conduit and seal each cable entry. Pump cables shall be provided of sufficient length so that the cables will be continuous between the pump and disconnect with no splices being allowed.

2.05 PUMP CONTROL SYSTEM

A. All pump level controls, motor starters, control panel enclosures, motor control centers, etc., shall be furnished under Specification Division 16 – Electrical and Division 13 – Process Instrumentation and Controls. Refer to these specification sections and the associated Drawings for details.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation shall be in strict accordance with the MANUFACTURER'S instructions and recommendations in the locations shown on the Drawings. The CONTRACTOR shall furnish all required oil and grease for initial operation, if required, in accordance with the MANUFACTURER's recommendations. Anchor bolts shall be set in accordance with the MANUFACTURER's recommendations.

B. Upon completion of each pump station, the MANUFACTURER shall inspect the installation and submit a certificate stating that the installation of the equipment is satisfactory, that the equipment is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication and care of each unit.

3.02 SHOP PAINTING

A. Before exposure to weather and prior to shop painting, all surfaces shall be thoroughly cleaned, dry and free from all mill-scale, rust, grease, dirt and other foreign matter.

B. All pumps and motors shall be shop coated with a two-part epoxy to 10 mils DFT.

C. All nameplates shall be properly protected during painting.

D. Gears, bearing surfaces, and other similar surfaces obviously not to be painted shall be given a heavy shop coat of grease or other suitable rust-resistant coating. This coating shall be of the type required to prevent corrosion during the period of storage and shall be satisfactory to protect the pumps up to the time of the final acceptance test.

3.03 INSPECTION AND TESTING

A. General:

1. The ENGINEER shall have the right to inspect, test or witness tests of all materials or equipment to be furnished under these Specifications, prior to their shipment from the point of assembly.

2. The pump manufacturer shall perform the following test on each pump prior to shipment from factory:

a. Megger motor and pump for insulation breaks or moisture.

b. Prior to submergence, the pump shall be run dry and checked for correct rotation.

c. Pump shall be run for a minimum of thirty (30) minutes in a submerged condition.

d. As noted in paragraph 2.02 C., each pump shall be given a complete non-witnessed test to Hydraulic Institute standards. Tests shall be performed to demonstrate that pumps meet Level A acceptance standards.

e. The pump shall be removed from test tank, meggered immediately for moisture and upper and lower seal unit shall be checked for water intrusion.

f. A written certification test report regarding the above tests shall be supplied with each pump at the time of shipment.

3. As specified in paragraph 3.01 B., the MANUFACTURER shall furnish the services of a factory representative who shall have complete knowledge of proper operation and maintenance to inspect the final installation and supervise the test run of the equipment.

4. Field tests shall not be conducted until such time that the entire installation is complete and ready for testing.

5. In the event that the equipment does not meet the Final Acceptance Test, the CONTRACTOR shall, at his own expense, make such changes and adjustments to the equipment which he deems necessary and shall conduct further tests until full satisfaction is indicated by the ENGINEER and written certification is received thereof.

B. Pumps:

1. After all pumps have been completely installed, and working under the direction of the CONTRACTOR, conduct in the presence of the ENGINEER such tests as are necessary to indicate that pumps conform to the Specifications. Field tests shall include all pumps included under this Section. The CONTRACTOR shall supply all electric power, water or wastewater, labor, equipment and incidentals required to complete the field tests.

2. The Final Acceptance Test shall demonstrate that all items of these Specifications have been met by the equipment as installed and shall include, but not be limited to, the following tests:

a. That the quick release lift out feature functions properly and allows the pump to be raised and lowered without draining the pit.

b. That all units have been properly installed and are in correct alignment.

c. That the units operate without overheating or overloading any parts and without objectionable vibration.

d. That there are no mechanical defects in any of the parts.

e. That the pumps can deliver the specified pressure and quantity of raw, unscreened sewage.

f. That the pump sensors and controls perform satisfactorily as to sequence control, correct start and stop elevations, and proper level alarm functions.

3. If the pump performance does not meet the Specifications, corrective measures shall be taken or pumps shall be removed and replaced with pumps which satisfy the conditions specified. A 24-hour operating period of the pumps will be required before acceptance.

C. Motors:

The CONTRACTOR shall check all motors for correct clearance and alignment and for correct lubrication in accordance with manufacturer's instructions. The CONTRACTOR shall check direction of rotation of all motors and reverse connections if necessary.

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TABLE 11306-1
PUMPING UNIT DESIGN REQUIREMENTS

Item Description	Mid-Town	West Paso	Lupine	Baywood	East Ysabel	East Paso	Solano	Sunny Oaks	Mtn. View
No. of Pumps (duty/standby)	(2 / 1)	(2 / 1)	(1 / 1)	(1 / 1)	(1 / 1)	(1 / 1)	(1 / 1)	(1 / 1)	(1 / 1)
Motor									
Max Speed (rpm)	1800	1800	1800	1800	1800	1800	1800	1800	1800
Volts/Phase	All Pumps Shall be 460 Volt / 3 Phase								
Max Horsepower	70	70	60	7.5	12	5	6	4	5
Pump and Hydraulics									
Min Discharge Dia (in)	6	4	4	4	4	4	4	3	4
Max Operating Temp (deg F)	80	80	80	80	80	80	80	80	80
Shut-Off Head Range (feet)	140-200	170-225	180-200	50-65	80-90	40-55	50-85	20-25	40-50
Static Head (feet)	80	120	110	24	47	16	31	5	20
Design Flow (gpm)	1161	775	623	380	300	300	300	153	125
Design TDH (feet)	100	141	138	31	61	33	38	12	35
Min Wire to Water Eff at Design Flow (%)	60	55	55	55	50	55	50	25	35
Secondary Flow (gpm)	1300	1000	800	500	400	400	400	200	175
Secondary TDH (feet)	88	120	120	26	57	23	31	10	31
Min Wire to Water Eff at Secondary Flow (%)	55	55	55	55	55	60	55	20	40
Max NPSH3 w/in Design Range (feet)	20	20	20	20	20	20	20	20	20
Pump Model used for Design – ABS and Flygt	XFP 150M NP 3202	XFP 100J NP 3202	XFP 100J NP 3202	XFP 100E NP 3102	XFP 100E NP 3127	XFP 100C NP 3102	XFP 100E NP 3102	XFP 80C NP 3085	XFP 100E NP 3102

END OF SECTION

SECTION 11310

SUBMERSIBLE GRINDER PUMPS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals to install submersible pumps and spare submersible pumps tested and ready for operation and with all accessories as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Yard piping is included in Division 2.

B. Concrete work is included in Division 3.

C. Field painting is included in Section 09902.

D. Instrumentation and control work, except as specified herein, is included in Division 13. Instrumentation and controls provided in this section shall adhere to Instrumentation and Control Specifications Sections in Division 13.

E. Mechanical piping, valves, pipe hangers and supports are included in the respective Sections of Division 15.

F. Electrical work is included under Division 16.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, copies of all materials required to establish compliance with this Section. Submittals shall include the following:

1. Certified shop and erection drawings showing all important details of construction, dimensions and anchor bolt locations.

2. Descriptive literature, bulletins and/or catalogs of the equipment.

3. Data on the characteristics and performance of the pumps. Data shall include guaranteed performance curves, based on actual shop tests of duplicate units, which show that they meet the specified requirements for head, capacity, efficiency, allowable NPSH, and horsepower. Curves shall be submitted on 8-1/2-in by 11-in sheets.

4. The total weight of the equipment including weight of the single largest item.

5. A complete total bill of materials for all equipment.

6. A list of the manufacturer's recommended spare parts with the manufacturer's current price for each item. Include gaskets, packing, etc, on the list. List the bearings by the bearing manufacturer's numbers only.

7. All information required by Section 01170.

8. A statement indicating bearing life.

9. Complete data on motors and power factor correction capacitors (if required) in accordance with Section 16460.

10. Complete description of surface preparation and shop prime painting.

B. Operation and Maintenance Data

1. Copies of an operating and maintenance manual for each size pump shall be furnished to the ENGINEER as provided for in Section 01730. The manuals shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc., that are required to instruct operating and maintenance personnel unfamiliar with such equipment.

2. A technical representative, from the respective pump manufacturer who has complete knowledge of proper operation and maintenance shall be provided for 1 day to instruct representatives of the OWNER and the ENGINEER on proper operation and maintenance. This work may be conducted in conjunction with the inspection of the installation and test run as provided under Paragraph 3.02 below. If there are difficulties in operation of the equipment due to the manufacturer's design or fabrication, additional service shall be provided at no additional cost to the OWNER.

1.04 REFERENCE STANDARDS

A. American National Standard Institute (ANSI)

B. American Bearing Manufacturers Association (ABMA)

C. National Electrical Manufacturers Association (NEMA)

D. National Electrical Code (NEC)

E. Factory Mutual (FM)

F. Underwriters Laboratories (UL)

G. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. All pumps furnished under this Section shall be the product of a single manufacturer.

B. The rated horsepower of the drive unit shall be such that the unit will not be overloaded nor the service factor reduced when the pump is operated at any point on the pump's capacity curve. If, due to the slope of the pump's performance curve, a drive unit of greater horsepower than specified is required to meet this condition, the pump will be considered for approval only if any and all changes in electrical work, etc., required by such a change will be provided at no additional cost to the OWNER and be to the satisfaction of the ENGINEER.

C. The pump manufacturer shall have an authorized warranty center within a 300-mile radius of the job site, fully staffed with factory-trained mechanics, and equipped with a stock of all necessary spare parts for each model of pump furnished under this contract. The service facility shall be an established entity prior to delivery of equipment for this project.

D. All equipment furnished under this Specification shall be new and unused, shall be the standard product of manufacturers having a successful record of manufacturing and servicing similar equipment and systems to that specified herein for a minimum of five (5) years.

E. The pumping equipment shall be furnished complete with controls, and accessories required and shall meet the detailed requirements of the Specifications.

F. The control system shall have an established record of successful performance for similar service.

1.06 SYSTEM DESCRIPTION

A. All of the equipment included herein is intended to be standard for submersible use.

B. The submersible pumps shall be as shown on the drawings.

C. The pumps will be operated at constant speed, controlled separately by the water level. The motors shall be submersible squirrel cage induction type.

1.07 MAINTENANCE

1. One set of all special tools required for normal operation and maintenance shall be provided as specified in Section 01170.

2. The following spare parts shall be provided:

   a. One extra set of mechanical seals for each pump.

   b. Two complete sets of gaskets, O-rings, etc, for each pump.

   c. One shaft sleeve if applicable.

   d. One set of pump radial and thrust bearings.

e. One set of wearing rings.

f. One shredding ring and impeller per pump.

3. One spare pump of each pump model provided under this specification

4. All tools and spare parts shall be furnished in accordance with Section 01170.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. This Section is intended to give a general description of what is required, but does not cover all details which will vary in accordance with the requirements of the equipment as offered. It is, however intended to cover all materials, equipment and appurtenances for the complete pumping units as herein specified, whether specifically mentioned in this Section or not.

B. For all units there shall be furnished and installed all necessary and desirable accessory equipment and auxiliaries whether specifically mentioned in this Section or not and as required for an installation incorporating the highest standards for the type of service.

C. Pump bases or base elbows as the case may be shall be rigidly and accurately anchored into position on concrete and all necessary foundation bolts, plates, nuts and washers shall be furnished and installed. Anchor bolts shall be Type 304 stainless steel.

D. Brass or stainless steel nameplates indicating pump and motor model and performance information shall be attached to each pump.

E. The manufacturer shall supply complete factory mounted equipment with sufficient power and signal cable, as required by the location.

F. All electrical materials and equipment shall be UL listed or FM approved and NEMA rated, and shall otherwise be equal to that supplied under Division 16, where applicable.

G. Control panels as applicable shall be factory wired, such that field wiring connections shall require connection of power and control/sensory wiring to the control panel and to the pumps and alarm wiring to the control panel and the pump failure alarm light. Field wiring connections shall be to numbered terminal strips. The entire control system shall be factory tested before shipment.

H. See the Pumping Station Data Table 11310-1 at the end of this section for the pump performance requirements.

I. Pumps shall be provided by ABS, Flygt, or pre-approved equal.

2.02 PUMP CONSTRUCTION

A. The pumps shall be totally submersible screenless grinder pumps designed for pumping raw residential sewage. The pumps shall be mounted on a guide rail system to allow the pumps to be easily removed for inspection or service, requiring no bolts, nuts or other fastenings to be removed for this purpose and no need for personnel to enter the pump well. Each pump shall be fitted with a 316 stainless steel lifting cable of adequate strength and length to permit raising the pump for inspection and removal.

B. The stator casing, coil casing and volute shall be constructed of gray iron ASTM A48 Class 40B with all components in contact with liquid protected by an epoxy coating intended for providing protection in harsh raw sewage environments. All external bolts and nuts shall be of 316 stainless steel.

C. The grinder pump shall have a cast iron ASTM A48 Class 40B impeller, Type 440 stainless steel shredding impeller, and Type 440 stainless steel shredding ring or hardened alloy steel Rockwell C58-62.

D. Each pump shall be provided with a tandem double mechanical seal running in an oil reservoir, composed of two separate lapped seal faces. Each seal face shall consist of one stationary and one positively driven rotating tungsten-carbide ring with each pair held in contact by a separate spring, so that the outside pressure assists spring compression in preventing the seal faces from opening. The compression spring shall be protected against exposure to the pumped liquid. The pumped liquid shall be sealed from the oil reservoir by one face seal and the oil reservoir from the air-filled motor chamber by the other. The seals shall require neither maintenance nor adjustment, and shall be easily replaced. Conventional double mechanical seals with a single spring between the rotating faces, requiring constant differential pressure to effect sealing and subject to opening and penetration by pumping forces shall not be considered equal to tandem seal specified and required. No seal damage shall result from operating without water, nor shall the sealing system rely on the pumped media for lubrication.

E. Pump shafts shall be of stainless steel, ANSI 431, 420 or equal.

F. Pump and motor bearings shall be anti-friction type with a B-10 life of 20,000 hours minimum.

G. Each pump shall be provided with a lifting handle, suitable for use with a lifting cable as later specified herein.

H. Each pump discharge elbow connection shall be permanently installed in the wet well along with the discharge piping. Each pump shall be automatically connected and sealed to its discharge connection elbow when lowered into place and shall be easily removable. Each pump shall be mounted on a sliding guide bracket which is used to guide the pump into place with the discharge connection elbow. The sliding guide bracket and the pump casing shall have a machined angle connection with yoke to connect with the cast iron discharge connection, which shall be bolted to the floor of the sump and so designed as to receive the pump angle connection without the need of any bolts or nuts. Provide Type 316 stainless steel anchor bolts for attachment to the floor.

I. Sealing of a pumping unit to its discharge connection shall be accomplished by a simple linear downward motion of the pump with the entire weight of the pumping unit guided to the wedging tightly against the angled discharge connection; no portion of the pump shall bear directly on the sump floor and no rotary motion of the pump shall be required for sealing. Sealing at the discharge connection by means of a diaphragm or similar method of sealing will not be accepted as an equal to a metal contact of the pump discharge and mating discharge connection as specified and required.

J. The lower guide holders shall be integral with the discharge connection. Each pump shall ride on guide bars when raised and lowered in the sump. Guide bars shall be of standard weight 2-in 316 stainless steel pipe. The discharge connection elbow shall have a flanged connection to the discharge piping. Base and slide will be rated as non-sparking

K. Pump motors shall be housed in an air-filled watertight submersible casing and shall have Class H insulated windings which shall be moisture resistant. Pump motors shall be 460 Volt, 3 Phase, 60 Hz. Motors shall be NEMA Design B and be IE3 rated as premium efficient. Pump motors shall have cooling characteristics suitable to permit continuous operation, in a totally, partially, or non-submerged condition. The pump motor shall be capable of running without damage, for extended periods. Pump and motor shall be explosion-proof, suitable for Class I, Division I, Group D applications. Motor shall be provided with pilot thermal sensors embedded in stator windings.

L. Pump power cable shall be suitable for submersible pump and Class I, Division I, Group D applications. Cable sizing shall conform to NEC standards for pump motors. Cable entry to each pump shall be designed for submersible pump applications. The cable entry junction box and motor shall be separated by a stator load sealing gland or terminal board or compressed cylindrical elastomer grommet with close tolerance fit against the cable outside diameter and entry inside diameter. Cable entry system shall isolate the motor interior from liquid or other foreign materials gaining access. Provide cable holder as herein specified.

M. The pumps, with their appurtenances and cable, shall be capable of continuous submergence under water without loss of watertight integrity to a depth of 65-ft. The pumps shall receive a factory test to determine that each unit operates satisfactorily and that all seals are properly in place.

N. All wetted parts shall be shop primed with a PVC epoxy. Exterior of pumps, in addition to above, shall receive a chloric rubber or two part epoxy finish coat.

2.03 PUMP CONTROLS

A. Provide an automatic pump control system for each wet well. All pump controls mounted inside the wet well shall be suitable for use in Class I, Division I, Group D applications.

1. The control system shall utilize liquid level sensors to operate at preset liquid levels in the pump well to control the pumps. Level controls shall be set to perform the following functions:

a. Switch No. 1: Redundant low level cut out and alarm

b. Switch No. 2: Pump Stop

c. Switch No. 3: Pump Start

d. Switch No. 4: Lag Pump Stop

e. Switch No. 5: Lag Pump Start

f. Switch No. 6: HWL Alarm

g. The sensors shall be as recommended by the pump manufacturer, rated for operation at milliwatt levels and be set at the elevations shown on the Drawings. Provisions shall be made to prevent tangling of the level sensor cables at all water levels in the wet well. Provide sufficient excess cable to permit field adjustment.

2. A complete control panel shall be provided for mounting and shall be completely wired and ready for field connection of power, control/sensory and alarm wiring. The control panel shall be of NEMA 4 stainless steel designed for outdoor mounting. The panel shall be mounted in the location shown on the Drawings.

3. Power supply to the control panel will be 480 Volt, 3 Phase, 60 Hz, 3 Wire. For each pump motor provide an individual NEMA rated thermal magnetic circuit breaker/disconnect switch interlocked with the door handle, three phase overload protection with manual reset, and a NEMA rated magnetic motor starter with NEMA Class 10 overload relays. 120 and/or 24 Volt control circuit transformer with disconnect and overload protection shall be included. Control design shall provide for automatic and manual operation. Level switches and control shall be UL approved as intrinsically safe. Control leads to and from the wet well shall be low voltage, microwatt type designed such that if system components fail, voltage and current will not exceed their normal values. All of the low voltage intrinsically safe components shall be isolated by and mounted through a grounded metal barrier. All field connections shall be by means of terminals. Panel shall have Hand/Off/Automatic selector switch, pump run light, pump running time meter, a thermostatically (adjustable) controlled condensate heater and lightning protection. Provide panel mounted lights for indication of each of the following: Low Water Level, High Water Level, High Motor Temperature. Provide a common contact for a panel powered external alarm.

4. Power supply to the control panel will be 480 Volt, 3 Phase, 60 Hz, 3 Wire. For each pump motor provide an individual NEMA rated thermal magnetic circuit breaker/disconnect switch interlocked with the door handle, three phase overload protection with manual reset, and a NEMA rated magnetic motor starter with NEMA Class 10 overload relays. 120 and/or 24 Volt control circuit transformer with disconnect and overload protection shall be included. Control design shall provide for automatic and manual operation. Level switches and control shall be UL approved as intrinsically safe. Control leads to and from the wet well shall be low voltage, microwatt type designed such that if system components fail, voltage and current will not exceed their normal values. All of the low voltage intrinsically safe components shall be isolated by and mounted through a grounded metal barrier. All field connections shall be by means of terminals. Panel shall have Hand/Off/Automatic selector switch, pump run light, pump running time meter, a thermostatically (adjustable) controlled condensate heater and lightning protection. Provide panel mounted lights for indication of each of the following: Low Water Level,

High Water Level, High Motor Temperature. Provide a common contact for a panel powered external alarm.

B. Controller shall provide the following:

1. Visual display of the liquid level
2. User adjustable on and off levels for both pumps and alarms
3. alarm log
4. event log historian
5. provide user level simulation for onsite station checks
6. pump run times
7. pump starts per hour
8. be telemetry ready for Modbus RTU
9. DF1 or intralink protocals with just the addition of a modem and antenna
10. be provided with a complete list of registers for future integration
11. Siemens LC150 or approved equal.

2.04 ACCESSORIES AND APPURTENANCES

A. Pump accessories and appurtenances shall include, but not be limited to:

1. Power and control/sensory holder. 316 stainless steel Kellum type.
2. Lifting cables
3. Safety chain hooks.
4. Guide rails.
5. Upper guide bar brackets.
6. Support bar for upper guide bar brackets.

B. Chain, safety chain hook and cable holder shall be 316 stainless steel. Chain hooks and cable holder shall be positioned on the access hatch cover frame in or concrete, as applicable. Cable holder must be 316 stainless steel.

C. Provide a stainless steel structural support bar, bolted to the concrete wall to as shown on the Drawings. Attached the upper guide bar brackets to the support bar to support the pump guide bars. Bracket to be 316 stainless steel

D. Provide structural steel support for the check valves as shown on the Drawings. Expansion bolts shall be Type 304 stainless steel, Hilti "Kwik Bolt" or equal. All other bolts, nuts and washers shall be of Type 304 stainless steel. Field paint steel support with Tnemec, Series 66 Epoxy Primer and finish coat, or equal surface preparation.

E. All exposed metal within the wet well, except stainless steel or unless otherwise specified herein shall be primed and finish painted to meet manufacturer's recommendations.

2.05 SURFACE PREPARATION AND PRIME PAINTING

A. All equipment furnished under this Section shall be shop primed and finish painted as specified in Section 09902 and herein.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the Drawings. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations. Anchor bolts shall be set in accordance with the manufacturer's recommendations.

3.02 INSPECTION AND TESTING

A. After all pumps have been completely installed, conduct in the presence of the ENGINEER and OWNER such tests as are necessary to indicate that pump efficiency and discharge conform requirements specified. Field tests shall be performed on all pumps furnished under this Section. Supply all electric power, labor and water or wastewater and auxiliary equipment required to complete the field tests.

B. If the pump performance does not meet the specified requirements, corrective measures shall be taken, or pumps shall be removed and replaced with pumps with satisfy the conditions specified. A 24 hour operating period of the pumps will be required before acceptance. During this 24 hour operating period, supply all power necessary.

C. The pumps and motors shall be designed and constructed to avoid the generation of objectionable noise or vibration. The sound pressure level at full load shall not exceed 90 (A Scale) decibels above 300 cycles, when measured at a point not exceeding 5-ft from the motor. Mufflers or external baffles will not be accepted. When operating at any point between no-load and full-load, the vibration measured in a horizontal plane at the top of the motor shall not exceed the limits recommended by the Hydraulic Institute Standards.

D. Any component parts which are damaged as a result of testing or which fail to meet the requirements specified shall be replaced, reinstalled and retested at the CONTRACTOR's expense.

TABLE 11310-1
PUMPING UNIT DESIGN REQUIREMENTS

Item Description	04A	05A	07A	08A	09A	09B	09C	10A	11A	12A	13A	15B
No. of Pumps	All Pump Stations will have 1 Duty and 1 Standby Pump											
Motor												
Max Speed (rpm)	All Pump Motors may have motor speeds up to 3600 rpm											
Volts/Phase	All pumps to be 230 Volt / Single Phase											
Max Horsepower	3.0	3.5	3.0	3.0	3.0	3.0	3.5	3.0	3.0	3.0	3.0	3.0
Hydraulic Requirements												
Max Discharge Dia (in)	1.5	1.5	1.5	1.5	1.5	1.5	2.0	1.5	1.5	1.5	1.5	1.5
Shut-Off Head Range (feet)	All Pumps shall have a shut-off head between 80 and 150 feet											
Static Head (feet)	40	30	28	54	48	18	12	47	47	34	28	17
Design Flow (gpm)	28	51	9	13	18	16	45	22	22	22	20	17
Design TDH (feet)	51	37	32	57	54	22	18	59	55	40	33	19
Pump Model For Design – ABS and Flygt	Pir S20 MP3068	Pir S26 MP3068	Pir S20 MP3068	Pir S20 MP3068	Pir S20 MP3068	Pir S20 MP3068	Pir S26 MP3068	Pir S20 MP3068	Pir S20 MP3068	Pir S20 MP3068	Pir S20 MP3068	Pir S20 MP3068

END OF SECTION

Division 13 Special Construction

SECTION 13410

PROCESS INSTRUMENTATION AND CONTROLS - GENERAL PROVISIONS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. A single Instrumentation System Supplier (ISS) shall furnish all services and equipment defined herein and in the following related Specification Sections.

a. Section 13420 – Process Instrumentation and Controls – Products.

b. Section 13421 – Process Control System – Hardware and Software.

c. Section 13422 – Control Panels and Panel-Mounted Equipment.

d. Section 13482 – Process Control Descriptions.

e. Section 13485 – Instrumentation List.

2. ISS:

a. The ISS shall provide all materials, equipment, labor, and services required to achieve a fully integrated and operational system except as noted below. The ISS shall design and coordinate the instrument and control system for proper operation with related equipment and materials furnished by other suppliers under other Sections of these Specifications.

b. The ISS shall provided all material, equipment, and labor to perform the configuration necessary to the PLC and network components to prove proper functionality of the system during the unwitnessed factory test and witnessed factory test. This “proof of communication function” shall be successfully completed before any application software is installed by the Programming Subcontractor.

3. WWTP (Wastewater Treatment Plant Contractor):

a. The ISS shall be responsible for coordinating with the WWTP Contract as described within this and referenced specification sections, for the following general items:

(1) West Paso/Baywood Standby Power Building OMI installation.

(2) Ethernet and communications network testing and commissioning.

(3) PLC data registers to SCADA system integration.

4. Programming Subcontractor:

    a. The Programming Subcontractor shall provide the PCS (Process Control System) programming on this Project.

    b. Refer to Specification Section 13411 for specific details on these requirements.

5. Auxiliary and accessory devices necessary for system operation or performance, such as transducers or relays to interface with existing equipment or equipment provided by other suppliers under other Sections of these Specifications, shall be included whether they are shown on the instrumentation or electrical Drawings or not.

6. Substitutions on functions or type of equipment specified will not be acceptable. In order to ensure the interchange ability of parts, the maintenance of quality, the ease of interfacing between the various subsystems and the establishment of minimums with regard to ranges and accuracy, strict compliance with the above requirements shall be maintained. In order to insure compatibility between all equipment, it shall be the responsibility of the ISS to coordinate all interface requirements with mechanical and electrical system suppliers and furnish any signal isolation devices that might be required.

7. Equipment shall be fabricated, assembled, installed and placed in proper operating condition in full conformity with detail Drawings, specifications, engineering data, instructions and recommendations of the equipment manufacturer as approved by the ENGINEER.

8. To facilitate the OWNER's future operation and maintenance, products shall be of the same instrumentation manufacturer, with panel mounted devices of the same type and model to the greatest extent possible.

9. All equipment and installations shall satisfy applicable Federal, State and local codes.

10. Supplementing this Section, the Drawings and the related Specification sections provide additional details showing panel elevations, instrument device schedules, functional requirements of the system and interaction with other equipment.

B. Related Sections:

1. Section 01730 – Operating and Maintenance Data.

2. Section 13411 – Plant Control System Programming.

3. Division 16 – Electrical.

C. Control System Diagrams And Details

1. To assist the ISS in determining the scope of work, Process and Instrumentation Diagrams (P&IDs) are provided in the Drawings. Unless specifically stated otherwise, the ISS shall be responsible for providing all instrumentation, control equipment and auxiliary devices necessary to perform the functions specified herein and as shown and described on these

Drawings. Any auxiliary devices such as lightning/surge protectors, relays, timers, signal isolators, signal boosters, etc., which are necessary for complete operation of the system, or to perform the functions specified shall be included, whether or not they are specifically shown or tabulated on the Drawings or device lists.

2. The intent of the P&IDs is to describe in as much detail as possible, the hardware, software and functional requirements of a process measurement or control system. They are not intended to convey requirements for conduit and wiring between panels or system components. This information is included in appropriate electrical Specifications and Drawings.

3. To assist the ISS and Programming Subcontractor in determining the scope of work and intent of the contract documents, written Process Control Descriptions have been included in Section 13482. The control descriptions are general in nature and do not detail all auxiliary devices and interlocks required.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

B. International Society of Automation (ISA):

1. ISA S5.2 - Binary Logic Diagrams for Process Operations.

2. ISA S5.3 - Graphic Symbols for Distributed Control/Shared Display Instrumentation Logic and Computer Systems.

3. ISA S5.4 - Instrument Loop Diagrams.

4. ISA S5.5 - Graphic Symbols for Process Displays.

5. ISA S20 - Specification Forms for Process Measurement and Control Instruments, Primary Elements, and Control Valves.

6. ISA RP60.3 - Human Engineering for Control Centers.

7. ISA RP60.6 - Nameplates, Labels, and Tags for Control Centers.

C. American National Standards Institute (ANSI):

1. ANSI X3.5 - Flowchart Symbols and Their Usage in Information Processing.

D. National Electrical Manufacturers Association (NEMA).

E. National Fire Protection Association (NFPA) - 70, National Electrical Code.

F. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.03 SUBMITTALS

A. General submittal requirements:

1. All submittals shall be in accordance with Section 01300.

2. Shop drawings shall fully demonstrate that the equipment and services to be furnished will comply with the provisions of these specifications and shall provide a true and complete record of the equipment as manufactured and delivered.

3. Submittals shall be bound in separate three-ring binders, with an index and sectional dividers, with all drawings reduced to a maximum size of 11-in by 17-in for inclusion within the binder.

4. Exceptions to the Specifications or Drawings shall be clearly defined by the ISS in a separate section of each submittal package. The submittal shall contain the reason for exception, the exact nature of the exception and the proposed substitution so that a proper evaluation may be made by the ENGINEER.

5. Submittals shall include:

a. Coordination meeting agenda.

b. Project plan.

c. ISA loop wiring diagrams.

d. Conduit riser diagram.

e. Hardware shop drawings.

f. Testing plans.

g. OWNER training plan.

h. Spares, expendables, and test equipment lists.

i. ISS qualifications.

B. Coordination Meetings Agenda Submittal

1. Agendas shall be submitted in accordance with Paragraph 1.07.

C. Project Plan Submittal

1. The ISS and Programmer's project plan shall be submitted and favorably reviewed before any further submittals will be accepted. The project plan shall, as a minimum, contain the following:

   a. Overview of the proposed system.

   b. Approach to work.

   c. Proposed schedule.

   d. Project personnel and organization.

   e. Proposed approach to testing.

   f. Proposed approach to Owner training.

   g. Preliminary paragraph by paragraph review of the specifications indicating any proposed deviations.

2. The schedule shall illustrate all major project milestones including the following:

   a. Schedule for all subsequent project submittals.

   b. Tentative dates for all project coordination meetings.

   c. Schedule of manufacture of all instrumentation and control system equipment.

   d. Schedule for shipment of all instrument and control system equipment.

   e. Schedule for all testing.

   f. Schedule for equipment start up.

   g. Schedule for all training.

3. Prerequisite Activities and Lead Times: The ISS's project schedule shall incorporate the following prerequisite activities and lead times.

   a. Hardware purchasing, fabrication, and assembly: associated design related submittals must be favorably reviewed. All relevant loop drawings shall be submitted at least 90 days before the first planned startup of a new or modified system.

   b. RTU components: Refer to 13421 for shipping of RTU components to the Programmer and Grinder Pump Supplier.

c. Factory Owner training: OWNER training plan must be favorably reviewed. Factory owner training shall take place before the factory test, but not more than two (2) months before.

d. Factory test: All design-related submittals must be favorably reviewed, unwitnessed factory test procedures favorably reviewed, and the unwitnessed factory test shall be complete. Additionally, all factory OWNER training must be complete. Give four (4) weeks notice prior to the planned test start date.

e. Shipment to site: Approval of all design-related submittals and, for those instrument system elements that are involved in the factory tests, completion of the factory tests.

f. Field Owner training (Pre-Startup): OWNER training plan must be favorably reviewed. Pre-startup training shall take place before startup but not more than 30 days before. Revised preliminary O&M Manuals must be favorably reviewed and ready for use prior to commencing pre-startup Field OWNER Training.

g. Functional acceptance test: Functional acceptance test procedures must be favorably reviewed. Give 30 days notice prior to the planned test start date.

h. Startup: Completion of instrument calibration and functional acceptance tests. Completion of pre-startup field OWNER training.

i. Field owner training (Post-startup): OWNER training plan must be favorably reviewed. Post-startup training shall take place after startup but not more than 30 days after. Final O&M manuals must be favorably reviewed and ready for use prior to commencing post-startup field OWNER training.

j. 30-Day Acceptance Test: Satisfactory completion of functional acceptance test. Field OWNER training must be complete.

D. ISA Loop Wiring Diagrams Submittal:

1. Detailed Instrumentation, Systems, and Automation Society (ISA) loop wiring diagrams showing requirements for each instrument which is furnished under this Section. Also see Drawings.

2. Submittal of generic diagrams will not be acceptable. Loop Drawings shall be prepared in accordance with ISA Standard S5.4 latest edition. Optional items 1, 3, 4, 6, and 7 from the optional list in paragraph 5.3 of S5.4 shall also be provided. Note that the Owner standard for loop numbering used in these Contract Documents (and as part of the ISS work) does not comply with ISA standards.

3. The loop diagrams shall show all components of the loop including electrical relays, switches, and other devices necessary for the proper operation of the loop. Loop diagrams shall show all wiring and piping details, identify all field termination and grounding points within cabinets and panels, show all I/O terminations, and identify connection points on all devices and identify all wire/cable numbers.

4. Loop diagrams shall be organized in a numerical sequence with each loop detailed on a separate drawing.

E. Conduit Riser Diagram Submittal:

1. A complete conduit riser diagram and conduit schedule shall be prepared and submitted for the interconnection of all equipment specified in this section. The riser diagram and conduit schedule shall detail conduit identification number, size, wires, and location.

2. The conduit riser diagram shall be submitted and favorably reviewed before the Division 16 contractor begins conduit installation.

3. The conduit riser diagrams shall utilize the same identification scheme as used on the Drawings.

F. Hardware Shop Drawing Submittal:

1. Shop Drawings shall be submitted as detailed herein. Submittals consisting of only general sales literature will not be acceptable.

2. The data sheets shall be provided with an index and proper identification and cross-referencing. All devices including in-line equipment, field equipment, and panels and panel equipment shall be included in a comprehensive index.

3. Submit detailed information for each instrument or control device, including manufacturer's descriptive literature and an ISA/S20.3c data sheet for each device. The data sheets shall be provided with an index and proper identification and cross-referencing. All devices including in-line equipment, field equipment, and panels and panel equipment shall be included in a comprehensive index. Include as a minimum:

a. Plant Equipment Number and ISA tag number per the P&IDs.

b. Product (item) name as specified and indicated on the Drawings.

c. Manufacturer's name and complete model number.

d. Location of the device.

e. Input/output characteristics.

f. Range, size, span, setpoint, deadbands, etc.

g. Physical size with dimensions, enclosure NEMA classification and mounting details.

h. Materials of construction of all components.

i. Instrument or control device sizing calculations where applicable.

j. Certified calibration data on all flow metering devices.

4. Hardware Submittals

    a. Catalog cuts for RTU equipment including PLC central processing unit, input modules, output modules, modems, network interface modules, and power supplies.

    b. Descriptive literature for each hardware component which fully describes the unit being provided.

    c. Complete block diagram showing the interconnections between major hardware components and a complete input/output signal listing.

    d. Block diagrams for all hardware components showing the interconnection of all modules, interface devices, modems, and plug in circuit boards.

    e. All planning information, site preparation instructions, grounding and bonding procedures, cabling diagrams, plug identifications, safety precautions or guards, and equipment layouts in order to enable the Contractor to proceed with the detailed site preparation for all equipment.

    f. Description of communication interfaces between PLCs.

5. Control Panels: Submit detailed drawings for all control panels furnished. As a minimum, the drawings shall include:

    a. Interior and exterior panel elevation drawings to scale.

    b. Nameplate schedule.

    c. Conduit access locations.

    d. Panel construction details.

    e. The elevation drawing shall include a bill of material on the drawing with each panel component clearly defined. The bill of material shall be cross-referenced to the drawing so that a non-technical person can readily identify any component of the assembly by manufacturer and model number.

    f. Fabrication and painting specifications.

    g. Point to point wiring diagrams depicting wiring within the panel as well as connections to external devices.

    h. Heat calculations for each panel supplied indicating conformance with specified cooling requirements. Calculations shall include the recommended type of equipment required for both heating and cooling.

i. Engineering calculations shall be furnished in accordance with Section 01615 – Seismic Design Criteria. As a minimum, these shall demonstrate that each of the panels will adequately transfer the design seismic forces to the anchor bolts and foundation.

j. Submit evidence that all control panels are constructed in conformance with UL 508 and bear the UL seal confirming the construction. Specify if UL compliance and seal application will be accomplished at the fabrication location or by field inspection by UL inspector.

6. Instrumentation Equipment List: An instrument list shall be furnished for all instruments supplied under this Specification Section. The list shall be prepared in MS EXCEL (latest IBM compatible version) format by the ISS. The instrument list submittal shall include both a hard copy printout of the list and a CD-ROM containing this file. The instrument list shall be sorted by loop number. The Instrumentation Equipment List shall contain as a minimum the following:

a. Full instrument number.

b. Description (ISA function).

c. Manufacturer and model number.

d. Scale and setpoint (where applicable).

e. Physical location.

f. PLC I/O address (where applicable).

7. UPS performance specifications:

a. kVA rating.

b. Input and output voltage and phase.

c. Run time at full and half load.

d. Voltage (output regulation, input tolerance, unbalance, transfer/retransfer voltage, etc.)

e. Battery specifications and warranty.

f. UPS Loading and battery sizing calculations to support runtimes as specified.

G. Deviation List: A complete list of all deviations proposed shall be included with the submittal. The list shall include a specific but brief written indication of any specific exceptions taken to the interconnection and control intent as shown on the electrical schematics, control descriptions, and specified herein.

H. Software System Submittals

1. This submittal shall be developed with input from the ISS, the process equipment suppliers, and the programming subcontractor for the separate WWTP contract, and shall define all standards and conventions that will be used as the basis for development of the application specific programs and configuration of the system. The submittal shall define all aspects of the system programming and configuration and shall include as a minimum the following:

    a. System configuration, including network addressing and PLC/RTU addressing.

    b. System naming conventions, such as database naming, tag names, and computer naming.

    c. PLC/RTU standard modules, including flow totalization and equipment runtime.

2. Submit software logic and documentation for ladder logic, function block, high level language or other controller language used for the application engineering effort. Program documentation shall include individual rung, network, and/or command descriptions with abundant comments to clearly identify function and intent of each code segment. Link between "coil" and "contact" shall be clearly presented, the function of each timer described, the purpose of each subroutine call labeled and defined, etc. Program documentation shall be sufficiently clear to allow determination of compliance with the process control requirements included in the Process Control Descriptions and with the Drawings. The submittal shall demonstrate that all logic provided under this project follows the same structure and format and reflects a common programming approach.

3. Submit details of control system communication. Submit hardware and software configuration information in sufficient detail to verify performance of the communication system. Include description of drivers and impact of drivers on PLC memory configuration. Any specific communication block memory addresses shall be defined.

4. Submit a memory usage report for each PLC. This report shall indicate both used and unused memory addresses. Include constant and variable memory assignment records that tabulates area, location, number, and description of each numeric constant or variable stored in memory.

5. Submit cross reference index of I/O allocation and PLC memory address. Every physical I/O point as well calculated or virtual I/O required for the implementation of the process scheme shall be included.

6. Make additional changes to the software configuration, beyond those identified in the initial draft submittal, based on comments during the factory and field tests, and during the commissioning process.

7. Each custom program developed specifically for the system shall include the following information as a minimum:

    a. Overview of the program

b. Narrative describing specifically how the program works. All calculations, references to process I/O points and operator inputs should be mentioned and cross referenced to the logic diagrams or code.

c. A List of Variables used by the program including the function of each. A cross reference to the Software Functional Design Documentation shall be provided where appropriate.

I. Testing Submittal

1. Outline of Proposed Test Procedure Submittal: Prior to preparation of the detailed testing procedures, submit outlines of the specific proposed tests. Submittals shall include examples of the proposed forms and checklists.

2. Detailed Test Procedure Submittal: After the outlines for the proposed testing have been reviewed by the ENGINEER and returned stamped either "No Exceptions Noted" or "Approved as Noted", submit the proposed detailed test procedures.

   a. The detailed test procedure submittal shall address each test as required for each test session. The forms and checklist shall indicate applicable test session, i.e., Unwitnessed Factory Test (UFT), Witnessed Factory Test (WFT), etc. Where testing requires simulation indicate proposed method of techniques and equipment to be used to simulate a signal.

      Testing shall begin after review and approval by the ENGINEER of the proposed detailed test procedures.

3. Submit a proposed "Punchlist/Resolution" form that is required for the Witnessed Factory Test and the Functional Acceptance Test. This form shall include how and when the problem occurred and how the problem was solved. Include specifics such as software documentation, references to manuals, hardware components, etc.

4. Test Result Submittals: The following is the sequence of submittals required during testing. Subsequent testing will not occur until favorable review of the previous test results have been reviewed by the ENGINEER. The test result submittals review process shall comply with Section 01300.

   a. Unwitnessed Factory Test (UFT) Results.

   b. Witnessed Factory Test (WFT) Results.

   c. Operational Readiness Test (ORT) Results.

   d. Functional Acceptance Test (FAT) Results.

5. All test results shall be kept in a separate Test Results Documentation binder and shall be submitted for review after completion of the 30-Day Test. The Punchlist/Resolution forms shall be included in the Test Results Documentation.

6. Refer to Section 13411 for additional details.

J. OWNER Training Plan Submittal

1. Preliminary training plan submittal:

   a. Submit an overview of the proposed training plan. This overview shall include, for each course proposed:

      (1) An overview of the training plan explaining why specific courses are proposed.

      (2) Course title and objectives.

      (3) Prerequisite training and experience of attendees.

      (4) Recommended types of attendees.

      (5) Course Content - A topical outline.

      (6) Course Duration.

      (7) Course Location - Training center or job site.

      (8) Course Format - Lecture, laboratory demonstration, etc.

   b. The ENGINEER will review the preliminary training plan submittal with the OWNER.

2. Training Plan Submittal: Upon receipt of the OWNER's and ENGINEER's comments on the preliminary training plan, submit the specific proposed training plan. The training plan shall include:

   a. Definitions of each course.

   b. Specific course attendance.

   c. Schedule of training courses including dates, duration and locations of each class.

   d. Resumes of the instructors who will actually implement the plan.

K. Spares, Expendables, and Test Equipment Lists Submittal

1. This submittal shall include for each Subsystem:

   a. A list of, and descriptive literature for, spares, expendables and test equipment as specified.

   b. A separate list of, and descriptive literature for, additional spares, expendables and test equipment recommended by the ISS.

   c. Provide storage instructions for all spare parts.

1.04 QUALITY ASSURANCE

A. The Instrumentation System Supplier (ISS) shall be a "systems integrator" or a manufacturer regularly engaged in the design and the installation of instrumentation systems and their associated subsystems as they are applied to the municipal water and wastewater industry. For the purposes of this Specification Section, a "systems house" shall be interpreted to mean an organization that complies with all of the following criteria:

1. Employs a registered professional Control Systems Engineer or Electrical Engineer to supervise or perform the work required by this Specification Section.

2. Employs personnel on this project who have successfully completed ISA or manufacturers training courses on general process instrumentation.

3. Has performed work of similar or greater complexity on at least five previous projects.

4. Has been actively engaged in the type of work specified in this Specification Section for a minimum of the last 5 consecutive years using Modicon system hardware.

5. Is an active member in good standing for a minimum of 3 years of a nationally recognized professional accrediting association or industry council. Membership in CSIA (Control Systems Integrator Association) or similar is acceptable to meet this criteria.

B. For the purposes of this Specification Section, a "manufacturer" shall be interpreted to mean an organization that complies with all of the following criteria:

1. Manufactures at least 50 percent (as measured by equipment cost) of the hardware specified in this section and which is furnished for this project.

2. Complies with the preceding criteria established for a "systems house".

C. The ISS shall maintain a permanent, fully staffed and equipped service facility within 350 miles of the project site with full time employees capable of designing, fabricating, installing, calibrating, and testing the systems specified herein.

D. Actual installation of the instrumentation system need not be performed by the ISS's employees; however, the ISS as a minimum shall be responsible for the technical supervision of the installation by providing on site supervision to the installers of the various components.

E. The ISS shall furnish equipment which is the product of one manufacturer to the maximum practical extent. Where this is not practical, all equipment of a given type shall be the product of one manufacturer.

F. The ISS shall be one of the following:

1. KBL, Hayward, CA

2. FluidIQs, Napa, CA

3. MCC Control Systems, Vacaville, CA

4. HSQ Technology, Hayward, CA

5. Transdyn, Pleasanton, CA

G. Being listed in this specification does not relieve any potential ISS from meeting the qualifications specified in this Section.

H. The ISS, the manufacturers of the equipment and fabricators of panels and/or cabinets supplied under this Section shall allow the 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/or devices. A minimum of ten working days notification shall be provided to the ENGINEER prior to testing. No shipments shall be made without the ENGINEER's prior, written approval.

1.05 DELIVERY, STORAGE AND HANDLING

A. Shipping Precautions

1. 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 weights shall be shown on shipping tags together with instructions for unloading, transporting, storing and handling at job site.

2. Special instructions for proper field handling, storage and installation required by the manufacturer for proper protection, shall be securely attached to the packaging for each piece of equipment prior to shipment. The instructions shall be stored in resealable plastic bags or other acceptable means of protection.

B. Identification

1. Each component shall be tagged to identify its location, tag number and function in the system. Identification shall be prominently displayed on the outside of the package.

2. 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 supplied under this Section.

C. Storage

1. Equipment shall not be stored out-of-doors. 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 his/her own cost and expense. If any apparatus has been subject to

possible injury by water, it shall be thoroughly dried out and put through such tests as directed by the ENGINEER. This shall be at the cost and expense of the CONTRACTOR, or the apparatus shall be replaced by the CONTRACTOR at his/her own expense.

1.06 MAINTENANCE

A. Spare Parts

1. Spare parts shall be as defined in the related specification sections. All spare parts shall be new and unused.

2. All spare parts shall be individually packaged and labeled.

3. Provide one quart of touch-up paint, in one-quart containers, for each type and color used for all cabinets, panels, consoles, etc, supplied under the related specification sections.

4. The spares listed above shall be packed in a manner suitable for long-term storage and shall be adequately protected against corrosion, humidity and temperature.

1.07 COORDINATION MEETINGS

A. The ISS shall schedule a minimum of three mandatory coordination meetings during the shop drawing submittal phase of the project. The meetings shall include as a minimum the ENGINEER, OWNER, the CONTRACTOR's field management, the ISS project engineer, the Programmer, and other subcontractors performing any portion of the instrumentation system installation. The ISS shall prepare and distribute an agenda for the meetings a minimum of one week before the scheduled meeting date.

1. The first meeting shall be held within 60 days of the CONTRACTOR’s Notice to Proceed and in advance of the first Section 13410 (and subordinate sections) shop drawing submittal. The purpose of the meeting shall be for the ISS to summarize their understanding of the project, discuss any proposed substitutions or alternatives; schedule testing and delivery milestone dates; and request any additional information required from the OWNER. The ISS shall prepare and distribute an agenda for this meeting a minimum of one week before the scheduled meeting date.

2. The second coordination meeting shall include the programming/instrument subcontractor for the separate Wastewater Treatment Plant contract in addition to the parties above. The purpose of meeting will be to exchange information on the PLC memory maps, program listings, Ethernet switch configuration, etc.

3. The third meeting shall be scheduled to review operational constraints associated with testing and startup of the control system and related process equipment. The programmer for the WWTP shall also attend if there are any outstanding coordination issues.

1.08 FINAL SYSTEM DOCUMENTATION

A. Prior to final acceptance of the system and OWNER training, operating and maintenance manuals covering instruction and maintenance on each type of equipment shall be furnished in accordance with the Section 01730.

B. The instructions shall be bound in three-ring binders with Drawings reduced or folded for inclusion and shall provide at least the following as a minimum.

1. A comprehensive index.

2. A complete "As Constructed" set of favorably reviewed shop Drawings.

3. A complete list of the equipment supplied, including serial numbers, ranges and pertinent data.

4. Full specifications on each item.

5. System schematic drawings "As Constructed", illustrating all components, piping and electrical connections of the systems supplied under this Section.

6. Detailed service, maintenance and operation instructions for each item supplied.

7. Special maintenance requirements particular to this system shall be clearly defined, along with special calibration and test procedures.

8. The operating instructions shall also incorporate a functional description of the entire system, with references to the systems schematic drawings and instructions.

9. Complete parts lists with stock numbers and name, address and telephone number of the local supplier.

C. The final documentation shall be new documentation written specifically for this project, but may include standard and modified standard documentation. All standard documentation furnished shall have all portions that apply clearly indicated. All portions that do not apply shall be lined out.

D. The manuals shall contain all illustrations, detailed drawings, wiring diagrams and instructions necessary for installing, operating and maintaining the equipment. The illustrated parts shall be numbered for identification. All information contained therein shall apply specifically to the equipment furnished and shall only include instructions that are applicable. All such illustrations shall be incorporated within the printing of the page to form a durable and permanent reference book.

E. If any included documentation or other technical information is considered proprietary, such information shall be designated. Documentation or technical information which is designated as being proprietary will be used only for the design, construction, operation, or maintenance of the system and, to the extent permitted by law, will not be published or otherwise disclosed.

F. The requirements for the final documentation are as follows:

1. As built documentation shall include all previous submittals, as described in this Specification, updated to reflect the as-built system. Any corrections or modifications to the system resulting from the Factory and/or Field Acceptance Tests shall be incorporated in this documentation.

2. The Hardware Maintenance Documentation shall describe the detailed preventive and corrective procedures required to keep the system in good operating condition. Within the complete Hardware Maintenance Documentation, all hardware maintenance manuals shall make reference to appropriate diagnostics, where applicable, and all necessary timing diagrams shall be included. A maintenance manual or a set of manuals shall be furnished for all delivered hardware, including peripherals. The Hardware Maintenance Documentation shall include, as a minimum, the following information:

   a. Operation Information - This information shall include a detailed description of how the equipment operates and a block diagram illustrating each major assembly in the equipment.

   b. Preventative-Maintenance Instructions - These instructions shall include all applicable visual examinations, hardware testing and diagnostic routines and the adjustments necessary for periodic preventive maintenance of the System.

   c. Corrective-Maintenance Instructions - These instructions shall include guides for locating malfunctions down to the card-replacement level. These guides shall include adequate details for quickly and efficiently locating the cause of an equipment malfunction and shall state the probable source(s) of trouble, the symptoms, probable cause and instructions for remedying the malfunction.

   d. Parts Information - This information shall include the identification of each replaceable or field-repairable module. All parts shall be identified on a list in a drawing; the identification shall be of a level of detail sufficient for procuring any repairable or replaceable part. Cross-references between system supplier's part number and manufacturer's part numbers shall be provided.

3. The Software Maintenance documentation shall provide a detailed description of the entire software system. This documentation shall be sufficient for software maintenance and modification of the entire software system. The following items shall be included with the software maintenance documentation.

   a. System Supplier's User Manuals - All applicable software manuals developed by the system supplier for the application software shall be provided.

   b. Application/Custom Software Manuals - These manual(s) shall include all software maintenance information not included in the computer manufacturer's and system supplier's standard manuals. Each custom program developed specifically for the system shall include the following information as a minimum:

(1) Table of Contents

(2) Overview of the program

(3) Narrative describing specifically how the program works. All calculations, references to process I/O points and operator inputs should be mentioned and cross referenced to the logic diagrams or code.

(4) A flowchart shall be provided to clarify the narrative description.

(5) A List of Variables used by the program including the function of each. A cross reference to the Software Functional Design Documentation shall be provided where appropriate.

c. Software Listings - Two sets of well-annotated program listings of all software provided shall be furnished for all software items. These shall include, but not be limited to, the following:

(1) All listings associated with the system generation and software configuration of the specific system (i.e., system parameterization tables, build maps, disk maps, etc).

(2) Listings of all data bases configured for and associated with the system.

(3) Listing of all custom or modified software developed specifically for the system. Listings shall reflect any changes made after the factory acceptance test.

d. Machine Readable Documentation - The supplier shall provide two sets of the following as-built documentation in machine readable format:

(1) CD-ROMs of the entire as-built software system in object format ready to execute on the system. The machine readable documentation shall be 100 percent compatible with the Software Listings previous defined. As with the Software Listings, any changes made during or after factory acceptance test shall be reflected in both the media.

e. Retrofit Documentation - The Supplier shall investigate, diagnose, repair, update and distribute all pertaining documentation of deficiencies which become evident during the warranty period. All such documentation shall be submitted to the OWNER within 30 days of solving the problem.

f. Submit original copies of all application software provided under this Contract. Provide license agreements, serial numbers and product support telephone numbers and access codes as applicable.

4. Provide Operator's Manuals for the system. These manuals shall be separately bound and shall contain all information necessary for the operator to operate the system. The manuals shall be written in nontechnical terms and shall be organized for quick access to each

detailed description of the operator's procedure. Manuals shall contain, but not be limited to, the following information:

a. A simple overview of the entire system indicating the function and purpose of each piece of equipment.

b. A detailed description of the operation and interface of all hardwired panels.

c. Complete step-by-step procedures for starting up and shutting down each system.

d. Complete step-by-step procedures for starting up or shutting down an individual component.

e. A complete description of the operation of each plant control function. All operator input to these functions shall be described.

f. A listing of all data base point names with their respective point descriptions.

g. A complete glossary of terms.

h. Complete, step-by-step procedures for performing complete system or selected file backup and restoration.

G. Final documentation shall include the results of all PID controller loop tuning procedures per the requirements of Part 3 of this specification. Submit tuning documentation for all PID loops included in this Contract including all identical loops in parallel process trains.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Type

1. All instrumentation supplied shall be of the manufacturer's latest design and shall produce or be activated by signals which are established standards for the water and wastewater industries.

2. All electronic instrumentation shall be of the solid-state type and shall utilize linear transmission signals of 4 to 20 mA dc (milliampere direct current), however, signals between instruments within the same panel or cabinet may be 1-5V dc (volts direct current), or the like.

3. Outputs of equipment that are not of the standard signals as outlined, shall have the output immediately raised and/or converted to compatible standard signals for remote transmission. No zero based signals will be allowed.

4. All instruments shall be provided with mounting hardware and floor stands, wall brackets, or instrument racks as shown on the Drawings or as required.

5. Equipment installed in a hazardous area shall meet Class, Group, and Division as shown on the Electrical Drawings, to comply with the National Electrical Code.

6. All indicators and recorder readouts shall be linear in process units, unless otherwise noted.

7. Electronic equipment shall be of the manufacturer's latest design, utilizing printed circuitry and suitably coated to prevent contamination by dust, moisture and fungus. Solid state components shall be conservatively rated for their purpose, to assure optimum long term performance and dependability over ambient atmosphere fluctuations and 0 to 100 percent relative humidity. The field mounted equipment and system components shall be designed for installation in dusty, humid, and corrosive service conditions.

8. All equipment, cabinets and devices furnished hereunder shall be heavy-duty type, designed for continuous industrial service. The system shall contain products of a single manufacturer, in-so-far as possible and shall consist of equipment models which are currently in production. All equipment provided shall be of modular construction and shall be capable of field expansion.

9. All electronic/digital equipment shall be provided with radio frequency interference protection and shall be FCC approved.

10. All transmitters' output signals shall include signal and power source isolation.

11. All transmitters shall be provided with either integral indicators or close coupled conduit body mounted, line powered indicators calibrated in process engineering units. Indicators shall have an accuracy of two percent of full scale or better.

B. Electrical

1. All equipment shall be designed to operate on a 60 Hertz alternating current power source at a nominal 117 volts, plus or minus 10 percent, except where specifically noted. All regulators and power supplied required for compliance with the above shall be provided between power supply and interconnected instrument loop. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.

2. Materials and equipment used shall be U.L. approved wherever such approved equipment and materials are available.

3. All equipment shall be designed and constructed so that in the event of a power interruption, the equipment specified hereunder shall resume normal operation without manual resetting when power is restored.

2.02 SURGE PROTECTION

A. General – Surge protection shall be provided to protect the electronic instrumentation system from induced surges propagating along the signal and power supply lines from lightning, utility, or the plant electrical system. The protection systems shall be such that the protective level shall not interefere with normal operation, but shall be lower than the instrument surge withstand level.

Protection shall be maintenance free and self-restoring. Devices shall have a response time of less than 50 nanoseconds and be capable of handling a discharge surge current (at an 8x20µs impulse waveform) of at least 8 kA. Ground wires for all instrumentation device surge protectors shall be connected to a low resistance ground.

B. Provide protection of all analog signal (4-20 mA) circuits where any part of the circuit is outside of the building envelope. Protection devices in control panels shall be MTL Surge Technologies (Telematic) SD Series, Phoenix Contact PT Series, Citel BP1-24, or equal. Substitution of a single device to protect both 120 VAC and 4-20 mA wires to an instrument is acceptable.

C. Provide protection of all power feeds into control panels and control room equipment. Surge arresters for 120 VAC power feeds shall be Transtector ACP-100BW Series, Phoenix Contact "Mains-PlugTrab", MCG Surge Protection 400 Series, or equal. 480, 240, or 208 volt control panels shall be provided with a lightning and surge protection unit on the load side of the main circuit breaker. Unit shall be 600 Volt, 3 Phase, General Electric "Tranquell" Series or approved equal.

D. Inductive Loads – Interposing relays shall be provided on all process controller outputs. Refer to Section 13421.

2.03 TUBING AND FITTINGS

A. All instrument air header takeoffs and branch connections less than 2-inches shall be 316 stainless steel.

B. All instrument shut-off valves and associated fittings shall be supplied in accordance with the piping specifications and all instrument installation details. Fittings shall be Swagelok 316 stainless steel or equal and valves shall be Whitey 316 stainless steel or equal.

C. All instrument tubing shall be fully annealed ASTM A269 Seamless 316 grade free of OD scratches having the following dimensional characteristics as required to fit the specific installation:

1. 1/4-inches to 1/2-inches O.D. by 0.035 wall thickness.

2. 5/8-inches to 1-inches O.D. by 0.049 wall thickness.

3. 1-inches O.D. by 0.065 wall thickness.

4. 1-1/4-inches O.D. by 0.065 wall thickness.

5. 1-1/2-inches O.D. by 0.083 wall thickness.

6. 2-inches O.D. by 0.095 wall thickness.

D. All process connections to instruments shall be annealed stainless steel tubing, Type 316.

E. All tube track shall be supported by stainless steel and installed as per manufacturer's installation instructions.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION

A. Instrumentation and accessory equipment shall be installed in accordance with the manufacturer's instructions. The locations of equipment, transmitters, alarms and similar devices shown on the Drawings are approximate only. Exact locations shall be as approved by the ENGINEER during construction. Obtain in the field all information relevant to the placing of process control work and in case of any interference with other work, proceed as directed by the ENGINEER and furnish all labor and materials necessary to complete the work in an approved manner.

B. The P&IDs indicate the intent and not the precise nature of the interconnection between the individual instruments. Any exceptions taken to the implied interconnection shall be noted for review by the ENGINEER.

C. The instrumentation installation details on the Drawings indicate the designed installation for the instruments specified. Where specific installation details are not specified or shown on the Drawings, the American Petroleum Institute (API) Recommended Practice 550 shall be followed as applicable.

D. All work shall be executed in full accordance with codes and local rulings. Should any work be performed contrary to said rulings, ordinances and regulations, the CONTRACTOR shall bear full responsibility for such violations and assume all costs arising therefrom.

E. All equipment used in areas designated as hazardous shall be designed for the Class, Group and Division as required on the Electrical Drawings for the locations. All work shall be in strict accordance with codes and local rulings, should any work be performed contrary to said rulings, ordinances and regulations, the supplier shall bear full responsibility for such violations and assume all costs arising there from.

F. Unless specifically shown in the Drawings, direct reading or electrical transmitting instrumentation shall not be mounted on process piping. Instrumentation shall be mounted on instrument racks or stands as detailed on the installation detail drawings. All instrumentation connections shall be provided with shutoff and drain valves. For differential pressure transmitters, valve manifolds for calibration, testing and blowdown service shall also be provided. For slurries, chemical or corrosive fluids, diaphragm seals with flushing connections shall be provided.

G. All piping and tubing to and from field instrumentation shall be provided with necessary unions, calibrations and test tees, couplings, adaptors, and shut-off valves. Process tubing shall be installed to slope from the instrument toward process for gas measurement service and from the process toward the instrument for liquid measurement service. Provide drain/vent valves or fittings at any process tubing points where the required slopes cannot be maintained.

H. Field instruments requiring power supplies shall be provided with local electrical shutoffs and fuses as required.

I. Brackets and hangers required for mounting of equipment shall be provided. They shall be installed in a workmanlike manner and not interfere with any other equipment.

J. The ISS shall investigate each space in the building through which equipment must pass to reach its final location. If necessary, the ISS shall be required to ship his/her material in sections sized to permit passing through restricted areas in the building. The ISS shall also investigate, and make any field modifications to the allocated space for each cabinet, enclosure and panel to assure proper space and access (front, rear, side).

K. The shield on each process instrumentation cable shall be continuous from source to destination and be grounded as directed by the manufacturer of the instrumentation equipment. However, in no case shall more than one ground point be employed for each shield. Unless otherwise necessary, all analog cables shall be grounded in the PLC I/O drop cabinets.

L. Lifting rings from cabinets/assemblies shall be removed. Hole plugs shall be provided for the holes of the same color as the cabinet.

M. The ISS, acting through the CONTRACTOR, shall coordinate the installation, the placing and location of system components, their connections to the process equipment panels, cabinets and devices, subject to the ENGINEER's approval. The ISS shall be responsible to insure that all field wiring for power and signal circuits are correctly done in accordance with best industry practice and provide for all necessary system grounding to insure a satisfactory functioning installation. The CONTRACTOR hereunder shall schedule and coordinate his/her work under this section with that of the electrical work specified under applicable Sections of Division 16.

N. Two complete sets of favorably reviewed shop drawings shall be kept at the job site during all on-site construction. Both sets shall be identically marked up to reflect any modifications made during field installation or start-up. All markings shall be verified and initialed by the ENGINEER or his/her designated representative. Following completion of installation and the operational readiness test, one set of the marked up drawings shall be provided to the ENGINEER, the other retained by the supplier for incorporation of the mark-ups into final record documentation.

O. Loop Tuning - All electronic control stations incorporating PID controllers shall be tuned following device installation but prior to commencement of the field tests.

1. Optimal loop tuning shall be achieved either by auto-tuning software or manually by trial and error, Ziegler-Nichols step-response method, etc. Assigning common PID factors for identical loops following field tuning of a single typical loop is acceptable. However, tuning documentation shall be submitted for each loop individually as specified in Part 1 of these Specifications.

2. Determine and configure optimal tuning parameters to assure stable, steady state operation of final control elements running under the control of field mounted, dedicated PID controllers or software based PID controllers residing as part of the programmable logic controller system. Each control loop that includes anti-reset windup features shall be adjusted to provide optimum response following startup from an integral action saturation condition.

3. Tune all PID control loops to eliminate excessive oscillating final control elements. Loop parameters shall be adjusted to achieve 1/4 amplitude damping or better. In addition, loop steady state shall be achieved at least as fast as the loop response time associated with critical damping.

4. Loop performance and stability shall be verified in the field following tuning by step changes to setpoint. Submit loop tuning methodology and verification as part of the final system documentation as specified in Part 1.

5. For cascade loops, tune both sets of controllers so that the cascade loop achieves the loop tuning characteristics specified herein.

3.02 TESTING

A. General

1. As part of the requirement of this specification section it is the responsibility of the ISS to provide a complete operational control system. Confirmation of an operational control system is dependent upon results derived from test procedures as specified in this Section. As part of this contract the ISS shall provide factory testing prior to shipment of the equipment and also testing of the equipment once installed in the field. Once the plant is in operation an additional 30-Day Acceptance Test is required.

2. Each test shall be in the cause and effect format. The person conducting the test shall initiate an input (cause) and upon the system's or subsystem's producing the correct result (effect), the specific test requirement will have been satisfied.

3. All tests shall be conducted in accordance with prior ENGINEER- approved procedures, forms and checklist. Each specific test to be performed shall be described and a space provided after it for sign off by the appropriate party after its satisfactory completion.

4. Copies of these sign off test procedures, forms and checklists will constitute the required test documentation.

5. Provide all special testing materials and equipment. Wherever possible, perform tests using actual process variables, equipment, and data. Where it is not practical to test with real process variables, equipment and data, provide suitable means of simulation. Define these simulations techniques in the test procedures.

6. The ISS shall coordinate all required testing with the CONTRACTOR, all affected Subcontractors, and the ENGINEER.

7. The ENGINEER reserves the right to test or retest all specified functions whether or not explicitly stated in the prior favorably reviewed Test Procedures until the functional requirements of the overall system are met. No additional compensation shall be provided for any required extended testing.

8. The ENGINEER's decision shall be final regarding the acceptability and completeness of all testing.

9. No equipment shall be shipped until the ENGINEER has received all test results and approved the system is ready for shipment.

10. The ISS shall furnish the services of field service engineers, all special calibration and test equipment and labor to perform the field tests.

11. Any additional hardware or software that may be required to successfully verify system operation shall be supplied at no cost to the OWNER.

B. Factory Testing

1. Prior to shipment of the equipment the following factory tests are required:

a. Unwitnessed Factory Test (UFT).

(1) The entire system except for primary elements, final control elements, and field mounted transmitters shall be interconnected and tested to ensure the system will operate as specified. All analog and discrete input/output points not interconnected at this time shall be simulated to ensure proper operation of all alarms, monitoring devices/functions and control devices/functions.

(2) All panels, consoles and assemblies shall be inspected and tested to verify that they are in conformance with related submittals, Specifications and Drawings. During the tests all digital system hardware and software shall be operated for at least five days continuously without a failure to verify the system is capable of continuous operation.

(3) Tests to be performed shall include but not be limited to the following. Each of these tests shall be specifically addressed in the Test Procedure submittal.

a) Building and loading the System Data Base.

b) Conduct online modifications to the data base.

c) Demonstrate operability of the interfaces (hardware and software).

d) Demonstrate operability of the data communication network.

e) Demonstrate all system software functions specified.

f) Verify the displays and interactive capabilities of the operator's console.

g) Simulate selected operating conditions to verify the performance of the monitoring and control functions.

h) Generate reports using test data.

i) Verify communication links between all remote sites. Testing of all parameters within the protocol shall be included.

(4) All control panels shall be included in these tests.

(5) Submit UFT results for review by the ENGINEER per Paragraph 1.03H.

b. Witnessed Factory Test (WFT).

(1) Implicit in the scheduling of the witnessed factory acceptance test is the assumption that the ISS has completed the test procedures as defined in the UFT.

(2) All system tests specified for the unwitnessed factory test shall be repeated.

(3) The ISS shall notify the ENGINEER in writing that the system is ready for the Witnessed Factory Test and allow the ENGINEER and/or OWNER to schedule a test date within 30 days of receipt of the "Ready To Test" letter. At the time of notification, the ISS shall submit any revisions to the detailed test procedure previously approved by the ENGINEER in the project system plan.

(4) The purpose of the test shall be to verify the functionality, performance and stability of the hardware and software. Each system must operate continually for 1 hour without failure before the test shall be judged successful. Successful completion of this test, as determined by the ENGINEER, shall be the basis for approval of the system to be shipped to the site.

(5) The various tests performed during the ENGINEER and/or OWNER witnessed factory demonstration test shall be designed to demonstrate that hardware and software fulfill all the requirements of the Specifications. The test conditions shall resemble, as closely as possible, the actual installed conditions.

(6) During the test for a period of time equal to at least 20 percent of the test duration, the ENGINEER and/or OWNER's representative shall have unrestricted access to the system.

(7) All deficiencies identified during these tests shall be corrected and retested prior to completing of the Factory Test as determined by the ENGINEER.

(8) Punchlist items and resolutions noted during the test shall be documented on the Punchlist/Resolution form.

(9) The following documentation shall be made available by the ISS to the Engineer at the test site both before and during the Factory Tests:

a) All Drawings and Specifications, addenda, letters of clarification, and Extra Work authorizations.

b) Master copy of the test procedure.

c) List of the equipment to be tested including make, model and serial number.

d) Design-related hardware submittal applicable to the equipment being tested.

e) Preliminary software documentation submittal.

(10) The daily schedule during these tests shall be as follows:

a) Testing and meetings: Nominally 8 hours per day; 10 hours per day if required to meet schedule.

b) Morning meetings to review the day's test schedule.

c) Evening meetings to review the day's test results and to review or revise the next day's test schedule.

d) Unstructured testing period by the witnesses.

(11) Submit WFT results for review by the ENGINEER per Paragraph 1.03H – Testing Submittals.

C. Field Testing

1. Prior to plant start up the following tests are required:

a. Operational Readiness Test (ORT)

(1) General: Prior to startup and the Functional Acceptance Test, the entire system shall be certified (inspected, wired, calibrated, tested, etc, and documented) that it is installed and ready for the ORT as defined below.

(2) Loop/Component Inspections and Tests: The entire system shall be checked for proper installation, calibrated and adjusted on a loop-by-loop and component-by-component basis to ensure that it is in conformance with related submittals and these Specifications. Loop tuning shall be completed per Paragraph 3.01.O of this Section.

a) The Loop/Component Inspections and Tests shall be implemented using ENGINEER-approved forms and checklists.

Each loop shall have a Loop Status Report to organize and track its inspection, adjustment and calibration. These reports shall include the following information and checkoff items with spaces for sign off by the system supplier:

1) Project Name.

2) Loop Number.

3) Tag Number for each component.

4) Checkoffs/signoffs for each component.

- Tag/identification
- Installation
- Termination - wiring
- Termination - tubing
- Calibration/adjustment

5) Checkoffs/signoffs for the loop.

- Panel interface terminations
- I/O interface terminations
- I/O signal operation
- Inputs/outputs operational: received/sent, processed, adjusted
- Total loop operation

6) Space for comments.

(3) Each active Analog Subsystem element and each I/O module shall have a Component Calibration Sheet. These sheets shall have the following information, spaces for data entry and a space for sign off by the system supplier:

a) Project Name.

b) Loop Number.

c) Component Tag Number of I/O Module Number.

d) Component Code Number Analog System.

e) Manufacturer (for Analog system element).

f) Model Number/Serial Number (for Analog system).

g) Summary of Functional Requirements. For example:

- For Indicators and Recorders: Scale and chart ranges
- For Transmitters/Converters: Scale and chart ranges

- For Computing Elements: Function
- For Controllers: Action (direct/reverse) control modes (PID)
- For Switching Elements: Unit range, differential (FIXED/ADJUSTABLE), reset (AUTO/MANUAL)
- For I/O Modules: Input or output

h) Calibrations; for example:

- For Analog Devices: Required and actual inputs and outputs at 0, 10, 50 and 100 percent of span, rising and falling.
- For Discrete Devices: Required and actual trip points and reset points.
- For Controllers: Mode settings (PID).
- For I/O Modules: Required and actual inputs or outputs for 0, 10, 50 and 100 percent of span, rising and falling.

i) Space for comments.

j) Space for sign off by the ISS.

(4) The ISS shall maintain the Loop Status Reports and Components Calibration sheets at the job site and make them available to the ENGINEER/OWNER at any time.

(5) These inspections and tests do not require witnessing. However, the ENGINEER will review and initial all Loop Status Sheets and Component Calibration Sheets and spot-check their entries periodically and upon completion of the Operational Readiness Tests. Any deficiencies found shall be corrected.

(6) Submit ORT results for review by the ENGINEER per Paragraph 1.03H.

b. Functional Acceptance Test (FAT).

1) Prior to startup and the Functional Acceptance Test (FAT), the entire installed instrument and control system shall be certified that it is ready for operation. All preliminary testing, inspection, and calibration shall be complete as defined in the Operational Readiness Tests.

2) Once the facility has been started up and is operating, a witnessed FAT shall be performed on the complete system to demonstrate that it is operating and in compliance with these Specifications. Each

specified function shall be demonstrated on a paragraph-by-paragraph, loop-by-loop, and site-by-site basis.

3) Loop-specific and non-loop-specific tests shall be the same as specified under Factory Tests except that the entire installed system shall be tested and all functions demonstrated.

4) Updated versions of the documentation specified to be provided for during the Factory Tests shall be made available to the ENGINEER at the job site both before and during the tests. In addition, one copy of all O & M Manuals shall be made available to the ENGINEER at the job site both before and during testing.

5) The daily schedule specified to be followed during the Factory Tests shall also be followed during the Functional Acceptance Testing.

6) The system shall operate for a continuous 100 hours without failure before this test will be considered successful.

7) Punchlist items and resolutions noted during the test shall be documented on the Punchlist/Resolution form.

8) Submit FAT results for review by the ENGINEER per Paragraph 1.03H.

c. 30-Day Acceptance Test

1) After completion of the Operational Readiness and Functional Acceptance Tests the ISS shall be responsible for operation of each separate process system as it is incorporated into service for a period of 30 consecutive days, under conditions of full plant process operation, without a single non-field repairable malfunction.

2) During this test, plant operating and ISS personnel shall be present as required. The ISS is expected to provide personnel for this test who have an intimate knowledge of the hardware and software of the system.

3) While this test is proceeding, the OWNER shall have full use of the system. Only plant operating personnel shall be allowed to operate equipment associated with live plant processes.

4) Any malfunction during the tests shall be analyzed and corrections made by the ISS. The ENGINEER and/or OWNER will determine whether any such malfunctions are sufficiently serious to warrant a repeat of this test.

5) Any malfunction, during this 30 consecutive day test period, which cannot be corrected within 24 hours of occurrence by the ISS's

personnel, or more than two similar failures of any duration, will be considered as a non-field-repairable malfunction.

6) Upon completion of repairs, by the ISS, the test shall be repeated as specified herein.

7) In the event of rejection of any part or function, the ISS shall perform repairs or replacement within 60 days or prior to Substantial Completion, whichever occurs first.

8) All data base errors must be corrected prior to the start of each test period. The 30 day test will not be considered successful until all data base points are correct.

9) The total availability of the system shall be greater than 99.5 percent during this test period. Availability shall be defined as "Avail. = (Total Time-Down Time) ÷ Total Time".

Down times due to power outages or other factors outside the normal protection devices or backup power supplies provided, shall not contribute to the availability test times above.

3.03 TRAINING

A. The cost of training programs to be conducted with OWNER's personnel shall be included in the Contract Price. The training and instruction, insofar as practicable, shall be directly related to the system being supplied.

B. Provide detailed manuals to supplement the training courses. The manuals shall include specific details of equipment supplied and operations specific to the project.

C. Make use of teaching aids, manuals, slide/video presentations, etc. After the training services, such materials shall be delivered to OWNER.

D. The training program shall represent a comprehensive program covering all aspects of the operation and maintenance of the system.

E. All training schedules shall be coordinated with, and at the convenience of the OWNER. Shift training may be required to correspond to the OWNER's working schedule. The training shall run at times chosen by the OWNER.

F. Training shall comply with the requirements of Division 1 and shall include operation and maintenance of:

1. Field instruments.

2. RTU panels.

3. RTU hardware.

4. PLC software.

5. System operation.

6. UPS.

7. Communications and networking components.

G. Training shall be scheduled within 2 weeks of project commissioning and shall include two 8-hour days of instruction.

END OF SECTION

SECTION 13411

PROCESS CONTROL SYSTEM PROGRAMMING

PART 1 GENERAL

1.01 SUMMARY

A. This specification summarizes the tasks required to program, configure, document, test, startup, and commission the applications software for the Process Control System (PCS). All application software work, except as specifically indicated as being performed by others, is included. The application software work shall be performed by the Programming Subcontractor, hereinafter referred to as the "Programmer".

B. Scope of Work:

1. General Contractor (hereinafter referred to as GC):

a. GC shall coordinate the work between the GC equipment vendors and the ISS and Programmer. Each equipment and packaged system vendor supplying control system components shall be provided with a complete set of Instrumentation and Control System Division 13 documents and drawings prior to bidding, such that vendor provided control work adheres to the same specifications and requirements as the work performed under the requirements of Section 13410.

b. GC shall provide overall coordination for GC supplied equipment and packaged systems vendors and the ISS and Programmer.

c. GC shall provide, for use by the ISS and Programmer, complete documentation of all GC vendor provided control system components including, as a minimum, the following:

(1) Control Strategy Descriptions.

(2) Electrical drawings.

(3) Operating instructions.

d. GC, through the services of the equipment suppliers, shall provide all programming and configuration of other programmable devices provided under this contract, such as RVSSs, switchboard relays, etc.

2. ISS:

a. The Instrumentation System Supplier (ISS) shall be responsible for providing a complete and operating control system. The ISS shall furnish all labor, material and supervision required to complete the work, except for the work specifically indicated as being performed by the Programmer.

b. The ISS shall be responsible for all control systems work described in these specifications and drawings, including but not limited to, PLCs, UPSs, network

equipment, and control system software, except for programming and configuration services explicitly specified to be provided by the Programmer herein, which are an integral component of a packaged electrical system, or which are to be performed by the WWTP contractor under a separate contract with the OWNER.

c. The ISS shall be responsible for all submittals, procurement, assembly, wiring, packing, shipping, installation, set up, startup, specified testing, and as-built drawings for all control system equipment and purchased software except for panels that are specifically specified to be provided under other sections of the Specifications.

d. The ISS shall provide all material, labor and equipment required for a complete and operable control system, except for items specifically excluded from the ISSs work.

e. After approvals of the PCS hardware and software submittals, all PLCs, purchased software and related control system equipment shall be promptly delivered by ISS to the Programmer's facility for use in the application software development and the testing of control system software. Upon completion of the Programmer's software development, the ISS shall disassemble, pack, and transport PLC and other control system equipment to the panel assembly shop for installation and factory testing.

f. The ISS shall prepare and submit for approval complete Loop Diagrams, I/O Elementary and other drawings as required.

g. The ISS shall test the RTU/PLC I/O system as specified herein to verify proper performance independent of the use of the Application software programming and configuration developed by the Programmer.

h. The Programmer and ISS shall perform certain control system and start-up tests jointly to ensure proper system operation. For tests that are conducted jointly, the ISS shall provide appropriate full-time on-site support. The ISS shall maintain familiarity with the Control Strategy Descriptions to support the startup and testing activities.

i. The ISS shall provide the PCS communications networks as specified herein and indicated on the Drawings and other sections of the specification.

3. Programmer:

a. The Programmer shall operate under the direction of ISS.

b. The Programmer shall utilize the hardware and software provided by the ISS to develop the project-specific Applications software as described in Section 13482 – Process Control Descriptions.

c. The Programmer shall be responsible for coordinating with the Pump Station Equipment Supplier to integrate their systems into the overall PCS.

d. The Programmer shall be responsible for shop drawings documenting the project-specific Application software.

e. Software/configuration testing forms shall be developed by the Programmer.

f. The following is a list of the major tasks which shall be performed by the Programmer to provide a complete and properly operating PCS:

(1) PLC programming

(2) Ethernet switch configuration

(3) PCS communication system

(4) Coordination meetings with OWNER, Wastewater Treatment Plant Design ENGINEER, and Grinder Pump (pocket pump station) equipment supplier

(5) Factory and Field Testing

(6) Field Startup and Commissioning

(7) Submittals

(8) Post commissioning service

(9) Operations and Maintenance manuals

g. The only devices that are NOT programmed and configured under the Programmer's scope of work include:

(1) Programming and configuration of Process Control System devices at the future wastewater treatment plant (WWTP), such as Ethernet switches, servers, computer workstations, RTUs, and Operator workstations.

(2) Programming and configuration of the future Operator workstation at the West Paso/Baywood Standing Power Building.

(3) Programming or configuration of other specific purpose programmable devices provided under this contract, such as switchgear protective relays, etc.

(4) Configuration of Local Operator Interfaces provided as part of packaged mechanical or electrical systems.

1.02 REFERENCES

A. Section 13410 – Process Instrumentation and Controls – General Provisions.

B. Section 13421 – Process Control System – Hardware and Software.

C. Section 13482 – Process Control Descriptions.

D. Drawings – P&IDs and supporting instrumentation drawings.

1.03 DEFINITIONS

A. Where a term is used in specification section number series (Division 13) relating to instrumentation, and the meaning is not defined therein or elsewhere in the Contract Documents, the meaning of the term shall be as defined in ISA S51.1 Process Instrumentation Terminology, or if not contained in ISA 51.1, as defined in listed reference standards under "References".

1.04 SUBMITTALS

A. Furnish complete submittals in accordance with Sections 01300 and 13410 and as listed below.

B. Test Procedure Submittals:

1. Submit the procedures to be followed during the test. Procedures shall include test descriptions, forms, and checklists to be used to control and document the required tests. (Refer to Part 3 of this Section for testing requirements).

a. Preliminary test procedure submittals: Prior to the preparation of the detailed test procedures, submit outlines of the specific proposed tests. Submittals shall include examples of the proposed forms and checklists.

b. Test Procedure Submittals: After the preliminary test procedure submittals have been reviewed and returned stamped either “approved” or “approved as noted, confirm” submit the proposed detailed test procedures. Following this, the tests may be started.

2. Test Documentation: Upon completion of each required test, the ISS and Programmer shall document the test by submitting a copy of the signed off test procedures.

3. The ISS and Programmer shall develop and submit test plans and forms for all tests specified in this section, as well as all other control system related testing, and as required in Section 13410.

1.05 DELIVERY, STORAGE, AND HANDLING

A. The ISS shall be responsible for all shipping of control system equipment to and from the Programmer’s facility, test sites and the final installation site. The CONTRACTOR shall be responsible for all equipment during the time it is located at the Programmer’s site.

B. The ISS shall extend the manufacturer’s warranty period, as needed, to cover the time the equipment is located at the Programmer’s facility.

1.06 QUALITY ASSURANCE

A. The Programmer shall be a “systems integrator” regularly engaged in the application programming of Programmable Logic Controls and related devices as they are applied to the municipal water and wastewater industry. For the purposes of this Specification Section, a “systems integrator” shall be interpreted to mean an organization that complies with all of the following criteria:

1. Employs a registered professional Control Systems Engineer or Electrical Engineer to supervise or perform the work required by this Specification Section.

2. Employs personnel on this project who have successfully completed ISA or manufacturers training courses on general process instrumentation.

3. Has performed work of similar or greater complexity on at least five previous projects.

4. Has been actively engaged in the type of work specified in this Specification Section for a minimum of the last 5 consecutive years using Modicon system hardware and programming software of the same model and version that is provided for the project.

B. The Programmer shall maintain a permanent, fully staffed and equipped service facility within 350 miles of the project site with full time employees capable of programming and testing the systems specified herein.

C. The Programmer shall be one of the following:

1. KBL, Hayward, CA

2. FluidIQs, Napa, CA

3. MCC Control Systems, Vacaville, CA

4. HSQ Technology, Hayward, CA

5. Transdyn, Pleasanton, CA

6. Or equal

D. Being listed in this specification does not relieve any potential Programmer from meeting the qualifications specified in this Section.

1.07 PLC PROGRAMMING

A. The RTU/PLC Programming work under this task shall include the following major activities:

1. Programming of all RTU/PLCs provided under Section 13421. The RTU/PLC programming shall adhere to the following general criteria:

a. Programming shall be developed using a combination of Function Block and Ladder type structure (main body being Function Block and subroutines being Ladder).

b. Programming shall be based on the Process Control Descriptions in Specifications Section 13482 and the contract drawings

c. All controls, scaling, and alarming shall be performed in the controller
The controller tag database shall utilize the same structure as used in the HMI tag database to the maximum extent possible.

d. All function block and ladder programming shall be fully annotated describing the function of the program

e. Analog alarming shall be done in the RTU/PLC (including high & low limits, loss of signal, out-of-range, etc)

f. All analog scaling to engineering units shall be done in the RTU/PLC (floating point)

g. Running time shall be calculated for all process equipment that has status input to the RTU/PCS and available for display at any HMI.

1.08 TESTING, STARTUP AND COMMISSIONING

A. The work under this task shall include but not necessarily limited to the following activities:

1. Factory testing: Factory unwitnessed and factory witnessed testing of the entire PLC/PCS system including:

a. Organizing and facilitating the testing location(s) with the project ISS (Instrumentation System Supplier) and the General Contractor

b. Preparation of software/configuration testing "signoff" forms

2. Field startup and testing:

a. Provide staffing as required during the startup of all PLC/PCS components

b. Coordinate field testing and startup with project ISS.

c. Preparation of software/configuration testing "signoff" forms

3. Field commissioning:

a. Provide all PLC/PCS training for OWNER

b. Provide all Operation and Maintenance Manuals

c. Include a minimum of 8 Mh for training

4. Post Commissioning Services:

a. A minimum of 2 field visits (8 hours on site per each visit) to make adjustments and fine tune the PCS to meet OWNER's additional requirements

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 EARLY DELIVERY ITEMS

A. The ISS shall expedite the approval and purchase of the following equipment items which fall under the ISS's scope of supply. These items shall include, but not be limited to:

1. RTU/PLCs, including racks, power supplies and cards.

2. Network and Communications Components.

3. Accessory patch cords, power cords, mounting hardware.

4. RTU/PLC application development software.

5. Other items, as required, for a complete control system.

B. Unless otherwise indicated, all portions of the control system critical to the development of the application software shall be submitted by the ISS for review within 45 days of the Notice to Proceed. Priority items shall include PLC, network hardware, and software.

C. Unless otherwise indicated, components of the PCS shall be shipped by the ISS to the Programmer's facility within 60 days of the CONTRACTOR's Notice to Proceed. The ISS shall be responsible for all shipping costs.

D. Unless otherwise indicated all control system submittals shall be submitted by the ISS in sufficient detail to allow them to be approved within 90 days from the ISS's Notice to Proceed or a minimum of 90 days prior to the witnessed factory test whichever is earlier.

E. Unless otherwise indicated all vendor-provided control system information required for the Programmer, shall be submitted by the CONTRACTOR and ISS in sufficient detail to allow them to be approved within 90 days from the Notice to Proceed, or a minimum of 90 days prior to Witnessed Factory Tests, whichever is earlier.

F. Control System components needed for factory testing shall be made available to the ISS's panel assembly shop 30 days prior to the start of the test. The ISS shall notify the Programmer, in writing, of the proposed test at least 30 days prior to the shipping date. However, the ISS shall not be entitled to ship equipment or schedule UFT or WFT until the ISS receives approval for the test plan.

G. If the scheduling constraints of Division 1 are more stringent than the constraints within this Section, Division 1 requirements shall be followed.

H. The ISS shall provide all labor and equipment to assemble, interconnect, load system software, and test the PCS before the Programmer begins development of the Application software. This assembly and test shall be done at the Programmer's offices. The requirement is to provide a fully operational, networked PCS before the Programmer begins Application development.

3.02 COORDINATION MEETINGS

A. Refer to Section 13410 – Process Instrumentation and Controls – General Provisions for coordination meeting requirements.

3.03 TESTING

A. Refer to Section 13410 – Process Instrumentation and Controls – General Provisions for testing requirements.

3.04 TRAINING

A. Refer to Section 13410 – Process Instrumentation and Controls – General Provisions for training requirements.

END OF SECTION

SECTION 13420

PROCESS INSTRUMENTATION AND CONTROLS - PRODUCTS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:

1. The detailed technical requirements for the furnishing, installation, and services for the field and panel-mounted instrumentation and control equipment.

B. Related Sections. See Related Sections for additional requirements applicable to this Section (typical).

1. Section 13410 - Process Instrumentation and Controls – General Provisions

2. Section 13485 - Instrumentation List

1.02 REFERENCES

A. Refer to Section 13410.

1.03 SUBMITTALS

A. All submittals shall be in accordance with Sections 01300 and 13410.

B. Instrumentation Equipment List: An Instrumentation Equipment List shall be furnished for all instruments supplied under this Specification Section in accordance with Section 13410.

C. Shop Drawings: Shop drawings shall be furnished for all instruments supplied under this Specification Section in accordance with Section 13410.

1.04 QUALITY ASSURANCE

A. Refer to Section 13410.

1.05 MAINTENANCE AND TEST EQUIPMENT

A. Spare Parts

1. Miscellaneous Spare Parts:

a. One year’s supply of items recommended by the manufacturer of the equipment for each component.

2. Provide other spare parts as indicated on the individual device specifications.

3. All spares shall be packed in a manner suitable for long-term storage and shall be adequately protected against corrosion, humidity and temperature.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Refer to Section 13410 for general requirements of all instrumentation and control equipment.

2.02 LEVEL INSTRUMENTS

A. Level Element and Transmitter (Pressure Transducer Type)

1. The level element and transmitter shall be a loop powered submersible level transducer system that uses hydrostatic head pressure sensing to provide a proportional 4-20 mA signal representing level.

2. The transducer shall be suitable for continuous submergence and operation. The bottom diaphragm face of the sensor shall be installed approximately 6 inches above the floor and mounted using a stainless steel cable system.

3. The transducer housing shall be fabricated of Teflon coated 316 stainless steel with a bottom diaphragm 2-5/8" diameter of heavy-duty, limp, foul-free, molded Teflon bonded to a synthetic rubber back/seal. Housing construction shall resist and be unaffected by the build-up of solids on its surfaces or sensing diaphragm. The transducer electronics shall be encased within the protective housing and shall be electrically and mechanically isolated from the sensed media via non-conductive fluid filled pressure transference cavity and barometric compensated transducer electronics chamber.

4. The submersible level transducer shall be a two-wire type and shall operate from a supply voltage of 9 to 30 VDC and produce a 4-20 mA signal in direct proportion to the measured level excursion over a precalibrated range as required by the application. The unit shall be able to drive a minimum load of 750 Ohms at 24 VDC loop power. The sensor technology shall be based on piezo-resistive pressure element – 40 to 185 Deg F. temperature range and shall have not more than a 3% full scale error. The transducer element shall incorporate high over-pressure protection and be designed to withstand intermittent overpressures.

5. The internal pressure of the transducer assembly shall be relieved to atmospheric pressure through a heavy-duty urethane jacketed hose/cable assembly with a dedicated breather tube. The breather system shall be sealed through the use of a rugged maintenance free air bladder assembly connected to the breather tube and mounted within a junction box or monitoring panel. The sealed breather system shall compensate for variations in barometric pressure including expansion and contraction of air due to temperature changes and altitude as well as prevent fouling from moisture and other corrosive/atmospheric elements.

6. The mounting shall include, but not be limited to, all stainless steel cable, weight, attachment hardware and other parts necessary to mount the transducer in the wet well.

7. The submersible level transducer system shall be Siemens Water Technologies Model A1000i, or equal.

B. Float Switch

1. Float switches shall be of 5-1/2 inch diameter type 316 stainless steel construction and include normally-open, mercury-free type, tilt-type, switch rated for switching 20 AMP resistive loads at 120 VAC. Switches shall include 40-feet of nitrile PVC jacketed, Type SO, 3-conductor, No. 14 AWG, cable suitable for underwater service. Switches shall be suitable for use in Class 1, Division 1 sewage wet well locations.

2. The direct acting float switch liquid level sensors shall be mounted to a common stainless steel cable/weight suspension mounting kit. The stainless steel cable shall be multi-stranded and have a minimum of 1/8" diameter. A plastisol-coated, 20-pound cast-iron weight with a cast-in-place stainless steel eyelet (for connection to the stainless steel cable with two stainless steel clamps) shall provide drift free mounting. The kit shall utilize stainless steel float switch cable clamp mounting hardware with two stainless steel screws per clamp to provide easy field adjustment of float switch operating elevations. The stainless steel cable shall have a loop with two cable clamps at the upper end of the assembly for mounting to an eyelet installed in the top slab of the wet well. Switches shall be installed per the manufacturer's requirements.

3. Level switches shall be Siemens Water Technology model 9GEF with model CBM Suspension mounting, or equal.

2.03 PRESSURE INSTRUMENTS

NOT USED

2.04 ANALYZERS AND MISCELLANEOUS INSTRUMENTS

NOT USED

2.05 PANEL DEVICES

A. Pilot Type Indicating Lights

1. Type: Heavy duty oiltight type which utilizes a low voltage lamp.

2. Functional: Units shall be provided with low voltage lamps suitable for the voltage supplied. Lights supplied with 120V AC power shall have integral reduced voltage transformers; lamps shall be replaceable from the front of the unit.

3. Physical:

a. Lens color:

Running, on, open - Red
Stopped, off, closed - Green
Alarm, not ready, fault – Amber
Local panel control power - White

Lens shall be approximately 1-1/4-in in diameter. Provide legend faceplates engraved to indicate the required function of each device; NEMA rating - 4x.

4. Manufacturers: Allen Bradley Type 800H; Microswitch; General Electric; or Square D.

B. Selector Switches and Pushbuttons

1. Type: Control devices shall be heavy duty oiltight type with stackable contact blocks.

2. Functional: Provide contact arrangement and switching action as required for the control system specified.

3. Physical: For 120V AC service provide contacts rated 10 amps at 120V AC, for 24V DC service provide silver sliding contacts rated 5 amps at 125V DC, for electronic (millivolt/ milliamp) switching provide contacts rated lamp at 28V DC; Pushbuttons shall have flush type operators. Selector switches shall have knob or wing lever operators; NEMA rating - 4x; Provide legend plates denoting switch/pushbutton position/ function.

4. Manufacturers: Allen Bradley Type 800H; Microswitch; General Electric; Square D.

C. Potentiometer

1. Type: Device shall be heavy duty 30 mm oiltight type.

2. Functional: 270^{o} dial; Rated for 1,000 ohms.

3. Physical: Mounting - Suitable for panel mounting; NEMA 4x rating; escutcheon plates scaled in engineering units.

4. Manufacturers: Allen Bradley Co.; Cutler-Hammer; or Square D.

D. General Purpose Relays and Time Delays

1. Type: general purpose plug-in type.

2. Functional: Contact arrangement/function shall be as required to meet the specified control function; Mechanical life expectancy shall be in excess of 10 million; Duty cycle shall be rated for continuous operation; Units shall be provided with integral indicating light to indicate if relay is energized; Solid state time delays shall be provided with polarity protection (DC units) and transient protection; Time delay units shall be adjustable and available in ranges from .1 second to 4.5 hours.

3. Physical: For 120V AC service provide contacts rated 10 amps at 120V AC, for 24V DC service provide contacts rated 5 amps at 28V DC, for electronic (milliamp/millivolt) switching applicator provide gold plated contacts rated for electronic service; relays shall be provided with dust and moisture resistant covers.

4. Options/Accessories Required: Provide mounting sockets with pressure type terminal blocks rated 300 volt and 10 amps; provide mounting rails/holders as required.

5. Manufacturers: IDEC; Allen Bradley; Potter & Brumfield; Square D, or equal.

E. Signal Relay Switches (Current Trips)

1. Type: Solid state, ASIC technology, electronic type.

2. Functional: Input - 4-20 mA; Output - Isolated contact output, double pole double throw, rated 5 amps at 120V AC; Accuracy - 0.1 percent; Protection - Provide RFI protection; Deadband - Adjustable between 0.1 and 5.0 percent of span; Setpoint Adjustment - Single Point alarms shall be adjustable to trip on rising or falling input signal, dual point alarms shall be adjustable to trip on rising and falling input signals; Repeatability - Trip point repeatability shall be at least 0.1 percent of span.

3. Physical: Mounting - DIN rail.

4. Manufacturers: Action Instruments Slim Pak; or equal.

F. Signal Isolators/Boosters/Converters

1. Type: Solid state, ASIC technology; electronic type.

2. Functional: Accuracy - 0.15 percent; Inputs - Current, voltage, frequency, temperature, or resistance as required; Outputs - Current or voltage as required; Isolation - There shall be complete isolation between input Circuitry, output circuitry, and the power supply; Adjustments - Zero and span adjustment shall be provided; Protection - Provide RFI protection.

3. Physical:

a. Mounting - DIN Rail.

4. Manufacturers: Action Instruments Slim Pak; or equal.

G. Signal Selectors, Computation, and Conditioning Relays

1. Type: Solid state, ASIC technology, electronic type.

2. Functional: Inputs - 4-20 mA; Outputs - 4-20 mA; Protection - Provide RFI protection; Operation - The relay shall multiply, add, subtract, select, extract the square root, or perform the specified conditioning/ computation function required. All inputs shall be able to be individually rescaled and biased as required; Isolation - All inputs, outputs, and power supplies shall be completely isolated; Accuracy - 0.35 percent of span; Adjustments - Multiturn potentiometer for zero, span, scaling, and biasing.

3. Physical: Mounting - DIN rail.

4. Manufacturers: Action Instruments Slim Pak; or equal.

H. Intrinsically Safe Relay

1. All interfaces between control panels and remote devices mounted in the hazardous (classified area) shall be isolated via an intrinsically safe barrier relay. Intrinsically safe relays shall be solid state type with 5 Amp output contacts, suitable for use on a 120 Volt, 60 Hz power supply and shall be FM approved for pilot devices in Class I, Division 1, Group D hazardous atmospheres. Intrinsically safe relays shall be Gems Solid State Safe Pak as manufactured by Gems Sensors, Division of Transamerica Delaval, Inc.; R. Stahl, Inc; MTL Inc., or equal.

I. 24 VDC Power Supplies

1. Provide a 24 VDC power supply in the control panel to power field instruments, panel devices, etc., as required. Equip the power supply with a power on/off circuit breaker.

2. The 24 VDC power supply shall meet the following requirements:

   a. Input power: 115 VAC, plus or minus 10 percent, 60 Hz.

   b. Output voltage: 24 VDC.

   c. Output voltage adjustment: 5 percent.

   d. Line regulation: 0.05 percent for 10 volt line change.

   e. Load regulation: 0.15 percent no load to full load.

   f. Ripple: 3 mV RMS.

   g. Operating temperature: 32 to 140 degrees Fahrenheit.

3. Size the 24 VDC power supply to accommodate the design load plus a minimum 25 percent spare capacity.

4. Provide output overvoltage and overcurrent protective devices with the power supply to protect instruments from damage due to power supply failure and to protect the power supply from damage due to external failure.

5. Mount the 24 VDC power supply such that dissipated heat does not adversely affect other panel components.

6. As manufactured by Phoenix Contact, Acopian, PULS North America, or equal.

2.06 MISCELLANEOUS DEVICES

A. Intrusion Alarm Switch

1. Each contact shall be provided with matching magnet. All contacts shall be hermetically sealed for long term 10,000,000 cycle contact. All switches shall be 100 percent factory tested prior to installation. Install per manufacturer's recommendation.

2. Switches used in wet wells and valve vaults shall have NEMA 7 enclosures listed for use in Class I, Division 1 areas.

3. Honeywell Microswitch, Square D or equal.

PART 3 EXECUTION

3.01 GENERAL

A. See execution requirements in Section 13410.

END OF SECTION

SECTION 13421

PROCESS CONTROL SYSTEM – HARDWARE AND SOFTWARE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. The ISS shall furnish all labor, materials, equipment, services and incidentals required to install and place into operation the computer-based monitoring and control system components. The system shall consist of a Programmable Logic Controller (PLC)-based control system for process interface and data acquisition as shown on the Drawings. The system will utilize Personal Computers (PC) to provide the Operator Machine Interface (OMI) functions described. PC/OMI network, hardware, and configuration is provided by others at the future Wastewater Treatment Plant (WWTP). The combination of PLC, PC and related hardware and software is referred to as the PCS (Plant Control System) system.

2. The term RTU (Remote Terminal Unit) refers to the combination of PLC, its input/output modules (I/O), PLC power supply, PLC back plane, UPS (uninterruptible power supply), fiber-copper convertors, Ethernet switches, protective devices, and accessories. The terms "RTU" and "PLC" may be used interchangeably when referring to programmed logic.

3. The term OMI refers to the Operator Machine Interface of the PCS system. This interface provides the graphic display and operator control for the programmed logic of the PCS. The hardware used for this graphic display may be a desktop PC monitor, a laptop, or a panel mounted Operator Work Station (OWS). The term HMI may also be used with the same meaning as OMI.

4. The PCS specified in this and related sections will be integrated with the future Wastewater Treatment Plant; however, the collection system PCS shall be completely stand alone to allow testing and commissioning without reliance on the future Wastewater Treatment Plant project.

5. All PCS hardware and software shall be supplied by the ISS. The ISS shall coordinate interconnection of equipment as shown on the Process and Instrumentation Diagrams (P&ID).

6. The ISS shall provide ancillary devices, and services necessary to achieve a fully integrated and operational system.

7. All multi-conductor wire, coaxial, cable, and accessories for connecting the PCS and related equipment shall be furnished and tested under this Section. Furnishing and installation of fiber optic cables, connectors, and accessories shall be performed as required by Section 16801. The ISS shall certify that all associated cables are suitable for use by the PCS system.

8. All programming and configuration of the RTU/PLC for the control system components and functions shall be performed by the Programming Subcontractor (Programmer) as specified in Section 13411. All programming of the PC & OMI network will be by others in a separate contract.

9. All factory and field acceptance testing of the control system equipment and software shall be performed by the ISS in coordination with the Programming Subcontractor as specified in Section 13411, and (for Pocket Pump Station) in coordination with the Pump Supplier as specified in Section 11310.

10. Hardware and software required for programming, configuration, and factory testing by the programming subcontractor shall be delivered to the programmer's offices as specified in Section 13411.

11. Programmed RTU components for the Pocket Pump Stations (Submersible Grinder Pumps) shall be delivered to the Pump Supplier for factory mounting in the PPS-LCPs (Local Control Panels).

B. Related Sections. See Related Sections for additional requirements applicable to this Section (typical).

1. Section 13410 – Process Instrumentation and Controls – General Provisions.

2. Section 13411 – Plant Control System Programming.

3. Section 13422 – Control Panels and Panel Mounted Equipment.

4. Section 13482 – Process Control Descriptions.

5. Section 13485 – Instrumentation List.

6. Section 16000 – Electrical - General Provisions.

7. Section 16800 – Fiber Optic and Power Conduits Along Pipelines.

8. Section 16801 – Fiber Optic Cable System.

9. Section 11310 – Submersible Grinder Pumps.

1.02 REFERENCES

A. Refer to Section 13410.

1.03 SUBMITTALS

A. Submittals shall be prepared and transmitted to the ENGINEER for approval in compliance with Sections 01300 and 13410.

B. Certification indicating that the communications cables are suitable for use with the PCS system components furnished.

1.04 OPERATION AND MAINTENANCE MANUALS

A. Operation and Maintenance Manuals shall be provided for all devices furnished under this section in compliance with Sections 01730 and 13410.

1.05 MAINTENANCE

A. Tools and spare parts shall be provided in accordance with Section 13410.

B. The following spare parts shall be provided as a minimum:

1. AI Module: 2 each

2. Combination DI/DO Module: 4 each

3. DI Module: 4 each

4. RTU/PLC Processor: 1 of each type furnished

5. I/O Module Fuses: 1 for each 5 modules furnished

6. Ethernet Switch: 1 each

7. Fiber to Copper Converter: 2 each

1.06 DESCRIPTION OF SYSTEM

A. Software and hardware compatibility and consistency:

1. To maintain compatibility with the OWNER's future WWTP systems all PLC hardware shall be Modicon with Unity Pro software. No equal unless approved by OWNER and ENGINEER.

B. The following points are not intended to be a comprehensive list of the system's features, only a summary of the major functions of the system. The computer based monitoring and control system specified herein shall perform the following generalized functions:

1. Perform real-time process control, including proportional integral derivative control action, sequencing, process calculations, etc.

2. Collect and store accurate, reliable operating information for present and future uses.

3. Assist plant operating personnel by noting and communicating off-normal operating conditions and equipment failures.

4. Accumulate and store equipment running times for use in preventative maintenance.

5. Provide color graphic displays and summary reports for use by the plant operating and supervisory personnel.

6. Provide trending for all analog values.

7. Provide control system diagnostics.

C. The system is generally detailed on the Control System Architecture as included in the Drawings. The system shall include the following major components:

1. RTU/PLCs with local I/O, network communications and other capabilities as specified herein and shown on the Drawings.

2. PCs with associated peripherals, computer operating system, OMI control/graphic software and configuration by others in the future WWTP project.

3. RTU/PLC programming software, and other application software as specified herein.

4. The PLCs and PCs shall be linked to each other over an fiber optic Ethernet (IEEE 802.3) based local area network (LAN). RTU/PLCs and PCs shall be on separate networks as indicated on the Drawings.

1.07 PROCESS CONTROL DESCRIPTIONS

A. Refer to Section 13482 – Process Control Descriptions.

1.08 DELIVERY, STORAGE AND HANDLING

A. Delivery, storage, and handling shall be in accordance with Sections 13410 and 13411.

1.10 QUALITY ASSURANCE

A. Refer to Section 13410.

PART 2 PRODUCTS

2.01 GENERAL

A. All equipment, cabinets and devices furnished hereunder shall be heavy duty type, designed for continuous industrial service and shall comply with the requirements of Sections 13410 and based on the environmental conditions described in the detailed specifications and as indicated on the Drawings. All equipment provided shall be of modular construction and shall be capable of field expansion through the installation of plug-in standard modules.

B. Where there is more than one item of similar equipment required, all such similar equipment shall be the product of one manufacturer. All equipment models provided shall be currently in production at time of bid.

C. All equipment furnished shall be suitable for operation on an input voltage of 120 VAC plus or minus 10%, 60 Hz, single-phase electrical power supply unless specifically noted otherwise. Provide power supplies as required for other voltages.

D. All equipment furnished shall be designed and constructed so that in the event of power interruption, the systems specified hereunder will resume normal operation without manual resetting when power is restored.

2.02 PROGRAMMABLE LOGIC CONTROLLERS (PLCs)

A. General

1. All PLCs and related hardware shall be as manufactured by Modicon. No other manufacturers accepted without prior approval of OWNER and ENGINEER.

2. All PLCs shall be mounted in panels in the manner specified in Section 13422 unless specifically noted otherwise.

B. Central Processing Unit (CPU) & Peripheral Remote I/O Adaptor shall be Modicon M340 controller, part number BMXPRA0100. CPU shall be combination processor with 96 kB memory and Ethernet Modbus TCP/IP adaptor for communication with Modicon Premium, Quantum, or M340 CPUs, and shall provide for communication with the I/O modules.

C. Power supplies for PLCs shall be rack mounted, isolated, 24 VDC, Modicon BMXCPS2010.

D. Input/Output Modules

1. General

a. The I/O count and type shall be determined by the ISS as required to implement the functions specified plus an allowance for active spares as noted below.

b. The system shall include spares for future use. Provide minimum 2 spare AI at locations where AI are used. Provide 25 percent (minimum of 4) of each type of discrete I/O used at each PLC system. All spare points shall be active. Active spare points shall include all PLC configuration, all wiring between the I/O module and terminal block complete, and sufficient power supply capacity available to immediately put a point into service by connecting the terminal block to the external signal.

c. All outputs shall have field replaceable fuse protection and blown fuse indicators.

d. Power for sensing field dry contacts and powering analog instrument loops shall be provided by the ISS as a part of the system. The I/O power source shall have individual or grouped (of logically associated circuits) fusing and provided with a readily visible, labeled blown fuse indicators.

e. Provide surge protection for all outputs.

2. Discrete I/O

a. The discrete outputs shall be a Form-A dry contact rated at 2.0 amp minimum continuous, with maximum inrush of 10 amps for 16 mSec. Discrete outputs shall be supplied with interposing relays for all NEMA 3 and larger starter loads, and where

required to meet the previously stated specifications. Interposing relays shall have a minimum contact rating of 10 amps and shall be DPDT configuration.

b. Mixed discrete I/O modules shall be combination input output modules, Modicon BMXDDM16025, with 8 isolated inputs and 8 isolated relay outputs.

c. Discrete input modules shall be Modicon BMXDAI 16022, with 16 isolated inputs.

3. Analog I/O

a. Analog input modules shall be Modicon BMX AMI 0410, with 4 high-speed current channels

E. PLC racks shall be Modicon M340 Slot Backplane BMXXBP0400 with 1 slot for power supply and 4 for CPU & I/O modules, DIN rail mount type.

F. Provide terminal blocks and any other accessories as required.

G. Ethernet Cable:

1. The Ethernet cable shall be one of the following as detailed on the Drawings and as specified in Section 16801:

a. For copper wire sections: CAT6 22 AWG solid un-tinned copper, as required by the application.

b. For fiber optic sections: Refer to 16801.

2.03 SOFTWARE

A. General Requirements

1. Software shall be modular, comprised of an integrated group of proven, standard software modules.

2. Provide all software in original unopened packaging on CD(s).

3. Provide an original CD version with license.

B. PLC Program Development Software System

1. Provide software package to allow off-line or on-line program development, annotation, and monitoring on an IBM or compatible personal computer.

2. The software package shall include a software license agreement allowing the OWNER the rights to utilize the software as required for any current or future modification, documentation, or development of the PLCs furnished for this project.

3. The development software shall be suitable for programming in all IEC-1131 styles.

4. Development software shall be the latest version of Modicon Unity Pro, no equal, with Unity (M340) loader, firmware updates, and one-year subscription service.

2.04 ETHERNET SWITCHES AND MISCELLANEOUS COMMUNICATION HARDWARE

A. Ethernet Switch

1. General Description

a. Managed Industrial Ethernet switch shall be back panel mounted. The switch shall be a modules style with separate CPU and communication port modules housed in a back plane chassis. Provide a minimum of one Ethernet 100 base-TX RJ45 serial port and twelve fiber optics 100B-ST ports or as required to support the communications network as indicated on the Drawings. Ethernet Fault recovery time shall be less than 30 milliseconds.

b. Ethernet switch shall be N-Tron Series 9000 (9000 CPU, 9004FXE-SC-15, 9006TX and 9000 BP), or equal.

B. Fiber Optic to Copper Converter and Point to Point Modem

1. General Description

a. Fiber Optic to Copper Converter Modem shall be back panel mountable and industrial rated. It shall be able to convert and connect a point to point 10/100/1000Base RJ45 Ethernet link to single mode fiber optics.

b. Fiber Optic to Copper Modem shall be N-Tron 302MCE-SC-15 or equal.

2.05 UNINTERRUPTIBLE POWER SUPPLY (UPS)

A. General Description

1. Single Phase UPS - Internal to Control Panels. Industrially rated continuous-duty, on-line, solid state, line interactive, fully automatic, single-phase uninterruptible power system to provide power conditioning and power backup for PLC, communications hardware, and other critical electronic loads as indicated on the Drawings.

2. The UPS system shall include rectifier and battery charger, inverter, batteries and other features as described in this specification.

3. The UPS shall be minimum 850 VA and provide a minimum of 10 minutes battery operation at full load. The UPS shall be:

a. Allen Bradley 1609-U UPS

b. Sola Hevi Duty SDU UPS

c. Or equal

B. General Requirements

1. Suitable for installation in a UL508A listed panel.

2. DIN rail mountable.

3. UL recognized components for industrial applications in accordance with UL508 without derating.

4. Internal circuit breaker disconnect for battery protection.

5. Current limiting circuitry to protect the inverter output under any load condition

6. AC output neutral electrically isolated from the UPS chassis. The UPS chassis shall have an equipment ground terminal. Provisions for installation of a bonding connector shall be provided.

7. 120 volt input and output.

C. The UPS shall operate as a line interactive on-line, fully automatic system in the following modes:

1. Normal: The critical load shall be continuously supplied with filtered and regulated AC power by the inverter. The rectifier/battery chargers shall derive power from the preferred AC source and supply DC power to the inverter while simultaneously float charging the batteries.

2. Emergency: Upon failure of the preferred ac power source, the critical load shall continue to be supplied by the inverter. Inverter power shall be supplied without switching from the storage battery. There shall be no interruption to the critical load upon failure or restoration of the preferred AC sources. If the AC source cannot be restored before the battery discharges to its low voltage dropout value, the UPS shall automatically shut itself down in an orderly manner.

3. Recharge: Upon restoration of the AC source, the rectifier/battery charger shall power the inverter and simultaneously recharge the batteries. This shall be an automatic function causing no interruption to the critical load.

D. Batteries

1. High Temperature, sealed, maintenance-free, lead-acid cells.

2. The unit may have either internal or external batteries, or both, as necessary to support the runtime requirements.

PART 3 EXECUTION

3.01 FACTORY TESTING

A. Factory testing shall be in accordance with Section 13410.

3.02 FIELD TESTING AND INSPECTION

A. The entire PCS shall be field tested as specified in Section 13410.

3.03 TRAINING

A. Training for the Process Control System hardware and software shall be as specified in Section 13410.

END OF SECTION

SECTION 13422

CONTROL PANELS AND PANEL-MOUNTED EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:

1. Furnish and install control panels and panel mounted equipment as specified herein and shown on the Drawings.

2. All panels and cabinets furnished by the ISS are shown on the Drawings.

3. Panels furnished with the submersible grinder pumps shall comply with this section to the extent applicable.

B. Related Sections:

1. Section 01614 – Wind Design Criteria.

2. Section 01615 – Seismic Design Criteria.

3. Section 13410 – Process Instrumentation and Controls – General Provisions.

4. Section 13420 – Process Instrumentation and Controls – Products.

5. Section 13421 – Process Control System – Hardware and Software.

6. Section 11310 – Submersible Grinder Pumps.

C. Unless noted otherwise, all instrumentation and control panels furnished under this project shall conform to the requirements of this specification. The following is a general listing of the panels that are included:

Designation	Location	NEMA Rating	Equipment Included[(1)]	Number of Similar Panels	Notes
PPS-LCP-##	Pocket Pump Stations (Grinder Pumps)	4X	Utility metering, portable generator connection, power distribution, motor controllers, RTU, UPS, controls and indicators on a swing out inner panel	11	Panels provided under Section 11310. "##" replaced by pump station number for each panel (e.g., PPSLCP-09A)
PPS-LCP-05A	Pocket Pump Station 05A at Mid-Town (Grinder Pumps)	12	Power distribution, motor controllers, RTU, UPS, controls and indicators	1	Panel provided under Section 11310

Designation	Location	NEMA Rating	Equipment Included(1)	Number of Similar Panels	Notes
RTU Panel	Standby Power Buildings (WP/BW Power, EP, EY, Mountain View, Mid-Town Power, Lupine, Solano)	12	RTU, UPS, indicator lights: may include patch panel and Ethernet switch(es)	7	
RTU Panel	Pump Stations (Mid-Town, Sunny Oaks, WP, BW)	4X	RTU, UPS, indicator lights	4	
LCP	Effluent disposal sites	4X	Utility metering, portable generator connection, power distribution, RTU, UPS, valve control and indication. Operator controls mounted on swingout inner door.	2	

Note (1): Only selected equipment listed. See Drawings and remainder of Specifications for additional details and equipment.

1.02 SUBMITTALS

A. Refer to Section 13410 - Process Instrumentation and Controls – General Provisions.

B. Control panels with utility metering and pull sections shall be submitted to the Power Company for review.

1.03 REFERENCE STANDARDS

A. Refer to Section 13410 - Process Instrumentation and Controls – General Provisions.

1.04 QUALITY ASSURANCE

A. Refer to Section 13410 - Process Instrumentation and Controls – General Provisions.

1.05 DELIVERY, STORAGE AND HANDLING

A. Refer to Section 13410 - Process Instrumentation and Controls – General Provisions.

B. All panels shall be mounted on wood skids or similar to prevent damage during shipment to the project job site.

1.06 SPARE PARTS

A. The following control panel spare parts shall be furnished:

1. Timers and sockets – Two of each type installed.

2. Relays and sockets – Two of each type installed.

3. Fuses and circuit breakers – 10% (minimum of 10 fuses and 2 circuit breakers) of each type and size installed.

4. Light bulbs – 10% (minimum of 10) of each type installed. For LED type lights, 5% (minimum of 3) of each color installed.

5. Panel mounted power supplies – Four of each type installed.

6. Selector switches/pushbuttons – Two of each type installed including contact blocks.

7. Surge protection devices – Four of each type installed.

8. Provide touch-up paint of each type and color used for all panels supplied.

PART 2 PRODUCTS

2.01 GENERAL

A. Refer to Section 13410 - Process Instrumentation and Controls – General Provisions and Section 13420 – Process Instrumentation and Control - Products.

2.02 LIGHTNING/SURGE PROTECTION

A. Refer to Section 13410 - Process Instrumentation and Controls – General Provisions.

2.03 CONTROL PANEL GENERAL REQUIREMENTS

A. The general fabrication requirements of control panels, enclosures, consoles and cabinets. The dimensions on the Contract Drawings are for general reference only. The panel fabricator shall be responsible for ensuring final enclosure sizing and panel arrangements accommodate all required equipment for a fully integrated and operational system as specified herein and in the Contract Documents.

B. Each control panel and terminal cabinet shall bear the UL label. The UL Label shall apply to the enclosure, the specific equipment supplied with the enclosure, and the installation and wiring of the equipment within and on the enclosure. If required for UL labeling, provide ground fault protective devices, isolation transformers, fuses and any other equipment necessary to achieve compliance with UL 508 requirement. The Drawings do not detail all UL 508 requirements.

C. All panel doors shall have a locking provisions. Locking shall be with a keylock tumbler installed in the door handle or a hasp and staple for padlocking. Keylock tumblers for all panels provided under this Contract shall be keyed alike.

D. The instruments designated for rear-of-panel mounting shall be arranged within the panel according to respective panel drawings and in a manner to allow for ease of maintenance and adjustment. Heat generating devices such as power supplies shall be located at or near the top of the panel.

E. The panels shall be completely fabricated, instruments installed and wired at the fabricator's facility.

F. All components shall be mounted in a manner that shall permit servicing, adjustment, testing and removal without disconnecting, moving or removing any other component. Components mounted on the inside of panels shall be mounted on removable plates and not directly to the enclosure. Mounting shall be rigid and stable unless shock mounting is required otherwise by the manufacturer to protect equipment from vibration. Components mounting shall be oriented in accordance with the internal components shall be identified with suitable plastic or metal engraved tags attached with drive pins adjacent to (not on) each component identifying the component in accordance with the drawing, specifications, and approved submittal data.

G. All exterior panel mounted equipment shall be installed with suitable gaskets, faceplates, etc. required to maintain the NEMA rating of the panel.

H. Nameplates

1. All panels and panel devices shall be supplied with suitable nameplates which identify the panel and individual devices as required. Unless otherwise detailed on the Drawings, each device nameplate shall include up to three lines with the first line containing the device tag number as shown on the drawings, the second line containing a functional description (e.g., Recirculation Pump No. 1), and the third line containing a functional control description (e.g., Start).

2. Unless escutcheon plates are specified or unless otherwise noted on the Drawings, nameplates shall be 3/32 inch thick, black and white, Lamicoid with engraved inscriptions. The letters shall be black against a white background unless otherwise noted. Edges of the nameplates shall be beveled and smooth. Nameplates with chipped or rough edges will not be acceptable. Nameplates shall be affixed to the panels using 4-40 thread stainless steel button head hex screws.

3. Provide legend plates or 1-in by 3-in engraved nameplates with 1/4-in lettering for identification of door mounted control devices, pilot lights and meters

I. Mounting Elevations

1. ISA Recommended Practice RP60.3 shall be used as a guide in layout and arrangement of panels and panel mounted components. Dimensions shall account for all housekeeping pads that panels will sit on once they are installed.

2. Where possible, centerline of indicators and controllers shall be located no lower than 48 inches or higher than 66 inches above the floor on a panel face.

3. Where possible, centerline of lights, selector switches and pushbuttons shall be located no lower than 32 inches or higher than 70 inches above the floor on a panel face.

4. Installation of panel components shall conform to component manufacturers' guidelines.

2.04 PANEL MATERIALS AND CONSTRUCTION

A. Structure and Enclosure

1. Panels shall be of continuous welded-steel construction. Provide steel angle stiffeners as required on the back of the panel face to prevent panel deflection under instrument loading or operation. Internally the panels shall be supplied with a structural steel framework for instrument support purposes and panel bracing. The internal framework shall permit panel lifting without racking or distortion. Provide removable lifting rings designed to facilitate simple, safe rigging, and lifting of the control panels during installation. Plugs shall be provided and shall unobtrusively fill the panel lifting ring holes when substituted for the lifting rings after installation is complete. Plugs shall not compromise the overall NEMA rating of the panel.

2. Each panel shall be provided with full height, fully gasketed access doors. Doors shall be provided with a three-point stainless steel latch and heavy duty stainless steel locking handle unless shown otherwise. Rear access doors (where shown on Drawings) shall be conveniently arranged and sized such that they extend no further than 24 inches beyond the panel when opened to the 90-degree position. Panel access doors shall be provided with full length, continuous, piano type stainless steel hinges with stainless steel pins. Front access doors with mounted instruments or control devices shall be of sufficient width to permit door opening without interference from flush mounted instruments. Some panels require a door-in-door arrangement as shown on the Drawings. In those cases, the inner door shall be provided with a full length hinge and suitably arranged and braced to allow full opening without interference or flexing.

3. The panels, including component parts, shall be free from sharp edges and welding flaws. Wiring shall be free from kinks and sharp bends and shall be routed for easy access to other components for maintenance and inspection purposes.

4. The panel shall be suitable for top or bottom conduit entry as required by the Electrical Drawings. For top mounted conduit entry the panel top shall be provided with nominal one foot square removable access plates which may be drilled to accommodate conduit and cable penetrations. All conduit and cable penetrations shall be provided with ground bushings, hubs, gasketed locknuts, or other accessories as required to maintain the NEMA rating of the panel and electrical rating of the conduit system.

5. All panels in indoor, dry, non-corrosive environments shall be NEMA 12 unless otherwise noted. All panels in outdoor, wet, and corrosive environments shall be NEMA 4X unless otherwise noted. All panels located in a Hazardous location (e.g., Class I, Division 1) shall be rated NEMA 7.

6. All panels located outdoors shall be of a tamper- and vandal-resistant design.

B. Freestanding Vertical Panels

1. Freestanding vertical panels shall meet the NEMA classification as shown on the drawings or specified herein. The panels shall be constructed of 12 gauge sheet steel, suitably braced internally for structural rigidity and strength. All NEMA 4X rated panels shall be constructed of 316 stainless steel, unless FRP is specifically indicated to be provided. Front

panels or panels containing instruments shall be not less than 10 gauge stretcher leveled sheet steel, reinforced to prevent warping or distortion.

C. Wall or Unistrut Mounted Panels

1. All wall mounted panels shall meet the NEMA classification as shown on the drawings or specified herein. The panels shall be constructed of not less than USS 14 gauge steel, suitably braced internally for structural rigidity and strength. All NEMA 4X rated wall mounted panels shall be constructed of 316 stainless steel, unless FRP is specifically indicated. FRP panels shall be used in chlorine areas. All FRP panels located in direct sunlight shall be provided with a protective coating and sun shield to prevent discoloration and cracking.

D. Finish Requirements

1. All sections shall be descaled, degreased, filled, ground and finished. The enclosure when fabricated of steel shall be finished with two rust resistant phosphate prime coats and two coats of enamel, polyurethane, or lacquer finish which shall be applied by either the hot air spray or conventional cold spray methods. Brushed anodized aluminum, stainless steel, and FRP panels will not require a paint finish.

2. The panels shall have edges ground smooth and shall be sandblasted and then cleaned with a solvent. Surface voids shall be filled and ground smooth.

3. Immediately after cleaning, one coat of a rust-inhibiting primer shall be applied inside and outside, followed by an exterior intermediate and top coat of a two-component type epoxy enamel. A final sanding shall be applied to the intermediate exterior coat before top coating.

4. Apply a minimum of two (2) coats of flat white lacquer on the panel interior after priming.

5. Unless otherwise noted, the finish exterior colors shall be ANSI 61 gray with a textured finish.

E. Print storage pockets shall be provided on the inside of each panel. The storage pockets shall be steel, welded onto the door, and finished to match the interior panel color. The storage pocket shall be sufficient to hold off all of the prints required to service the equipment, and to accommodate 8.5 inch by 11 inch documents without folding.

F. Panel enclosures shall be Hoffman or equal.

2.05 ENVIRONMENTAL CONTROL

A. All panels shall be provided with louvers and forced air ventilation (for NEMA 12 panels only), or with air conditioning units as required to prevent temperature buildup inside of panel. The internal temperature of all panels shall be regulated to a range of 45 Deg F to 104 Deg F under all conditions. Under no circumstances shall the panel cooling or heating equipment compromise the NEMA rating of the panel.

B. Submit heat dissipation calculations for every control panel.

C. Where required, louvers shall be on front or sides.

D. Forced air ventilation fans, where used, shall provide a positive internal pressure within the panel and shall be provided with washable or replaceable filters. Fan motors shall operate on 120-volt, 60-Hz power.

E. All NEMA 4X panels mounted outdoors shall be provided with a closed circuit air conditioning system to minimize the degradation of panel internal components due to the salt air environment of the project site.

F. All enclosures shall be provided with a thermostatically controlled strip heater to reduce condensation and maintain the minimum internal panel temperature. Mount near the bottom of the enclosure with the discharge away from heat sensitive equipment. Heater shall be Hoffman DAH or equal.

2.06 CORROSION CONTROL

A. Panels shall be protected from internal corrosion by the use of corrosion-inhibiting vapor capsules or strips as manufactured by Northern Technologies International Corporation, Model Zerust VC; Hoffman Model A-HCI; or equal.

2.07 CONTROL PANEL - INTERNAL CONSTRUCTION

A. Internal Electrical Wiring

1. All interconnecting wiring shall be stranded, type MTW, and shall have 600 volt insulation and be rated for not less than 90 degrees Celsius. Wiring for systems operating at voltages in excess of 120 VAC shall be segregated from other panel wiring either in a separate section of a multi-section panel or behind a removable Plexiglas or similar dielectric barrier. Panel layout shall be developed such that technicians shall have complete access to 120 VAC and lower voltage wiring systems without direct exposure to higher voltages.

2. Power distribution wiring on the line side of protective devices (fuses or breakers) shall be 12 AWG minimum. Control wiring on the secondary side of protective devices shall be 16 AWG minimum. Electronic analog circuits shall utilize 18 AWG shielded, twisted pair, cable insulated for not less than 600 volts.

3. Power and low voltage DC wiring systems shall be routed in separate wireways. Crossing of different system wires shall be at right angles. Different system wires routed parallel to each other shall be separated by at least 6-inches. Different wiring systems shall terminate on separate terminal blocks. Wiring troughs shall not be filled to more than 60 percent visible fill.

4. Terminations

a. All wiring shall terminate onto single tier terminal blocks, where each terminal is uniquely and sequentially numbered. Direct wiring between field equipment and panel components, or between panel components, is not acceptable.

b. Multi-level terminal blocks or strips are not acceptable.

c. Terminal blocks shall be arranged in vertical rows and separated into groups (power, AC control, DC signal). Each group of terminal blocks shall have a minimum of 25 percent spares.

d. Terminal blocks shall be the compression type, fused, unfused, or switched as shown on the Drawings or specified elsewhere in Division 13.

e. Discrete inputs and outputs (DI and DO) shall have two terminals per point with adjacent terminal assignments. All active and spare points shall be wired to terminal blocks.

f. Analog inputs/outputs (AI and AO) shall have three terminals per shielded pair connection with adjacent terminal assignments for each point. The third terminal is for shielded ground connection for cable pairs. Ground the shielded signal cable at the PLC cabinet. All active and spare points shall be wired to terminal blocks.

g. Wire and tube markers shall be the sleeve type with heat impressed letters and numbers.

h. Only one side of a terminal block row shall be used for internal wiring. The field wiring side of the terminal shall not be within 6-inches of the side panel or adjacent terminal or within 8-inches of the bottom of free standing panels, or within 3-inches of stanchion mounted panels, or 3-inches of adjacent wireway.

5. All wiring to hand switches, etc., which are live circuits independent of the panel's normal circuit breaker protection shall be clearly identified as such.

6. All wiring shall be clearly tagged and color coded. All tag numbers and color coding shall correspond to the submitted panel wiring diagrams and loop drawings. All power wiring, control wiring, grounding and DC wiring shall utilize different color insulation for each wiring system used. The color coding scheme shall be:

   a. Incoming 120 VAC Hot - Black

   b. 120 VAC Hot wiring downstream of panel circuit breaker – Red

   c. 120 VAC Hot wiring derived from a UPS system – Red with Black stripe

   d. 240, 208 or 480 VAC wiring – as specified in Division 16

   e. 120 VAC neutral - White

   f. Ground - Green

   g. DC power or control wiring – Blue

   h. DC analog signal wiring – Black (-), White (+)

   i. Foreign voltage - Yellow

7. Provide surge protectors on all incoming power supply lines at each panel per the requirements of Section 13410.

8. Each field instrument shown on the Drawings as deriving input power from the control panel(s) shall have a separate power distribution circuit with a circuit breaker or fuse and blown fuse indication. Provide 24 VDC power supplies as required to power field instruments and panel devices.

9. Wiring trough for supporting internal wiring shall be plastic type with snap on covers. The side walls shall be open top type to permit wire changing without disconnecting. Trough shall be supported to the subpanel by stainless steel screws. Trough shall not be bonded to the panel with glue or adhesives.

10. Each panel bay shall have a single tube, 20 Watt fluorescent light fixture, mounted internally to the ceiling of the panel. Light fixture shall be switched and shall be complete with the lamp.

11. Each panel shall have a specification grade duplex convenience receptacle with ground fault interrupter, mounted internally within a stamped steel device box with appropriate cover and protected by a dedicated fuse or circuit breaker. Convenience receptacle shall not be powered from a UPS.

12. Each panel shall be provided with an isolated copper grounding bus for all signal and shield ground connections. Shield grounding shall be in accordance with the instrumentation manufacturer's recommendations.

13. Each panel shall be provided with a separate copper power grounding bus (safety) in accordance with the requirements of the National Electrical Code.

14. Each panel shall have control, signal and communication line surge suppression in accordance with Section 13410.

15. All microprocessor-based electronic devices in the panel that are powered by 120VAC shall be powered by the UPS (refer to appropriate Section in Division 13).

16. Each panel shall be provided with a circuit breaker to interrupt incoming power. Provide a minimum of two spare 20-amp breakers.

17. Provide limit (position) switches on each door for remote monitoring of panel intrusion.

18. Fiber optic patch panel is specified in Section 16801. Additional electrical components including transformers, motor starters, switches, circuit breakers, etc. shall be in compliance with the requirements of Division 16.

B. Pneumatic Tubing

1. Refer to Section 13410.

2. Pneumatic tubing shall be a minimum of 1/4-inch O.D. 316 stainless steel with compression fittings. All tubing shall be rigidly supported and run in horizontal or vertical planes.

3. All pneumatic equipment shall be provided with separate shut-off valves. Flexible polyethylene tubing shall be used on all devices mounted on hinged doors, etc.

4. A screened vent shall be provided on all enclosures using pneumatic instruments.

5. All pneumatic tubing shall be routed in separate bundles or wireways, and shall be separated from ALL electrical wiring by a minimum of 3-inches.

C. Relays not provided under Division 16 and required for properly completing the control function specified in Division 13, Division 16, or shown on the Drawings shall be provided under this Section.

D. Print storage pockets shall be provided on the inside of each panel. The storage pockets shall be steel, welded on to the door, and finished to match the interior panel color. The storage pocket shall be sufficient to hold all of the prints required to service the equipment, and to accommodate 8.5 inch by 11 inch documents without folding.

2.08 COMPONENTS

A. For panels provided with 480 volt service, the main circuit breaker shall be a 150 Amp frame, thermal-magnetic molded case breaker with amp trip and number of poles as detailed on the Drawings or as required. Provide a flange mounted main power disconnect operating handle with mechanical interlock having a bypass that will allow the panel door to open only when the switch is in the OFF position. Panels provided with 120 volt service shall have a 100 Amp frame molded case circuit breaker main panel disconnect mounted within the panel.

B. A mechanical disconnect mechanism, with bypass, shall be installed on each motor circuit protector, capable of being locked in the "OFF" position to provide a means of disconnecting power to the motor.

C. Auxiliary contacts shall be provided for remote run indication and indication of each status and alarm condition. Additional controls shall be provided as specified herein and as required by the detailed mechanical equipment requirements, the Instrumentation Loop Diagrams (Division 13), the Control Wiring Diagrams (Division 16) and as shown on the Drawings.

D. All operating control devices and instruments shall be securely mounted on the exterior door. All controls shall be clearly labeled to indicate function and shall be in accordance with the electrical area classification indicated on the Electrical Contract Drawings.

E. The control panel shall be provided with a lightning and surge protection unit per 13410.

F. All interfaces between control panel and remote devices shall be isolated via an interposing relay. Interposing relays shall have contacts rated for 250 VAC and 10 Amps continuous. Relays shall be by Potter and Brumfield or approved equal.

G. Refer to Section 13420 for additional requirements for panel-mounted devices.

2.09 TERMINAL BLOCKS AND ACCESSORIES

A. Terminal blocks shall be rail mounted. Terminal blocks and terminal accessories shall be Phoenix Contact, Entrelec, or equal.

B. End covers and end clamps shall be installed to secure terminal blocks.

C. The following terminal block hardware shall be used unless otherwise specified:

1. Standard type: Universal Feed Through Terminal Block, Phoenix UK4 or Entrelec M4/6 or equal.

2. Fused type: Disconnecting Fused Terminal Block with blown fuse LED, Phoenix UK6, 3-HESILED, Entrelec, or equal.

3. LED type: Double Connection Terminal Block with Current Indicator, Phoenix UDK4-ILA, or Entrelec, or equal.

4. Switch type: Knife Disconnect Terminal Blocks, Phoenix MTK-TP, Entrelec, or equal.

5. Ground type: Grounding Terminal Block, Phoenix USLKG4, Entrelec M4/6P, or equal.

6. Rail, Phoenix NS35/15, Entrelec PR5, or equal.

7. End clamps, Phoenix E/UK, Entrelec, or equal.

8. Terminal markers shall be Phoenix Contact Zack marker system ZB using the decade labeling system, or equal.

9. Fixed Bridge Bar FBR 10-6, Entrelec, or equal.

10. Other miscellaneous terminal block accessories shall be in accordance with listed terminal blocks.

D. Terminal Block Usage

1. Each discrete input loop shall incorporate the following terminal block types:

   a. Fuse type with blown fuse LED.

   b. Standard type (quantity as required).

2. Each discrete output loop shall incorporate the following terminal block types:

   a. Fuse type with blown fuse LED.

   b. Standard type.

3. Each analog input and output loops shall incorporate the following terminal block types:

   a. Fuse type with blown fuse LED.

   b. Standard type.

   c. Ground type for shield wire.

4. Power and miscellaneous circuits shall use terminal blocks as appropriate for the service consistent with these guidelines.

5. Provide ground type terminals as required for digital signal equipment ground.

PART 3 EXECUTION

3.01 INSTALLATION

A. The panels shall be installed at locations as shown on the Drawings.

B. Refer to Section 13410.

3.02 TESTS

A. Refer to Section 13410.

END OF SECTION

SECTION 13482

PROCESS CONTROL DESCRIPTIONS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. This section includes the Process Control Descriptions for the control systems that shall be developed for the Los Osos Collection System. Unless specifically noted otherwise, all PCS (Plant Control System) programming shall be completed by the Programming Subcontractor as detailed in Section 13411.

B. Related Sections. See Related Sections for additional requirements applicable to this Section (typical).

1. Section 13410 – Process Instrumentation and Control – General Provisions.

2. Section 13411 – Plant Control System Programming.

3. Section 13421 – Process Control System – Hardware and Software.

4. Section 11310 – Submersible Grinder Pumps.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.01 CONTROL SYSTEM CONCEPTUAL DESIGN CRITERIA

A. General

1. The Process Control Descriptions included in this Section include the general control overview for the various mechanical, electrical and instrumentation systems. The complete Process Control Descriptions describe strategies for both field and PCS control requirements.

2. The Process and Instrumentation Drawings form an integral part of these Process Control Descriptions and shall be used in conjunction with this Section to develop the overall control system.

3. The Electrical Control Schematics (included in the Electrical Drawings) form an integral part of these Process Control Descriptions and shall be used in conjunction with this Section to develop the overall control system.

4. The Process Control Descriptions, P&IDs, and Electrical Control Schematics provide the minimum functional requirements for each system. These documents do not include all software functions needed but that are obviously required for a complete and operational system. The ISS shall provide all hardware and field support (e.g., testing and training) that are required to implement each system. Limited software configuration by the ISS is also required to prove the functionality of the hardware provided.

5. The term PCS (Process Control System) is used in this Section to refer to the entire collection system, PC/PLC based control and monitoring system, and includes the PLC(s) and related hardware. Refer to Section 13421 for additional details.

6. The term OMI refers to the Operator Machine Interface of the PCS system. Refer to Section 13421 for additional details. The term HMI may also be used with the same meaning as OMI.

7. All PCS software development shall be in full conformance with Section 13411.

B. General Control Requirements

1. In general the control system shall allow control from only one location at a time (e.g. simultaneous control from two separate locations shall not be possible.) To implement this approach, a hierarchical design is utilized. Each controlled piece of process equipment shall have a Hand-Off-Auto (HOA) or Local-Off- Remote (LOR) switch located adjacent to the equipment in the field or at the controlling Motor Control Center (MCC). The HOA shall have the following functions:

   a. HAND – Local start. Automatic or remote control from any other location is not available except for safety shutdowns

   b. OFF – Equipment stopped. Control shall be unavailable from any location.

   c. AUTO – Automatic or manual control from PCS (or in some cases another field location.)

2. In general, any PCS stop command for a safety shutdown shall shut down the equipment irrespective of the position of the HOA (i.e., HAND or AUTO).

3. In general, all equipment shutdown conditions (e.g. motor overload, high motor temperature, etc.) shall prevent equipment from restarting until reset by the operator. The physical location of the reset (e.g. at the MCC, at PCS, etc.) shall be as defined in the Drawings or Process Control Descriptions.

4. All field mounted HOA and LOR switches shall have an input to PCS to monitor the status of the AUTO or REMOTE position of the switch.

5. All process control shall be implemented in the PCS PLCs. Process control functions shall not be implemented in the OMI software, server computers or workstations.

6. All strategies utilizing time or process variables (i.e. level, pressure, flow, temperature, etc) to control the operation of the system shall allow the operators to adjust the setpoints from the PCS system OMI. Adjustment of setpoints shall be password protected.

C. General Alarm and Monitoring Criteria

1. As a minimum, all field analog process variables that are connected to PCS shall include the following:

   a. Values shall be indicated in real time.

   b. Values shall be added to the historical archive data base.

   c. Historical values shall be available for trending.

2. As a minimum, all analog variables connected to the PCS system shall have high and low alarms. Alarm setpoints shall be developed in the PCS system software. All setpoints shall be easily changed by the operator/manager with the assigned security level privileges.

3. All alarms shall be capable of being acknowledged at any OMI or LOP in the system.

4. Equipment "Fail to Operate" alarms shall be generated within the PCS for all PCS controlled equipment. The Fail to Operate alarm shall be derived by comparing the equipment status field feedback signal (i.e. motor run, valve position, etc) with the PCS control command status signal. Parameters that are not in agreement after a time delay (adjustable from approximately 0 – 240 seconds) shall produce the Fail to Operate alarm.

D. The P&IDs do not indicate all of the required control, monitoring and alarming functions that shall be developed and configured within the PCS. The minimum requirements for the PCS based control, monitoring and alarming functions are indicated in the Process Control Descriptions. However, all software functions shall be provided as required to implement the control strategies.

General Process Control Descriptions
Reference Drawings for additional details

TYPICAL POCKET PUMP STATION

General:
Each Pocket Pump Station is a vender provided packaged system complete with duplex submersible grinder pumps, water level switches, and a Local Control Panel (LCP). The LCP houses power distribution equipment, pump controllers, and a PLC-based RTU system. The LCP enclosure and included hardwired controls are provided by the pump supplier under Specification 11310. The RTU and its programming are provided under Section 13411 and 13421.

PUMP CONTROL:
The constant speed pumps operate on duty-standby configuration, with the start and stop of the pumps controlled by water level within the wet well. Water level is monitored by float switches in the wet well. Individual controls are provided for each pump. Each pump has an LCP mounted hand-off-auto (HOA) switch. The pump will start when the HOA switch is in "hand". When the HOA is in "off" no control is available.

When the HOA is in "auto", RTU logic starts the duty pump when wet well medium level (LSM) is reached. On wet well high level (LSH), the standby pump is started. On wet well low level (LSL), both pumps stop and auto alternation logic will rotate between duty and standby pump to exercise both pumps equally.

The pump is shutdown in any mode on high motor temperature or motor overload.

Moisture (leak) in the motor and wet well high-high level (LSHH) as sensed by the redundant high level float switch will actuate panel alarm lights but will not affect pump operation.

Indication is provided at the LCP for "Run", moisture leak, and high motor temperature for each pump, and for wet well high-high level. Indications at the PCS will include pump running and run time totalization, pump fail, pump HOA in Auto, and wet well high-high level (LAHH).

INTRUSION:
The wet well and the LCP are monitored by the PCS for intrusion. No local alarm is provided. Separate indications will be provided at the PCS for LCP intrusion and wet well intrusion.

TYPICAL DUPLEX SUBMERSIBLE PUMP STATION

General:
Each duplex Pump Station includes duplex submersible pumps, water level transmitter, and redundant high-high level float switch. The motor controllers are housed in a motor control center (MCC). In some cases the MCC and the RTU Panel are located outdoors near the pumps and in others they are located within a nearby Standby Power Building.

PUMP CONTROL:
The constant speed pumps operate on duty-standby configuration, with the start and stop of the pumps controlled by water level within the wet well. Water level for pump control is monitored by a level transmitter in the wet well. Individual controls are provided for each pump. Each pump has an MCC mounted hand-off-auto (HOA) switch. The pump will start when the HOA switch is in "hand". When the HOA is in "off" no control is available.

When the HOA is in "auto", RTU logic starts the duty pump when wet well medium level (LSM) is reached; on wet well high level (LSH), the standby pump is started; on wet well low level (LSL), both pumps stop and auto alternation logic will rotate between duty and standby pump to exercise both pumps equally. When the standby generator runs, only one pump operates at any one time.

The pump is shutdown in any mode on power under voltage, high motor temperature, or motor overload.

Moisture (leak) in the motor and wet well high-high level (LSHH) as sensed by the redundant high level float switch will actuate MCC or RTU panel alarm lights but will not affect pump operation.

Indication is provided at the MCC for "Run", moisture leak, and high motor temperature for each pump. Wet well high-high level is indicated at the RTU panel. Indications at the PCS will include pump running and run time totalization, pump fail, pump HOA in Auto, and wet well high-high level (LAHH).
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INTRUSION:
The wet well, valve vault, and (if applicable) the outdoor MCC and RTU panel are monitored by the PCS for intrusion. No local alarm is provided. Separate indications will be provided at the PCS for wet well and valve vault intrusion (YA). Where applicable, outdoor RTU panel and multi-door MCC intrusion alarms are combined to a single alarm (YA).

TYPICAL TRIPLEX SUBMERSIBLE PUMP STATION

General:
Each triplex Pump Station includes three submersible pumps, water level transmitter, and redundant high-high level float switch. The motor controllers are housed in a motor control center (MCC). In some cases the MCC and the RTU Panel are located outdoors near the pumps and in others they are located within a nearby Standby Power Building.

PUMP CONTROL:
The pumps are constant speed, with reduced voltage solid state (RVSS) motor controllers to limit the inrush voltage. The pumps operate on Lead-Lag-standby configuration, with the start and stop of the pumps controlled by water level within the wet well. Water level for pump control is monitored by a level transmitter in the wet well. Individual controls are provided for each pump. Each pump has an MCC

mounted hand-off-auto (HOA) switch. The pump will start when the HOA switch is in “hand”. When the HOA is in “off” no control is available.

When the HOA is in “auto”, RTU logic starts the lead pump when wet well medium level (LSM) is reached; if the level continues to increase , lag and then the standby pumps are started. As level decreases, first the lag/standby pumps are shut off and then the lead pump stops and auto alternation logic will rotate between lead, lag, and standby pump to exercise all pumps equally. When the standby generator runs, only two pumps operate at any one time.

The pump is shutdown in any mode on power under voltage, high motor temperature, or motor overload.

Moisture (leak) in the motor and wet well high-high level (LSHH) as sensed by the redundant high level float switch will actuate MCC or RTU panel alarm lights but will not affect pump operation.

Indication is provided at the MCC for “Run”, moisture leak, and high motor temperature for each pump. Wet well high-high level is indicated at the RTU panel. Indications at the PCS will include pump running and run time totalization, pump fail, pump HOA in Auto, and wet well high-high level (LAHH).

Controls specific to the operation of the RVSS, such as ramp time, are provided under Division 16 and are not described here.

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INTRUSION:

The wet well, valve vault, and (if applicable) the outdoor MCC and RTU panel are monitored by the PCS for intrusion. No local alarm is provided. Separate indications will be provided at the PCS for wet well, valve vault, intrusion (YA). Where applicable, outdoor RTU panel and multi-door MCC intrusion alarms are combined to a single alarm (YA).

TYPICAL STANDBY POWER FACILITIES

General:

Standby power for the duplex and triplex submersible pump stations will be supplied by a permanently installed diesel or natural gas powered engine generator installed in a standby power building. The building also houses related electrical equipment.

STANDBY POWER SYSTEM:

Standby power will provide approximately 24 hours of operation. The standby power system consists of an engine generator system and an automatic power transfer (ATS) system. The engine generator is vendor supplied (EGSS).

The automatic transfer switch system (ATS) will normally be in AUTO. In the event of a loss of utility power, the ATS will automatically start the engine generator. When utility power is restored, the ATS will retransfer to utility power while the generator operates unloaded for cool-down period. Local controls specific to the operation of the ATS, such as time delays before transfer, are provided under Division 16 and are not described here. Refer to Specification Section 16492 for details

The engine generator is controlled automatically and manually at its local panel. Local controls specific to the operation of the generator are provided by the EGSS under Division 16 and are not described here. Refer to Specification Sections 16230 and 16231 for details.

Status monitoring signals [generator running and malfunction alarms, power failure (ATS in emergency power position)] are sent to the PCS.

FIRE:
A heat detector sends an alarm signal to the PCS on high temperature or high rate-of-rise in temperature. No local alarm is provided.

INTRUSION:
The door of each standby power building is monitored by the PCS for intrusion. No local alarm is provided.

TYPICAL EFFLUENT DISPOSAL SITE

General:
The solenoid actuated hydraulic valves disperse recycled water from the WWTP. Valves are located in vaults.

VALVES:
Valves are controlled remotely manually from the PCS. Local valve controls (HOA and open/close pushbuttons) are provided for testing and startup.

Open and closed position of each valve is monitored by the PCS and used for indication and valve operation.

Typically the HOA will be in "auto" allowing open-close control from a remote location. When the HOA is in "hand", valves are opened and closed by pushbuttons at the local panel. When the open-close signals are generated remotely, PCS logic will control the "open" operation by energizing the "open" solenoid until the valve's open position is reached, as sensed by the valve's limit switch. Remote "Close" operation will energize the "close" solenoid until the closed position is reached. When valves are operated locally, the open or close pushbutton is depressed until the valve travels to the desired position. When the HOA is in "off" no valve control is available.

Indication is provided at the PCS for valve open and closed, and HOA in "auto". Local indication of valve open and closed is provided.

Individual manual control of each valve will be provided at the future WWTP OMI (configuration by others). Typical operation of the Broderson site will be 4 valves open, four valves closed, alternating from month to month. Typical operation of the Bayridge Estates site will be to keep the single valve open at all times. The effluent disposal sites operate every day year round. When valves are de-energized, such as during a power failure, the valves will remain in their last position.

INTRUSION:
The hatch of each valve vault and the LCP or monitored by the PCS for intrusion. No local alarm is provided.

ACTIVE ODOR CONTROL SYSTEM

General:
The active odor control system at Mid-Town Pump Station is a skid mounted system that includes a fan and carbon vessel. The fan draws air out of the wet well and through the carbon vessel. The skid is mounted inside a vault.

FAN:
On-off fan controls are provided at the MCC (not by the system supplier). The fan runs continuously. "Run" indication is provided to the PCS.

VAULT:
The hatch of the vault is monitored by the PCS for intrusion.

Level float switch is used to provide indication to the PCS of water intrusion to vault.

No local alarm is provided.

END OF SECTION

SECTION 13485

INSTRUMENTATION LIST

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Listing of all numbered instrumentation devices.

2. Listing of PLC inputs/outputs.

3. Only numbered instruments are included in this list. Handheld or portable devices and mechanical gauges are not included.

B. Related Sections. See Related Sections for additional requirements applicable to this Section (typical).

1. Section 13410 – Process Instrumentation and Controls – General Provisions.

2. Section 13411 – Process Control System Programming.

3. Section 13420 – Process Instrumentation and Controls – Products.

4. Section 13421 – Programmable Logic Controllers and Computer Control System.

1.02 SUBMITTALS

A. Submittals shall be prepared and transmitted to the ENGINEER for approval in compliance with Sections 01300 and 13410.

1.03 OPERATION AND MAINTENANCE MANUALS

A. Operation and maintenance manuals shall be provided for all devices furnished under this section in compliance with Sections 01730 and 13410.

1.04 DESCRIPTION OF SYSTEM

A. The following notes apply to the tables included in this specification section:

1. Column labeled Tag Number: This column lists the partial instrument tag number as shown on the P&ID drawing. The full tag number is prefixed by the individual site abbreviation as noted on the P&ID.

2. Column labeled I/O PT. TYPE: This column lists the type of I/O that shall be provided (either DI, DO, AI, or AO).

3. Column labeled SPEC REF: This column lists the specification section and paragraph for which the device shall comply:

   a. Paragraph numbers only are references to Section 13420.

   b. References to Section 13421 are devices or functions that shall be implemented in the RTU/PLC system. Functions with this notation shall be jointly supplied by Section 13421 (hardware and software) and 13411 (programming)

   c. References to SCADA are indications or functions at the PC/OMI network (work done under separate WWTP contract).

   d. References to all other sections indicate the general specification location of the device(s).

4. Column labeled FURN BY: This column lists the supplier of the device. The following abbreviations are used in this column.

   a. GEN: General Contractor for the project.

   b. ISS: Instrumentation System Supplier for the project. May also include work by the Programmer (Section 13411).

   c. ELEC: Electrical Contractor for the project.

   d. SCADA: Wastewater Treatment Plant Contractor (not part of this Contract work).

   e. EXIST: Existing or furnished under another contract.

5. Column labeled P&ID DWG: This column lists the particular P&ID drawing on which the devices are located.

6. Column labeled RANGE OR SETPT: This column lists the range or setpoint that should be utilized in selection and field adjustment of the particular device. Level setpoints for the wet wells are indicated on the mechanical drawings.

7. Column labeled TOTAL # OF IDENTICAL LOOPS: For systems that included multiple identical devices, the Instrumentation Equipment List tabulates only the first loop in which the devices are utilized. This column indicates the total number of devices that shall be furnished.

B. The Table is provided as a convenience to the ISS. The ISS shall provide the total number of points as required by the rest of the Drawings and Specifications. In particular, the Table does not include the spare I/O points that are required by Specification Section 13421.

1.05 CONFIRMATION OF SETPOINTS

A. Instrument setpoints shall be confirmed with requirements of other associated equipment by the ISS. This confirmation shall be completed prior to the initial adjustment and startup of equipment. All setpoints shall be provided to the ENGINEER for review.

PART 2 PRODUCTS

2.01 INSTRUMENTATION LIST

A. Refer to the following Table 13485-1 for the project Instrumentation List.

PART 3 EXECUTION

3.01 FACTORY TESTING

A. Factory testing shall be in accordance with Section 13410.

3.02 FIELD TESTING

A. The entire instrumentation and control system shall be field tested as specified in Section 13410.

3.03 TRAINING

A. Training for the specific components furnished shall be as specified in the specific technical specification section.

Table 13485-1

TAG NUMBER			DESCRIPTION	I/O PT. TYPE	SPEC REF	FURNISHED BY	P&ID DWG	SIZE, RANGE OR SETPOINT	TOTAL # OF IDENTICAL LOOPS
			Duplex Submersible Pump Station						
MAH	1	A	Moisture Alarm High	---	DIV 16	ELEC	PS-I-101		3
MSH	1		Moisture Switch High	---	11306	GEN	PS-I-101	BY MFGR	3
TAH	1	A	Temperature Alarm High	---	DIV 16	ELEC	PS-I-101		3
TSH	1		Temperature Switch High	---	11306	GEN	PS-I-101	BY MFGR	3
HS	1	A	Hand Switch	---	DIV 16	ELEC	PS-I-101		3
HS	1	B	Pump Start	DO	13421	ISS	PS-I-101		3
YA	1	B	Fail Indication	DI	13421	ISS	PS-I-101		3
YA	1	C	Fail Indication	---	SCADA	SCADA	PS-I-101		3
YL	1		Status Light	---	DIV 16	ELEC	PS-I-101		3
YI	1	A	Run Indication	DI	13421	ISS	PS-I-101		3
YI	1	B	Run Indication	---	SCADA	SCADA	PS-I-101		3
YI	1	C	Auto Indication	DI	13421	ISS	PS-I-101		3
YI	1	D	Auto Indication	---	SCADA	SCADA	PS-I-101		3
YQI	1		Run Totalizer Indication	---	SCADA	SCADA	PS-I-101		3
MAH	2	A	Moisture Alarm High	---	DIV 16	ELEC	PS-I-101		3
MSH	2		Moisture Switch High	---	11306	GEN	PS-I-101	BY MFGR	3
TAH	2	A	Temperature Alarm High	---	DIV 16	ELEC	PS-I-101		3
TSH	2		Temperature Switch High	---	11306	GEN	PS-I-101	BY MFGR	3
HS	2	A	Hand Switch	---	DIV 16	ELEC	PS-I-101		3
HS	2	B	Pump Start	DO	13421	ISS	PS-I-101		3
YA	2	B	Fail Indication	DI	13421	ISS	PS-I-101		3
YA	2	C	Fail Indication	---	SCADA	SCADA	PS-I-101		3
YL	2		Status Light	---	DIV 16	ELEC	PS-I-101		3
YI	2	A	Run Indication	DI	13421	ISS	PS-I-101		3
YI	2	B	Run Indication	---	SCADA	SCADA	PS-I-101		3
YI	2	C	Auto Indication	DI	13421	ISS	PS-I-101		3
YI	2	D	Auto Indication	---	SCADA	SCADA	PS-I-101		3
YQI	2		Run Totalizer Indication	---	SCADA	SCADA	PS-I-101		3
LE	4		Level Element	---	2.02A	ISS	PS-I-101		3
LIC	4		Level Indicator Control	AI	13421	ISS	PS-I-101		3
LI	4		Level Indication	---	SCADA	SCADA	PS-I-101		3
LSHH	5	A	Level Switch High High	---	2.02B	ISS	PS-I-101		3
LSHH	5	B	Level Alarm High High	DO	13421	ISS	PS-I-101		3

Table 13485-1

TAG NUMBER			DESCRIPTION	I/O PT. TYPE	SPEC REF	FURNISHED BY	P&ID DWG	SIZE, RANGE OR SETPOINT	TOTAL # OF IDENTICAL LOOPS
LAHH	5	A	Level Alarm High High	DI	13421	ISS	PS-I-101		3
LAHH	5	B	Level Alarm High High	---	2.05A	ISS	PS-I-101		3
LAHH	5	C	Level Alarm High High	---	SCADA	SCADA	PS-I-101		3
YS	6		Intrusion Switch	---	2.06A	ISS	PS-I-101		3
YA	6	A	Intrusion Alarm	DI	13421	ISS	PS-I-101		3
YA	6	B	Intrusion Alarm	---	SCADA	SCADA	PS-I-101		3
YS	7		Intrusion Switch	---	2.06A	ISS	PS-I-101		3
YA	7	A	Intrusion Alarm	DI	13421	ISS	PS-I-101		3
YA	7	B	Intrusion Alarm	---	SCADA	SCADA	PS-I-101		3
YS	8	A	Intrusion Switch	---	DIV 16	ELEC	PS-I-101		1
YS	8	B	Intrusion Switch	---	2.06A	ISS	PS-I-101		1
YA	8	A	Intrusion Alarm	DI	13421	ISS	PS-I-101		1
YA	8	B	Intrusion Alarm	---	SCADA	SCADA	PS-I-101		1
			Triplex Submersible Pump Station						
MAH	1	A	Moisture Alarm High	---	DIV 16	ELEC	PS-I-101		1
MSH	1		Moisture Switch High	---	11306	GEN	PS-I-101	BY MFGR	1
TAH	1	A	Temperature Alarm High	---	DIV 16	ELEC	PS-I-101		1
TSH	1		Temperature Switch High	---	11306	GEN	PS-I-101	BY MFGR	1
HS	1	A	Hand Switch	---	DIV 16	ELEC	PS-I-101		1
HS	1	B	Pump Start	DO	13421	ISS	PS-I-101		1
YA	1	B	Fail Indication	DI	13421	ISS	PS-I-101		1
YA	1	C	Fail Indication	---	SCADA	SCADA	PS-I-101		1
YL	1		Status Light	---	DIV 16	ELEC	PS-I-101		1
YI	1	A	Run Indication	DI	13421	ISS	PS-I-101		1
YI	1	B	Run Indication	---	SCADA	SCADA	PS-I-101		1
YI	1	C	Auto Indication	DI	13421	ISS	PS-I-101		1
YI	1	D	Auto Indication	---	SCADA	SCADA	PS-I-101		1
YQI	1		Run Totalizer Indication	---	SCADA	SCADA	PS-I-101		1
MAH	2	A	Moisture Alarm High	---	DIV 16	ELEC	PS-I-101		1
MSH	2		Moisture Switch High	---	11306	GEN	PS-I-101	BY MFGR	1
TAH	2	A	Temperature Alarm High	---	DIV 16	ELEC	PS-I-101		1
TSH	2		Temperature Switch High	---	11306	GEN	PS-I-101	BY MFGR	1
HS	2	A	Hand Switch	---	DIV 16	ELEC	PS-I-101		1

Table 13485-1

TAG NUMBER			DESCRIPTION	I/O PT. TYPE	SPEC REF	FURNISHED BY	P&ID DWG	SIZE, RANGE OR SETPOINT	TOTAL # OF IDENTICAL LOOPS
HS	2	B	Pump Start	DO	13421	ISS	PS-I-101		1
YA	2	B	Fail Indication	DI	13421	ISS	PS-I-101		1
YA	2	C	Fail Indication	---	SCADA	SCADA	PS-I-101		1
YL	2		Status Light	---	DIV 16	ELEC	PS-I-101		1
YI	2	A	Run Indication	DI	13421	ISS	PS-I-101		1
YI	2	B	Run Indication	---	SCADA	SCADA	PS-I-101		1
YI	2	C	Auto Indication	DI	13421	ISS	PS-I-101		1
YI	2	D	Auto Indication	---	SCADA	SCADA	PS-I-101		1
YQI	2		Run Totalizer Indication	---	SCADA	SCADA	PS-I-101		1
MAH	3	A	Moisture Alarm High	---	DIV 16	ELEC	PS-I-101		1
MSH	3		Moisture Switch High	---	11306	GEN	PS-I-101	BY MFGR	1
TAH	3	A	Temperature Alarm High	---	DIV 16	ELEC	PS-I-101		1
TSH	3		Temperature Switch High	---	11306	GEN	PS-I-101	BY MFGR	1
HS	3	A	Hand Switch	---	DIV 16	ELEC	PS-I-101		1
HS	3	B	Pump Start	DO	13421	ISS	PS-I-101		1
YA	3	B	Fail Indication	DI	13421	ISS	PS-I-101		1
YA	3	C	Fail Indication	---	SCADA	SCADA	PS-I-101		1
YL	3		Status Light	---	DIV 16	ELEC	PS-I-101		1
YI	3	A	Run Indication	DI	13421	ISS	PS-I-101		1
YI	3	B	Run Indication	---	SCADA	SCADA	PS-I-101		1
YI	3	C	Auto Indication	DI	13421	ISS	PS-I-101		1
YI	3	D	Auto Indication	---	SCADA	SCADA	PS-I-101		1
YQI	3		Run Totalizer Indication	---	SCADA	SCADA	PS-I-101		1
LE	4		Level Element	---	2.02A	ISS	PS-I-101		1
LIC	4		Level Indicator Control	AI	13421	ISS	PS-I-101		1
LI	4		Level Indication	---	SCADA	SCADA	PS-I-101		1
LSHH	5	A	Level Switch High High	---	2.02B	ISS	PS-I-101		1
LSHH	5	B	Level Switch High High	DO	13421	ISS	PS-I-101		1
LAHH	5	A	Level Alarm High High	DI	13421	ISS	PS-I-101		1
LAHH	5	B	Status Light	---	2.05A	ISS	PS-I-101		1
LAHH	5	C	Level Alarm High High	---	SCADA	SCADA	PS-I-101		1
YS	6		Intrusion Switch	---	2.06A	ISS	PS-I-101		1
YA	6	A	Intrusion Alarm	DI	13421	ISS	PS-I-101		1
YA	6	B	Intrusion Alarm	---	SCADA	SCADA	PS-I-101		1

Table 13485-1

TAG NUMBER			DESCRIPTION	I/O PT. TYPE	SPEC REF	FURNISHED BY	P&ID DWG	SIZE, RANGE OR SETPOINT	TOTAL # OF IDENTICAL LOOPS
YS	7		Intrusion Switch	---	2.06A	ISS	PS-I-101		1
YA	7	A	Intrusion Alarm	DI	13421	ISS	PS-I-101		1
YA	7	B	Intrusion Alarm	---	SCADA	SCADA	PS-I-101		1
YS	8	A	Intrusion Switch	---	DIV 16	ELEC	PS-I-101		1
YS	8	B	Intrusion Switch	---	2.06A	ISS	PS-I-101		1
YA	8	A	Intrusion Alarm	DI	13421	ISS	PS-I-101		1
YA	8	B	Intrusion Alarm	---	SCADA	SCADA	PS-I-101		1
			Duplex Pump Pocket Pump Station						
MAH	1	A	Moisture Alarm High	---	11310	GEN	PS-I-102		8
MSH	1		Moisture Switch High	---	11310	GEN	PS-I-102	BY MFGR	8
TAH	1	A	Temperature Alarm High	---	11310	GEN	PS-I-102		8
TSH	1		Temperature Switch High	---	11310	GEN	PS-I-102	BY MFGR	8
HS	1	A	Hand Switch	---	11310	GEN	PS-I-102		8
HS	1	B	Pump Start	DO	13421	ISS	PS-I-102		8
YA	1	B	Fail Indication	DI	13421	ISS	PS-I-102		8
YA	1	C	Fail Indication	---	SCADA	SCADA	PS-I-102		8
YL	1		Status Light	---	11310	GEN	PS-I-102		8
YI	1	A	Run Indication	DI	13421	ISS	PS-I-102		8
YI	1	B	Run Indication	---	SCADA	SCADA	PS-I-102		8
YI	1	C	Auto Indication	DI	13421	ISS	PS-I-102		8
YI	1	D	Auto Indication	---	SCADA	SCADA	PS-I-102		8
YQI	1		Run Totalizer Indication	---	SCADA	SCADA	PS-I-102		8
MAH	2	A	Moisture Alarm High	---	11310	GEN	PS-I-102		8
MSH	2		Moisture Switch High	---	11310	GEN	PS-I-102	BY MFGR	8
TAH	2	A	Temperature Alarm High	---	11310	GEN	PS-I-102		8
TSH	2		Temperature Switch High	---	11310	GEN	PS-I-102	BY MFGR	8
HS	2	A	Hand Switch	---	11310	GEN	PS-I-102		8
HS	2	B	Pump Start	DO	13421	ISS	PS-I-102		8
YA	2	B	Fail Indication	DI	13421	ISS	PS-I-102		8
YA	2	C	Fail Indication	---	SCADA	SCADA	PS-I-102		8
YL	2		Status Light	---	11310	GEN	PS-I-102		8
YI	2	A	Run Indication	DI	13421	ISS	PS-I-102		8
YI	2	B	Run Indication	---	SCADA	SCADA	PS-I-102		8

Table 13485-1

TAG NUMBER			DESCRIPTION	I/O PT. TYPE	SPEC REF	FURNISHED BY	P&ID DWG	SIZE, RANGE OR SETPOINT	TOTAL # OF IDENTICAL LOOPS
YI	2	C	Auto Indication	DI	13421	ISS	PS-I-102		8
YI	2	D	Auto Indication	---	SCADA	SCADA	PS-I-102		8
YQI	2		Run Totalizer Indication	---	SCADA	SCADA	PS-I-102		8
LSH	4		Level Switch High	---	11310	GEN	PS-I-102		8
LSM	4		Level Switch Medium	---	11310	GEN	PS-I-102		8
LSL	4		Level Switch Low	---	11310	GEN	PS-I-102		8
LIC	4		Level Indicator Control	---	13421	ISS	PS-I-102		8
LIH	4		Level Indicator High	DI	13421	ISS	PS-I-102		8
LIM	4		Level Indicator Medium	DI	13421	ISS	PS-I-102		8
LIL	4		Level Indicator Low	DI	13421	ISS	PS-I-102		8
LAHH	5	A	Level Alarm High High	DI	13421	ISS	PS-I-102		8
LAHH	5	B	Status Light	---	11310	GEN	PS-I-102		8
LAHH	5	C	Level Alarm High High	---	SCADA	SCADA	PS-I-102		8
LSHH	5	A	Level Switch High High		11310	GEN	PS-I-102		8
LSHH	5	B	Level Switch High High	DO	13421	ISS	PS-I-102		8
YS	6		Intrusion Switch	---	2.06A	ISS	PS-I-102		8
YA	6	A	Intrusion Alarm	DI	13421	ISS	PS-I-102		8
YA	6	B	Intrusion Alarm	---	SCADA	SCADA	PS-I-102		8
YS	8		Intrusion Switch	---	11310	GEN	PS-I-102		8
YA	8	A	Intrusion Alarm	DI	13421	ISS	PS-I-102		8
YA	8	B	Intrusion Alarm	---	SCADA	SCADA	PS-I-102		8
			Standby Power Facility						
YS	8		Intrusion Switch	---	2.06A	ISS	PS-I-102		3
YA	8	A	Intrusion Alarm	DI	13421	ISS	PS-I-102		3
YA	8	B	Intrusion Alarm	---	SCADA	SCADA	PS-I-102		3
YA	9	A	Fail Indication	DI	13421	ISS	PS-I-102		3
YA	9	B	Fail Indication	---	SCADA	SCADA	PS-I-102		3
YI	9	A	Run Indication	DI	13421	ISS	PS-I-102		3
YI	9	B	Run Indication	---	SCADA	SCADA	PS-I-102		3
JS	21		Voltage Switch (Power Fail)	---	DIV 16	ELEC	PS-I-102		3
JA	21	A	Power Fail Alarm	DI	13421	ISS	PS-I-102		3
JA	21	B	Power Fail Alarm	---	SCADA	SCADA	PS-I-102		3
YS	22		Heat Detector	---	DIV 16	ELEC	PS-I-102		3

Table 13485-1

TAG NUMBER			DESCRIPTION	I/O PT. TYPE	SPEC REF	FURNISHED BY	P&ID DWG	SIZE, RANGE OR SETPOINT	TOTAL # OF IDENTICAL LOOPS
YA	22	A	Fire Alarm	DI	13421	ISS	PS-I-102		3
YA	22	B	Fire Alarm	---	SCADA	SCADA	PS-I-102		3
			Duplex Submersible Pump Station						
MAH	1	A	Moisture Alarm High	---	DIV 16	ELEC	PS-I-201		2
MSH	1		Moisture Switch High	---	11306	GEN	PS-I-201	BY MFGR	2
TAH	1	A	Temperature Alarm High	---	DIV 16	ELEC	PS-I-201		2
TSH	1		Temperature Switch High	---	11306	GEN	PS-I-201	BY MFGR	2
HS	1	A	Hand Switch	---	DIV 16	ELEC	PS-I-201		2
HS	1	B	Pump Start	DO	13421	ISS	PS-I-201		2
YA	1	B	Fail Indication	DI	13421	ISS	PS-I-201		2
YA	1	C	Fail Indication	---	SCADA	SCADA	PS-I-201		2
YL	1		Status Light	---	DIV 16	ELEC	PS-I-201		2
YI	1	A	Run Indication	DI	13421	ISS	PS-I-201		2
YI	1	B	Run Indication	---	SCADA	SCADA	PS-I-201		2
YI	1	C	Auto Indication	DI	13421	ISS	PS-I-201		2
YI	1	D	Auto Indication	---	SCADA	SCADA	PS-I-201		2
YQI	1		Run Totalizer Indication	---	SCADA	SCADA	PS-I-201		2
MAH	2	A	Moisture Alarm High	---	DIV 16	ELEC	PS-I-201		2
MSH	2		Moisture Switch High	---	11306	GEN	PS-I-201	BY MFGR	2
TAH	2	A	Temperature Alarm High	---	DIV 16	ELEC	PS-I-201		2
TSH	2		Temperature Switch High	---	11306	GEN	PS-I-201	BY MFGR	2
HS	2	A	Hand Switch	---	DIV 16	ELEC	PS-I-201		2
HS	2	B	Pump Start	DO	13421	ISS	PS-I-201		2
YA	2	B	Fail Indication	DI	13421	ISS	PS-I-201		2
YA	2	C	Fail Indication	---	SCADA	SCADA	PS-I-201		2
YL	2		Status Light	---	DIV 16	ELEC	PS-I-201		2
YI	2	A	Run Indication	DI	13421	ISS	PS-I-201		2
YI	2	B	Run Indication	---	SCADA	SCADA	PS-I-201		2
YI	2	C	Auto Indication	DI	13421	ISS	PS-I-201		2
YI	2	D	Auto Indication	---	SCADA	SCADA	PS-I-201		2
YQI	2		Run Totalizer Indication	---	SCADA	SCADA	PS-I-201		2
LE	4		Level Element	---	2.02A	ISS	PS-I-201		2
LIC	4		Level Indicator Control	AI	13421	ISS	PS-I-201		2

Table 13485-1

TAG NUMBER			DESCRIPTION	I/O PT. TYPE	SPEC REF	FURNISHED BY	P&ID DWG	SIZE, RANGE OR SETPOINT	TOTAL # OF IDENTICAL LOOPS
LI	4		Level Indication	---	SCADA	SCADA	PS-I-201		2
LSHH	5	A	Level Switch High High	---	2.02B	ISS	PS-I-201		2
LSHH	5	B	Level Alarm High High	DO	13421	ISS	PS-I-201		2
LAHH	5	A	Level Alarm High High	DI	13421	ISS	PS-I-201		2
LAHH	5	B	Level Alarm High High	---	2.05A	ISS	PS-I-201		2
LAHH	5	C	Level Alarm High High	---	SCADA	SCADA	PS-I-201		2
YS	6		Intrusion Switch	---	2.06A	ISS	PS-I-201		2
YA	6	A	Intrusion Alarm	DI	13421	ISS	PS-I-201		2
YA	6	B	Intrusion Alarm	---	SCADA	SCADA	PS-I-201		2
YS	7		Intrusion Switch	---	2.06A	ISS	PS-I-201		2
YA	7	A	Intrusion Alarm	DI	13421	ISS	PS-I-201		2
YA	7	B	Intrusion Alarm	---	SCADA	SCADA	PS-I-201		2
			Triplex Submersible Pump Station						
MAH	1	A	Moisture Alarm High	---	DIV 16	ELEC	PS-I-201		1
MSH	1		Moisture Switch High	---	11306	GEN	PS-I-201	BY MFGR	1
TAH	1	A	Temperature Alarm High	---	DIV 16	ELEC	PS-I-201		1
TSH	1		Temperature Switch High	---	11306	GEN	PS-I-201	BY MFGR	1
HS	1	A	Hand Switch	---	DIV 16	ELEC	PS-I-201		1
HS	1	B	Pump Start	DO	13421	ISS	PS-I-201		1
YA	1	B	Fail Indication	DI	13421	ISS	PS-I-201		1
YA	1	C	Fail Indication	---	SCADA	SCADA	PS-I-201		1
YL	1		Status Light	---	DIV 16	ELEC	PS-I-201		1
YI	1	A	Run Indication	DI	13421	ISS	PS-I-201		1
YI	1	B	Run Indication	---	SCADA	SCADA	PS-I-201		1
YI	1	C	Auto Indication	DI	13421	ISS	PS-I-201		1
YI	1	D	Auto Indication	---	SCADA	SCADA	PS-I-201		1
YQI	1		Run Totalizer Indication	---	SCADA	SCADA	PS-I-201		1
MAH	2	A	Moisture Alarm High	---	DIV 16	ELEC	PS-I-201		1
MSH	2		Moisture Switch High	---	11306	GEN	PS-I-201	BY MFGR	1
TAH	2	A	Temperature Alarm High	---	DIV 16	ELEC	PS-I-201		1
TSH	2		Temperature Switch High	---	11306	GEN	PS-I-201	BY MFGR	1
HS	2	A	Hand Switch	---	DIV 16	ELEC	PS-I-201		1
HS	2	B	Pump Start	DO	13421	ISS	PS-I-201		1

Table 13485-1

TAG NUMBER			DESCRIPTION	I/O PT. TYPE	SPEC REF	FURNISHED BY	P&ID DWG	SIZE, RANGE OR SETPOINT	TOTAL # OF IDENTICAL LOOPS
YA	2	B	Fail Indication	DI	13421	ISS	PS-I-201		1
YA	2	C	Fail Indication	---	SCADA	SCADA	PS-I-201		1
YL	2		Status Light	---	DIV 16	ELEC	PS-I-201		1
YI	2	A	Run Indication	DI	13421	ISS	PS-I-201		1
YI	2	B	Run Indication	---	SCADA	SCADA	PS-I-201		1
YI	2	C	Auto Indication	DI	13421	ISS	PS-I-201		1
YI	2	D	Auto Indication	---	SCADA	SCADA	PS-I-201		1
YQI	2		Run Totalizer Indication	---	SCADA	SCADA	PS-I-201		1
MAH	3	A	Moisture Alarm High	---	DIV 16	ELEC	PS-I-201		1
MSH	3		Moisture Switch High	---	11306	GEN	PS-I-201	BY MFGR	1
TAH	3	A	Temperature Alarm High	---	DIV 16	ELEC	PS-I-201		1
TSH	3		Temperature Switch High	---	11306	GEN	PS-I-201	BY MFGR	1
HS	3	A	Hand Switch	---	DIV 16	ELEC	PS-I-201		1
HS	3	B	Pump Start	DO	13421	ISS	PS-I-201		1
YA	3	B	Fail Indication	DI	13421	ISS	PS-I-201		1
YA	3	C	Fail Indication	---	SCADA	SCADA	PS-I-201		1
YL	3		Status Light	---	DIV 16	ELEC	PS-I-201		1
YI	3	A	Run Indication	DI	13421	ISS	PS-I-201		1
YI	3	B	Run Indication	---	SCADA	SCADA	PS-I-201		1
YI	3	C	Auto Indication	DI	13421	ISS	PS-I-201		1
YI	3	D	Auto Indication	---	SCADA	SCADA	PS-I-201		1
YQI	3		Run Totalizer Indication	---	SCADA	SCADA	PS-I-201		1
LE	4		Level Element	---	2.02A	ISS	PS-I-201		1
LIC	4		Level Indicator Control	AI	13421	ISS	PS-I-201		1
LI	4		Level Indication	---	SCADA	SCADA	PS-I-201		1
LSHH	5	A	Level Switch High High	---	2.02B	ISS	PS-I-201		1
LSHH	5	B	Level Switch High High	DO	13421	ISS	PS-I-201		1
LAHH	5	A	Level Alarm High High	DI	13421	ISS	PS-I-201		1
LAHH	5	B	Status Light	---	2.05A	ISS	PS-I-201		1
LAHH	5	C	Level Alarm High High	---	SCADA	SCADA	PS-I-201		1
YS	6		Intrusion Switch	---	2.06A	ISS	PS-I-201		1
YA	6	A	Intrusion Alarm	DI	13421	ISS	PS-I-201		1
YA	6	B	Intrusion Alarm	---	SCADA	SCADA	PS-I-201		1
YS	7		Intrusion Switch	---	2.06A	ISS	PS-I-201		1

Table 13485-1

TAG NUMBER			DESCRIPTION	I/O PT. TYPE	SPEC REF	FURNISHED BY	P&ID DWG	SIZE, RANGE OR SETPOINT	TOTAL # OF IDENTICAL LOOPS
YA	7	A	Intrusion Alarm	DI	13421	ISS	PS-I-201		1
YA	7	B	Intrusion Alarm	---	SCADA	SCADA	PS-I-201		1
			Odor Control System						
HS	12	A	Hand Switch	---	DIV 16	ELEC	PS-I-201		1
YL	12		Status Light	---	DIV 16	ELEC	PS-I-201		1
YI	12		Run Indication	DI	13421	ISS	PS-I-201		1
YI	12	B	Run Indication	---	SCADA	SCADA	PS-I-201		1
YQI	12		Run Totalizer Indication	---	SCADA	SCADA	PS-I-201		1
LSH	13		Level Switch High	---	2.02B	ISS	PS-I-201		1
LAH	13	A	Level Alarm High	DI	13421	ISS	PS-I-201		1
LAH	13	B	Level Alarm High High	---	SCADA	SCADA	PS-I-201		1
YS	14		Intrusion Switch	---	2.06A	ISS	PS-I-201		1
YA	14	A	Intrusion Alarm	DI	13421	ISS	PS-I-201		1
YA	14	B	Intrusion Alarm	---	SCADA	SCADA	PS-I-201		1
			Duplex Pump Pocket Pump Station						
MAH	1	A	Moisture Alarm High	---	11310	GEN	PS-I-202		1
MSH	1		Moisture Switch High	---	11310	GEN	PS-I-202	BY MFGR	1
TAH	1	A	Temperature Alarm High	---	11310	GEN	PS-I-202		1
TSH	1		Temperature Switch High	---	11310	GEN	PS-I-202	BY MFGR	1
HS	1	A	Hand Switch	---	11310	GEN	PS-I-202		1
HS	1	B	Pump Start	DO	13421	ISS	PS-I-202		1
YA	1	B	Fail Indication	DI	13421	ISS	PS-I-202		1
YA	1	C	Fail Indication	---	SCADA	SCADA	PS-I-202		1
YL	1		Status Light	---	11310	GEN	PS-I-202		1
YI	1	A	Run Indication	DI	13421	ISS	PS-I-202		1
YI	1	B	Run Indication	---	SCADA	SCADA	PS-I-202		1
YI	1	C	Auto Indication	DI	13421	ISS	PS-I-202		1
YI	1	D	Auto Indication	---	SCADA	SCADA	PS-I-202		1
YQI	1		Run Totalizer Indication	---	SCADA	SCADA	PS-I-202		1
MAH	2	A	Moisture Alarm High	---	11310	GEN	PS-I-202		1
MSH	2		Moisture Switch High	---	11310	GEN	PS-I-202	BY MFGR	1
TAH	2	A	Temperature Alarm High	---	11310	GEN	PS-I-202		1

Table 13485-1

TAG NUMBER			DESCRIPTION	I/O PT. TYPE	SPEC REF	FURNISHED BY	P&ID DWG	SIZE, RANGE OR SETPOINT	TOTAL # OF IDENTICAL LOOPS
TSH	2		Temperature Switch High	---	11310	GEN	PS-I-202	BY MFGR	1
HS	2	A	Hand Switch	---	11310	GEN	PS-I-202		1
HS	2	B	Pump Start	DO	13421	ISS	PS-I-202		1
YA	2	B	Fail Indication	DI	13421	ISS	PS-I-202		1
YA	2	C	Fail Indication	---	SCADA	SCADA	PS-I-202		1
YL	2		Status Light	---	11310	GEN	PS-I-202		1
YI	2	A	Run Indication	DI	13421	ISS	PS-I-202		1
YI	2	B	Run Indication	---	SCADA	SCADA	PS-I-202		1
YI	2	C	Auto Indication	DI	13421	ISS	PS-I-202		1
YI	2	D	Auto Indication	---	SCADA	SCADA	PS-I-202		1
YQI	2		Run Totalizer Indication	---	SCADA	SCADA	PS-I-202		1
LSH	4		Level Switch High	---	11310	GEN	PS-I-202		1
LSM	4		Level Switch Medium	---	11310	GEN	PS-I-202		1
LSL	4		Level Switch Low	---	11310	GEN	PS-I-202		1
LIC	4		Level Indicator Control	---	13421	ISS	PS-I-202		1
LIH	4		Level Indicator High	DI	13421	ISS	PS-I-202		1
LIM	4		Level Indicator Medium	DI	13421	ISS	PS-I-202		1
LIL	4		Level Indicator Low	DI	13421	ISS	PS-I-202		1
LAHH	5	A	Level Alarm High High	DI	13421	ISS	PS-I-202		1
LAHH	5	B	Status Light	---	11310	GEN	PS-I-202		1
LAHH	5	C	Level Alarm High High	---	SCADA	SCADA	PS-I-202		1
LSHH	5	A	Level Switch High High		11310	GEN	PS-I-202		1
LSHH	5	B	Level Switch High High	DO	13421	ISS	PS-I-202		1
YS	6		Intrusion Switch	---	2.06A	ISS	PS-I-202		1
YA	6	A	Intrusion Alarm	DI	13421	ISS	PS-I-202		1
YA	6	B	Intrusion Alarm	---	SCADA	SCADA	PS-I-202		1
YS	8		Intrusion Switch	---	11310	GEN	PS-I-202		1
YA	8	A	Intrusion Alarm	DI	13421	ISS	PS-I-202		1
YA	8	B	Intrusion Alarm	---	SCADA	SCADA	PS-I-202		1
			Standby Power Facility						
YS	8		Intrusion Switch	---	2.06A	ISS	PS-I-202		3
YA	8	A	Intrusion Alarm	DI	13421	ISS	PS-I-202		3
YA	8	B	Intrusion Alarm	---	SCADA	SCADA	PS-I-202		3

Table 13485-1

TAG NUMBER			DESCRIPTION	I/O PT. TYPE	SPEC REF	FURNISHED BY	P&ID DWG	SIZE, RANGE OR SETPOINT	TOTAL # OF IDENTICAL LOOPS
YA	9	A	Fail Indication	DI	13421	ISS	PS-I-202		3
YA	9	B	Fail Indication	---	SCADA	SCADA	PS-I-202		3
YI	9	A	Run Indication	DI	13421	ISS	PS-I-202		3
YI	9	B	Run Indication	---	SCADA	SCADA	PS-I-202		3
JS	21		Voltage Switch (Power Fail)	---	DIV 16	ELEC	PS-I-202		3
JA	21	A	Power Fail Alarm	DI	13421	ISS	PS-I-202		3
JA	21	B	Power Fail Alarm	---	SCADA	SCADA	PS-I-202		3
YS	22		Heat Detector	---	DIV 16	ELEC	PS-I-202		3
YA	22	A	Fire Alarm	DI	13421	ISS	PS-I-202		3
YA	22	B	Fire Alarm	---	SCADA	SCADA	PS-I-202		3
			Duplex Submersible Pump Station						
MAH	1	A	Moisture Alarm High	---	DIV 16	ELEC	PS-I-301		1
MSH	1		Moisture Switch High	---	11306	GEN	PS-I-301	BY MFGR	1
TAH	1	A	Temperature Alarm High	---	DIV 16	ELEC	PS-I-301		1
TSH	1		Temperature Switch High	---	11306	GEN	PS-I-301	BY MFGR	1
HS	1	A	Hand Switch	---	DIV 16	ELEC	PS-I-301		1
HS	1	B	Pump Start	DO	13421	ISS	PS-I-301		1
YA	1	B	Fail Indication	DI	13421	ISS	PS-I-301		1
YA	1	C	Fail Indication	---	SCADA	SCADA	PS-I-301		1
YL	1		Status Light	---	DIV 16	ELEC	PS-I-301		1
YI	1	A	Run Indication	DI	13421	ISS	PS-I-301		1
YI	1	B	Run Indication	---	SCADA	SCADA	PS-I-301		1
YI	1	C	Auto Indication	DI	13421	ISS	PS-I-301		1
YI	1	D	Auto Indication	---	SCADA	SCADA	PS-I-301		1
YQI	1		Run Totalizer Indication	---	SCADA	SCADA	PS-I-301		1
MAH	2	A	Moisture Alarm High	---	DIV 16	ELEC	PS-I-301		1
MSH	2		Moisture Switch High	---	11306	GEN	PS-I-301	BY MFGR	1
TAH	2	A	Temperature Alarm High	---	DIV 16	ELEC	PS-I-301		1
TSH	2		Temperature Switch High	---	11306	GEN	PS-I-301	BY MFGR	1
HS	2	A	Hand Switch	---	DIV 16	ELEC	PS-I-301		1
HS	2	B	Pump Start	DO	13421	ISS	PS-I-301		1
YA	2	B	Fail Indication	DI	13421	ISS	PS-I-301		1
YA	2	C	Fail Indication	---	SCADA	SCADA	PS-I-301		1

Table 13485-1

TAG NUMBER			DESCRIPTION	I/O PT. TYPE	SPEC REF	FURNISHED BY	P&ID DWG	SIZE, RANGE OR SETPOINT	TOTAL # OF IDENTICAL LOOPS
YL	2		Status Light	---	DIV 16	ELEC	PS-I-301		1
YI	2	A	Run Indication	DI	13421	ISS	PS-I-301		1
YI	2	B	Run Indication	---	SCADA	SCADA	PS-I-301		1
YI	2	C	Auto Indication	DI	13421	ISS	PS-I-301		1
YI	2	D	Auto Indication	---	SCADA	SCADA	PS-I-301		1
YQI	2		Run Totalizer Indication	---	SCADA	SCADA	PS-I-301		1
LE	4		Level Element	---	2.02A	ISS	PS-I-301		1
LIC	4		Level Indicator Control	AI	13421	ISS	PS-I-301		1
LI	4		Level Indication	---	SCADA	SCADA	PS-I-301		1
LSHH	5	A	Level Switch High High	---	2.02B	ISS	PS-I-301		1
LSHH	5	B	Level Alarm High High	DO	13421	ISS	PS-I-301		1
LAHH	5	A	Level Alarm High High	DI	13421	ISS	PS-I-301		1
LAHH	5	B	Level Alarm High High	---	2.05A	ISS	PS-I-301		1
LAHH	5	C	Level Alarm High High	---	SCADA	SCADA	PS-I-301		1
YS	6		Intrusion Switch	---	2.06A	ISS	PS-I-301		1
YA	6	A	Intrusion Alarm	DI	13421	ISS	PS-I-301		1
YA	6	B	Intrusion Alarm	---	SCADA	SCADA	PS-I-301		1
YS	7		Intrusion Switch	---	2.06A	ISS	PS-I-301		1
YA	7	A	Intrusion Alarm	DI	13421	ISS	PS-I-301		1
YA	7	B	Intrusion Alarm	---	SCADA	SCADA	PS-I-301		1
			Standby Power Facility						
YS	8		Intrusion Switch	---	2.06A	ISS	PS-I-301		1
YA	8	A	Intrusion Alarm	DI	13421	ISS	PS-I-301		1
YA	8	B	Intrusion Alarm	---	SCADA	SCADA	PS-I-301		1
YA	9	A	Fail Indication	DI	13421	ISS	PS-I-301		1
YA	9	B	Fail Indication	---	SCADA	SCADA	PS-I-301		1
YI	9	A	Run Indication	DI	13421	ISS	PS-I-301		1
YI	9	B	Run Indication	---	SCADA	SCADA	PS-I-301		1
JS	21		Voltage Switch (Power Fail)	---	DIV 16	ELEC	PS-I-301		1
JA	21	A	Power Fail Alarm	DI	13421	ISS	PS-I-301		1
JA	21	B	Power Fail Alarm	---	SCADA	SCADA	PS-I-301		1
YS	22		Heat Detector	---	DIV 16	ELEC	PS-I-301		1
YA	22	A	Fire Alarm	DI	13421	ISS	PS-I-301		1

Table 13485-1

TAG NUMBER			DESCRIPTION	I/O PT. TYPE	SPEC REF	FURNISHED BY	P&ID DWG	SIZE, RANGE OR SETPOINT	TOTAL # OF IDENTICAL LOOPS
YA	22	B	Fire Alarm	---	SCADA	SCADA	PS-I-301		1
			Effluent Disposal Site						
HS	1		Hand Switch	---	2.05B	ISS	PS-I-302		1
HSO	1		Hand Switch Open	---	2.05B	ISS	PS-I-302		1
HSC	1		Hand Switch Close	---	2.05B	ISS	PS-I-302		1
YI	1	A	Auto Indication	DI	13421	ISS	PS-I-302		1
YI	1	B	Auto Indication	---	SCADA	SCADA	PS-I-302		1
ZC	1		Position Control	---	SCADA	SCADA	PS-I-302		1
ZCO	1		Position Control Open	DO	13421	ISS	PS-I-302		1
ZCC	1		Position Control Close	DO	13421	ISS	PS-I-302		1
ZIO	1	A	Position Indication Open	DI	13421	ISS	PS-I-302		1
ZIO	1	B	Position Indication Open	---	SCADA	SCADA	PS-I-302		1
ZIC	1	A	Position Indication Closed	DI	13421	ISS	PS-I-302		1
ZIC	1	B	Position Indication Closed	---	SCADA	SCADA	PS-I-302		1
ZLO	1		Position Light Open	---	2.05A	ISS	PS-I-302		1
ZLC	1		Position Light Closed	---	2.05A	ISS	PS-I-302		1
ZSO	1		Limit Switch Opened	---	EXIST	EXIST	PS-I-302		1
ZSC	1		Limit Switch Closed	---	EXIST	EXIST	PS-I-302		1
HS	2		Hand Switch	---	2.05B	ISS	PS-I-302		1
HSO	2		Hand Switch Open	---	2.05B	ISS	PS-I-302		1
HSC	2		Hand Switch Close	---	2.05B	ISS	PS-I-302		1
YI	2	A	Auto Indication	DI	13421	ISS	PS-I-302		1
YI	2	B	Auto Indication	---	SCADA	SCADA	PS-I-302		1
ZC	2		Position Control	---	SCADA	SCADA	PS-I-302		1
ZCO	2		Position Control Open	DO	13421	ISS	PS-I-302		1
ZCC	2		Position Control Close	DO	13421	ISS	PS-I-302		1
ZIO	2	A	Position Indication Open	DI	13421	ISS	PS-I-302		1
ZIO	2	B	Position Indication Open	---	SCADA	SCADA	PS-I-302		1
ZIC	2	A	Position Indication Closed	DI	13421	ISS	PS-I-302		1
ZIC	2	B	Position Indication Closed	---	SCADA	SCADA	PS-I-302		1
ZLO	2		Position Light Open	---	2.05A	ISS	PS-I-302		1
ZLC	2		Position Light Closed	---	2.05A	ISS	PS-I-302		1
ZSO	2		Limit Switch Opened	---	EXIST	EXIST	PS-I-302		1

Table 13485-1

TAG NUMBER			DESCRIPTION	I/O PT. TYPE	SPEC REF	FURNISHED BY	P&ID DWG	SIZE, RANGE OR SETPOINT	TOTAL # OF IDENTICAL LOOPS
ZSC	2		Limit Switch Closed	---	EXIST	EXIST	PS-I-302		1
HS	3		Hand Switch	---	2.05B	ISS	PS-I-302		1
HSO	3		Hand Switch Open	---	2.05B	ISS	PS-I-302		1
HSC	3		Hand Switch Close	---	2.05B	ISS	PS-I-302		1
YI	3	A	Auto Indication	DI	13421	ISS	PS-I-302		1
YI	3	B	Auto Indication	---	SCADA	SCADA	PS-I-302		1
ZC	3		Position Control	---	SCADA	SCADA	PS-I-302		1
ZCO	3		Position Control Open	DO	13421	ISS	PS-I-302		1
ZCC	3		Position Control Close	DO	13421	ISS	PS-I-302		1
ZIO	3	A	Position Indication Open	DI	13421	ISS	PS-I-302		1
ZIO	3	B	Position Indication Open	---	SCADA	SCADA	PS-I-302		1
ZIC	3	A	Position Indication Closed	DI	13421	ISS	PS-I-302		1
ZIC	3	B	Position Indication Closed	---	SCADA	SCADA	PS-I-302		1
ZLO	3		Position Light Open	---	2.05A	ISS	PS-I-302		1
ZLC	3		Position Light Closed	---	2.05A	ISS	PS-I-302		1
ZSO	3		Limit Switch Opened	---	EXIST	EXIST	PS-I-302		1
ZSC	3		Limit Switch Closed	---	EXIST	EXIST	PS-I-302		1
HS	4		Hand Switch	---	2.05B	ISS	PS-I-302		1
HSO	4		Hand Switch Open	---	2.05B	ISS	PS-I-302		1
HSC	4		Hand Switch Close	---	2.05B	ISS	PS-I-302		1
YI	4	A	Auto Indication	DI	13421	ISS	PS-I-302		1
YI	4	B	Auto Indication	---	SCADA	SCADA	PS-I-302		1
ZC	4		Position Control	---	SCADA	SCADA	PS-I-302		1
ZCO	4		Position Control Open	DO	13421	ISS	PS-I-302		1
ZCC	4		Position Control Close	DO	13421	ISS	PS-I-302		1
ZIO	4	A	Position Indication Open	DI	13421	ISS	PS-I-302		1
ZIO	4	B	Position Indication Open	---	SCADA	SCADA	PS-I-302		1
ZIC	4	A	Position Indication Closed	DI	13421	ISS	PS-I-302		1
ZIC	4	B	Position Indication Closed	---	SCADA	SCADA	PS-I-302		1
ZLO	4		Position Light Open	---	2.05A	ISS	PS-I-302		1
ZLC	4		Position Light Closed	---	2.05A	ISS	PS-I-302		1
ZSO	4		Limit Switch Opened	---	EXIST	EXIST	PS-I-302		1
ZSC	4		Limit Switch Closed	---	EXIST	EXIST	PS-I-302		1
HS	5		Hand Switch	---	2.05B	ISS	PS-I-302		1

Table 13485-1

TAG NUMBER			DESCRIPTION	I/O PT. TYPE	SPEC REF	FURNISHED BY	P&ID DWG	SIZE, RANGE OR SETPOINT	TOTAL # OF IDENTICAL LOOPS
HSO	5		Hand Switch Open	---	2.05B	ISS	PS-I-302		1
HSC	5		Hand Switch Close	---	2.05B	ISS	PS-I-302		1
YI	5	A	Auto Indication	DI	13421	ISS	PS-I-302		1
YI	5	B	Auto Indication	---	SCADA	SCADA	PS-I-302		1
ZC	5		Position Control	---	SCADA	SCADA	PS-I-302		1
ZCO	5		Position Control Open	DO	13421	ISS	PS-I-302		1
ZCC	5		Position Control Close	DO	13421	ISS	PS-I-302		1
ZIO	5	A	Position Indication Open	DI	13421	ISS	PS-I-302		1
ZIO	5	B	Position Indication Open	---	SCADA	SCADA	PS-I-302		1
ZIC	5	A	Position Indication Closed	DI	13421	ISS	PS-I-302		1
ZIC	5	B	Position Indication Closed	---	SCADA	SCADA	PS-I-302		1
ZLO	5		Position Light Open	---	2.05A	ISS	PS-I-302		1
ZLC	5		Position Light Closed	---	2.05A	ISS	PS-I-302		1
ZSO	5		Limit Switch Opened	---	EXIST	EXIST	PS-I-302		1
ZSC	5		Limit Switch Closed	---	EXIST	EXIST	PS-I-302		1
HS	6		Hand Switch	---	2.05B	ISS	PS-I-302		1
HSO	6		Hand Switch Open	---	2.05B	ISS	PS-I-302		1
HSC	6		Hand Switch Close	---	2.05B	ISS	PS-I-302		1
YI	6	A	Auto Indication	DI	13421	ISS	PS-I-302		1
YI	6	B	Auto Indication	---	SCADA	SCADA	PS-I-302		1
ZC	6		Position Control	---	SCADA	SCADA	PS-I-302		1
ZCO	6		Position Control Open	DO	13421	ISS	PS-I-302		1
ZCC	6		Position Control Close	DO	13421	ISS	PS-I-302		1
ZIO	6	A	Position Indication Open	DI	13421	ISS	PS-I-302		1
ZIO	6	B	Position Indication Open	---	SCADA	SCADA	PS-I-302		1
ZIC	6	A	Position Indication Closed	DI	13421	ISS	PS-I-302		1
ZIC	6	B	Position Indication Closed	---	SCADA	SCADA	PS-I-302		1
ZLO	6		Position Light Open	---	2.05A	ISS	PS-I-302		1
ZLC	6		Position Light Closed	---	2.05A	ISS	PS-I-302		1
ZSO	6		Limit Switch Opened	---	EXIST	EXIST	PS-I-302		1
ZSC	6		Limit Switch Closed	---	EXIST	EXIST	PS-I-302		1
HS	7		Hand Switch	---	2.05B	ISS	PS-I-302		1
HSO	7		Hand Switch Open	---	2.05B	ISS	PS-I-302		1
HSC	7		Hand Switch Close	---	2.05B	ISS	PS-I-302		1

Table 13485-1

TAG NUMBER			DESCRIPTION	I/O PT. TYPE	SPEC REF	FURNISHED BY	P&ID DWG	SIZE, RANGE OR SETPOINT	TOTAL # OF IDENTICAL LOOPS
YI	7	A	Auto Indication	DI	13421	ISS	PS-I-302		1
YI	7	B	Auto Indication	---	SCADA	SCADA	PS-I-302		1
ZC	7		Position Control	---	SCADA	SCADA	PS-I-302		1
ZCO	7		Position Control Open	DO	13421	ISS	PS-I-302		1
ZCC	7		Position Control Close	DO	13421	ISS	PS-I-302		1
ZIO	7	A	Position Indication Open	DI	13421	ISS	PS-I-302		1
ZIO	7	B	Position Indication Open	---	SCADA	SCADA	PS-I-302		1
ZIC	7	A	Position Indication Closed	DI	13421	ISS	PS-I-302		1
ZIC	7	B	Position Indication Closed	---	SCADA	SCADA	PS-I-302		1
ZLO	7		Position Light Open	---	2.05A	ISS	PS-I-302		1
ZLC	7		Position Light Closed	---	2.05A	ISS	PS-I-302		1
ZSO	7		Limit Switch Opened	---	EXIST	EXIST	PS-I-302		1
ZSC	7		Limit Switch Closed	---	EXIST	EXIST	PS-I-302		1
HS	8		Hand Switch	---	2.05B	ISS	PS-I-302		1
HSO	8		Hand Switch Open	---	2.05B	ISS	PS-I-302		1
HSC	8		Hand Switch Close	---	2.05B	ISS	PS-I-302		1
YI	8	A	Auto Indication	DI	13421	ISS	PS-I-302		1
YI	8	B	Auto Indication	---	SCADA	SCADA	PS-I-302		1
ZC	8		Position Control	---	SCADA	SCADA	PS-I-302		1
ZCO	8		Position Control Open	DO	13421	ISS	PS-I-302		1
ZCC	8		Position Control Close	DO	13421	ISS	PS-I-302		1
ZIO	8	A	Position Indication Open	DI	13421	ISS	PS-I-302		1
ZIO	8	B	Position Indication Open	---	SCADA	SCADA	PS-I-302		1
ZIC	8	A	Position Indication Closed	DI	13421	ISS	PS-I-302		1
ZIC	8	B	Position Indication Closed	---	SCADA	SCADA	PS-I-302		1
ZLO	8		Position Light Open	---	2.05A	ISS	PS-I-302		1
ZLC	8		Position Light Closed	---	2.05A	ISS	PS-I-302		1
ZSO	8		Limit Switch Opened	---	EXIST	EXIST	PS-I-302		1
ZSC	8		Limit Switch Closed	---	EXIST	EXIST	PS-I-302		1
YS	1		Intrusion Switch	---	2.06A	ISS	PS-I-302		1
YS	2		Intrusion Switch	---	2.06A	ISS	PS-I-302		1
YS	3		Intrusion Switch	---	2.06A	ISS	PS-I-302		1
YS	4		Intrusion Switch	---	2.06A	ISS	PS-I-302		1
YS	8		Intrusion Switch	---	2.06A	ISS	PS-I-302		1

Table 13485-1

TAG NUMBER			DESCRIPTION	I/O PT. TYPE	SPEC REF	FURNISHED BY	P&ID DWG	SIZE, RANGE OR SETPOINT	TOTAL # OF IDENTICAL LOOPS
YA	8	A	Intrusion Alarm	DI	13421	ISS	PS-I-302		1
YA	8	B	Intrusion Alarm	---	SCADA	SCADA	PS-I-302		1
			Effluent Disposal Site						
HS	1		Hand Switch	---	2.05B	ISS	PS-I-303		1
HSO	1		Hand Switch Open	---	2.05B	ISS	PS-I-303		1
HSC	1		Hand Switch Close	---	2.05B	ISS	PS-I-303		1
YI	1	A	Auto Indication	DI	13421	ISS	PS-I-303		1
YI	1	B	Auto Indication	---	SCADA	SCADA	PS-I-303		1
ZC	1		Position Control	---	SCADA	SCADA	PS-I-303		1
ZCO	1		Position Control Open	DO	13421	ISS	PS-I-303		1
ZCC	1		Position Control Close	DO	13421	ISS	PS-I-303		1
ZIO	1	A	Position Indication Open	DI	13421	ISS	PS-I-303		1
ZIO	1	B	Position Indication Open	---	SCADA	SCADA	PS-I-303		1
ZIC	1	A	Position Indication Closed	DI	13421	ISS	PS-I-303		1
ZIC	1	B	Position Indication Closed	---	SCADA	SCADA	PS-I-303		1
ZLO	1		Position Light Open	---	2.05A	ISS	PS-I-303		1
ZLC	1		Position Light Closed	---	2.05A	ISS	PS-I-303		1
ZSO	1		Limit Switch Opened	---	EXIST	EXIST	PS-I-303		1
ZSC	1		Limit Switch Closed	---	EXIST	EXIST	PS-I-303		1
YS	6		Intrusion Switch	---	2.06A	ISS	PS-I-303		1
YS	8		Intrusion Switch	---	2.06A	ISS	PS-I-303		1
YA	8	A	Intrusion Alarm	DI	13421	ISS	PS-I-303		1
YA	8	B	Intrusion Alarm	---	SCADA	SCADA	PS-I-303		1
			Duplex Pocket Pump Station						
MAH	1	A	Moisture Alarm High	---	11310	GEN	PS-I-401		3
MSH	1		Moisture Switch High	---	11310	GEN	PS-I-401	BY MFGR	3
TAH	1	A	Temperature Alarm High	---	11310	GEN	PS-I-401		3
TSH	1		Temperature Switch High	---	11310	GEN	PS-I-401	BY MFGR	3
HS	1	A	Hand Switch	---	11310	GEN	PS-I-401		3
HS	1	B	Pump Start	DO	13421	ISS	PS-I-401		3
YA	1	B	Fail Indication	DI	13421	ISS	PS-I-401		3
YA	1	C	Fail Indication	---	SCADA	SCADA	PS-I-401		3

Table 13485-1

TAG NUMBER			DESCRIPTION	I/O PT. TYPE	SPEC REF	FURNISHED BY	P&ID DWG	SIZE, RANGE OR SETPOINT	TOTAL # OF IDENTICAL LOOPS
YL	1		Status Light	---	11310	GEN	PS-I-401		3
YI	1	A	Run Indication	DI	13421	ISS	PS-I-401		3
YI	1	B	Run Indication	---	SCADA	SCADA	PS-I-401		3
YI	1	C	Auto Indication	DI	13421	ISS	PS-I-401		3
YI	1	D	Auto Indication	---	SCADA	SCADA	PS-I-401		3
YQI	1		Run Totalizer Indication	---	SCADA	SCADA	PS-I-401		3
MAH	2	A	Moisture Alarm High	---	11310	GEN	PS-I-401		3
MSH	2		Moisture Switch High	---	11310	GEN	PS-I-401	BY MFGR	3
TAH	2	A	Temperature Alarm High	---	11310	GEN	PS-I-401		3
TSH	2		Temperature Switch High	---	11310	GEN	PS-I-401	BY MFGR	3
HS	2	A	Hand Switch	---	11310	GEN	PS-I-401		3
HS	2	B	Pump Start	DO	13421	ISS	PS-I-401		3
YA	2	B	Fail Indication	DI	13421	ISS	PS-I-401		3
YA	2	C	Fail Indication	---	SCADA	SCADA	PS-I-401		3
YL	2		Status Light	---	11310	GEN	PS-I-401		3
YI	2	A	Run Indication	DI	13421	ISS	PS-I-401		3
YI	2	B	Run Indication	---	SCADA	SCADA	PS-I-401		3
YI	2	C	Auto Indication	DI	13421	ISS	PS-I-401		3
YI	2	D	Auto Indication	---	SCADA	SCADA	PS-I-401		3
YQI	2		Run Totalizer Indication	---	SCADA	SCADA	PS-I-401		3
LSH	4		Level Switch High	---	11310	GEN	PS-I-401		3
LSM	4		Level Switch Medium	---	11310	GEN	PS-I-401		3
LSL	4		Level Switch Low	---	11310	GEN	PS-I-401		3
LIC	4		Level Indicator Control	---	13421	ISS	PS-I-401		3
LIH	4		Level Indicator High	DI	13421	ISS	PS-I-401		3
LIM	4		Level Indicator Medium	DI	13421	ISS	PS-I-401		3
LIL	4		Level Indicator Low	DI	13421	ISS	PS-I-401		3
LAHH	5	A	Level Alarm High High	DI	13421	ISS	PS-I-401		3
LAHH	5	B	Status Light	---	11310	GEN	PS-I-401		3
LAHH	5	C	Level Alarm High High	---	SCADA	SCADA	PS-I-401		3
LSHH	5	A	Level Switch High High		11310	GEN	PS-I-401		3
LSHH	5	B	Level Switch High High	DO	13421	ISS	PS-I-401		3
YS	6		Intrusion Switch	---	2.06A	ISS	PS-I-401		3
YA	6	A	Intrusion Alarm	DI	13421	ISS	PS-I-401		3

Table 13485-1

TAG NUMBER			DESCRIPTION	I/O PT. TYPE	SPEC REF	FURNISHED BY	P&ID DWG	SIZE, RANGE OR SETPOINT	TOTAL # OF IDENTICAL LOOPS
YA	6	B	Intrusion Alarm	---	SCADA	SCADA	PS-I-401		3
YS	8		Intrusion Switch	---	11310	GEN	PS-I-401		3
YA	8	A	Intrusion Alarm	DI	13421	ISS	PS-I-401		3
YA	8	B	Intrusion Alarm	---	SCADA	SCADA	PS-I-401		3
			Duplex Submersible Pump Station						
MAH	1	A	Moisture Alarm High	---	DIV 16	ELEC	PS-I-401		1
MSH	1		Moisture Switch High	---	11306	GEN	PS-I-401	BY MFGR	1
TAH	1	A	Temperature Alarm High	---	DIV 16	ELEC	PS-I-401		1
TSH	1		Temperature Switch High	---	11306	GEN	PS-I-401	BY MFGR	1
HS	1	A	Hand Switch	---	DIV 16	ELEC	PS-I-401		1
HS	1	B	Pump Start	DO	13421	ISS	PS-I-401		1
YA	1	B	Fail Indication	DI	13421	ISS	PS-I-401		1
YA	1	C	Fail Indication	---	SCADA	SCADA	PS-I-401		1
YL	1		Status Light	---	DIV 16	ELEC	PS-I-401		1
YI	1	A	Run Indication	DI	13421	ISS	PS-I-401		1
YI	1	B	Run Indication	---	SCADA	SCADA	PS-I-401		1
YI	1	C	Auto Indication	DI	13421	ISS	PS-I-401		1
YI	1	D	Auto Indication	---	SCADA	SCADA	PS-I-401		1
YQI	1		Run Totalizer Indication	---	SCADA	SCADA	PS-I-401		1
MAH	2	A	Moisture Alarm High	---	DIV 16	ELEC	PS-I-401		1
MSH	2		Moisture Switch High	---	11306	GEN	PS-I-401	BY MFGR	1
TAH	2	A	Temperature Alarm High	---	DIV 16	ELEC	PS-I-401		1
TSH	2		Temperature Switch High	---	11306	GEN	PS-I-401	BY MFGR	1
HS	2	A	Hand Switch	---	DIV 16	ELEC	PS-I-401		1
HS	2	B	Pump Start	DO	13421	ISS	PS-I-401		1
YA	2	B	Fail Indication	DI	13421	ISS	PS-I-401		1
YA	2	C	Fail Indication	---	SCADA	SCADA	PS-I-401		1
YL	2		Status Light	---	DIV 16	ELEC	PS-I-401		1
YI	2	A	Run Indication	DI	13421	ISS	PS-I-401		1
YI	2	B	Run Indication	---	SCADA	SCADA	PS-I-401		1
YI	2	C	Auto Indication	DI	13421	ISS	PS-I-401		1
YI	2	D	Auto Indication	---	SCADA	SCADA	PS-I-401		1
YQI	2		Run Totalizer Indication	---	SCADA	SCADA	PS-I-401		1

Table 13485-1

TAG NUMBER			DESCRIPTION	I/O PT. TYPE	SPEC REF	FURNISHED BY	P&ID DWG	SIZE, RANGE OR SETPOINT	TOTAL # OF IDENTICAL LOOPS
LE	4		Level Element	---	2.02A	ISS	PS-I-401		1
LIC	4		Level Indicator Control	AI	13421	ISS	PS-I-401		1
LI	4		Level Indication	---	SCADA	SCADA	PS-I-401		1
LSHH	5	A	Level Switch High High	---	2.02B	ISS	PS-I-401		1
LSHH	5	B	Level Alarm High High	DO	13421	ISS	PS-I-401		1
LAHH	5	A	Level Alarm High High	DI	13421	ISS	PS-I-401		1
LAHH	5	B	Level Alarm High High	---	2.05A	ISS	PS-I-401		1
LAHH	5	C	Level Alarm High High	---	SCADA	SCADA	PS-I-401		1
YS	6		Intrusion Switch	---	2.06A	ISS	PS-I-401		1
YA	6	A	Intrusion Alarm	DI	13421	ISS	PS-I-401		1
YA	6	B	Intrusion Alarm	---	SCADA	SCADA	PS-I-401		1
YS	7		Intrusion Switch	---	2.06A	ISS	PS-I-401		1
YA	7	A	Intrusion Alarm	DI	13421	ISS	PS-I-401		1
YA	7	B	Intrusion Alarm	---	SCADA	SCADA	PS-I-401		1
			Standby Power Facility						
YS	8		Intrusion Switch	---	2.06A	ISS	PS-I-401		1
YA	8	A	Intrusion Alarm	DI	13421	ISS	PS-I-401		1
YA	8	B	Intrusion Alarm	---	SCADA	SCADA	PS-I-401		1
YA	9	A	Fail Indication	DI	13421	ISS	PS-I-401		1
YA	9	B	Fail Indication	---	SCADA	SCADA	PS-I-401		1
YI	9	A	Run Indication	DI	13421	ISS	PS-I-401		1
YI	9	B	Run Indication	---	SCADA	SCADA	PS-I-401		1
JS	21		Voltage Switch (Power Fail)	---	DIV 16	ELEC	PS-I-401		1
JA	21	A	Power Fail Alarm	DI	13421	ISS	PS-I-401		1
JA	21	B	Power Fail Alarm	---	SCADA	SCADA	PS-I-401		1
YS	22		Heat Detector	---	DIV 16	ELEC	PS-I-401		1
YA	22	A	Fire Alarm	DI	13421	ISS	PS-I-401		1
YA	22	B	Fire Alarm	---	SCADA	SCADA	PS-I-401		1

END OF TABLE

Division 15 Mechanical

SECTION 15100

VALVES AND APPURTENANCES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and provide all buried and exposed valves, valves in manholes and underground vaults, hydrants and appurtenances complete with actuators and all accessories as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Trenching, backfill, and compaction are included in Section 02221.

B. Concrete is included in Division 3.

C. Miscellaneous metal fabrication is included in Section 05500.

D. Surface preparation and shop painting is included in Section 09902.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, materials required to establish compliance with this Section for shop drawings. Submittals shall include the following:

1. Manufacturer's literature, illustrations, specifications and engineering data including:

a. Dimensions.

b. Size.

c. Materials of construction.

d. Weight.

e. Protection coating.

f. Actuator weight.

g. Calculations for actuator torque where applicable.

B. Test Reports

1. Four copies of all certified shop test results specified herein.

C. Operation and Maintenance Manuals

1. Submit complete operation and maintenance manuals including copies of all approved Shop Drawings.

D. Certificates

1. Certificates of compliance where required by referenced standards: For each valve specified to be manufactured and/or installed in accordance with AWWA and other standards, submit an affidavit of compliance with the appropriate standards, including certified results of required tests and certification of proper installation.

1.04 REFERENCE STANDARDS

A. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

B. American Water Works Association (AWWA)

1. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron and Pressure Pipe and Fittings.

2. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.

4. AWWA C504 - Rubber-Seated Butterfly Valves.

5. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.

6. AWWA C515 - Reduced Wall, Resilient-Seated Gate Valves for Water Supply Service

7. AWWA C800 – Underground Service Lines and Fittings

C. American Society for Testing and Materials (ASTM)

1. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

2. ASTM A536 - Standard Specification for Ductile Iron Castings.

D. The Society for Protective Coatings (SSPC)

1. SSPC SP-6 - Joint Surface Standard Commercial Blast Cleaning

E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. Manufacturer's Qualifications

1. Valves and appurtenances provided under this Section shall be the standard product in regular production by manufacturers whose products have proven reliable in similar service for at least 10 years. If required, the manufacturer shall furnish evidence of installation in satisfactory operation.

2. All units of the same type shall be the product of one manufacturer.

B. Design Criteria

1. All valves and appurtenances shall be new and in perfect working condition. Valves shall be designed for continuous use with a minimum of maintenance and service required and shall perform the required function without exceeding the safe limits for stress, strain or vibration. In no case will used or damaged valves be acceptable. The selection of equipment to meet the specified design conditions is the responsibility of the CONTRACTOR. Both workmanship and material shall be of the very best quality and shall be entirely suitable for the service conditions specified.

C. Source Quality Control

1. Valves shall be shop tested in accordance with the following:

a. Metal-seated gate valves: AWWA C500.

b. Rubber-seated butterfly valves: AWWA C504.

c. Resilient-seated gate valves: AWWA C509.

d. Reduced-wall, resilient-seated gate valves: AWWA C515.

2. Obtain each type of valve from no more than one manufacturer.

1.06 SYSTEM DESCRIPTION

A. All of the equipment and materials specified herein is intended to be standard for use in controlling the flow of wastewater and recycled water as noted on the Drawings.

B. Valves, appurtenances and miscellaneous items shall be installed as shown on the Drawings and as specified, so as to form complete workable systems.

C. Unless otherwise noted all exposed powered valve operators shall have:

1. Valves larger than 3-in: electric operators 460 Volt, 3 Phase, 60 Hz.

2. See other paragraphs for additional requirements.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the site to ensure uninterrupted progress of the work.

B. Protect threads and seats from corrosion and damage. Rising stems and exposed stem valves shall be coated with a protective oil film which shall be maintained until time of use.

C. Furnish covers for all openings.

1. All valves 3-in and larger shall be shipped and stored on site until time of use with wood or plywood covers on each valve end.

2. All butterfly valves shall be delivered with blind flanges bolted in place until valve is pressure-tested on site, before installation and burial.

D. Store equipment to permit easy access for inspection and identification. Any corrosion in evidence at the time of ENGINEER acceptance shall be removed, or the valve shall be removed from the job.

E. Store all equipment in covered storage off the ground.

1.08 COORDINATION

A. Review installation procedures under other Sections and coordinate with the work which is related to this Section including buried piping installation, and site utilities.

B. Coordinate the location and placement of concrete thrust blocks when required.

PART 2 PRODUCTS

2.01 GENERAL

A. All buried valves shall open counter-clockwise.

B. The use of a manufacturer's name and/or model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

C. Valves shall be of the size shown on the Drawings or as noted and as far as possible equipment of the same type shall be identical and from one manufacturer.

D. Valves shall have the name of the maker, nominal size, flow directional arrows, working pressure for which they are designed and standard to which they are manufactured cast in raised letters on some appropriate part of the body.

E. Unless otherwise noted, valves shall have a minimum working pressure of 150 psi or be of the same working pressure as the pipe they connect to, whichever is higher, and suitable for the pressures noted where they are installed.

F. Valves shall be of the same nominal diameter as the pipe or fittings they are connected to. Except as otherwise noted, joints shall be mechanical joints, with joint restraint where the adjacent piping is required to be restrained.

G. Valves shall be constructed for buried service.

2.02 VALVE BOXES

A. All gate, butterfly and plug valves shall be provided with extension shafts, operating nuts and valve boxes as follows:

1. Extension shafts shall be Type 304 stainless steel and the operating nut shall be 2-in square. Shafts shall be designed to provide a factor of safety of not less than four. Operating nuts shall be pinned to the shafts.

2. Top of the operating nut shall be located 2-in below the rim of the valve box.

3. Valve boxes shall be as manufactured by Clow; Mueller; Tyler; or equal and shall be a heavy-pattern cast iron, three-piece, telescoping type box with dome base suitable for installation on the buried valves. Inside diameter shall be at least 4-1/2-in. Barrel length shall be adapted to the depth of cover, with a lap of at least 6-in when in the most extended position. Covers shall be cast iron with integrally-cast direction-to- open arrow, and the word "RECYCLED WATER" for the recycled water valves or "SEWER" for the conveyance force main valves shall also be integrally cast. Aluminum or plastic are not acceptable. A means of lateral support for the valve extension shafts shall be provided in the top portion of the valve box.

4. The upper section of each box shall have a top flange of sufficient bearing area to prevent settling. The bottom of the lower section shall enclose the stuffing box and operating nut of the valve and shall be oval.

5. A position-indicating device shall be provided for each gate and butterfly valve. The position-indicating device shall be GPI Series Geared Position Indicator by Dyna-Torque Inc., Muskegon, MI or equal, which shall mount over the shaft and visually show the position of the valve at all times. All material shall be non-corrosive, nonmagnetic and shall require no lubrication. Unit shall be furnished and arranged for use with the valve box. The required valve box adapters and cover shall be furnished.

6. An approved operating key or wrench shall be furnished.

7. All fasteners shall be Type 316 stainless steel.

2.03 RESILIENT WEDGE GATE VALVES

A. General

1. All gate valves shall conform to the requirements of AWWA C509, except as may be specifically modified herein.

2. Valves 3-in and larger shall be iron body, bronze mounted.

B. Gate valves 3-in and larger

1. Valves shall be double disc-type with 150 psig working pressure rating with a minimum non-shock rating of 200 psig.

2. Buried valves shall have non-rising stems, mechanical joint ends and 2-in square operating nuts. Valves shall be furnished with O-ring seals.

3. Furnish valves and accessories as manufactured by one of the following:

   a. Henry Pratt

   b. DeZurik

   c. Or equal

2.04 TAPPING SLEEVES AND TAPPING VALVES

A. Tapping sleeves shall be of stainless steel, designated for working pressure not less than 200 psi. Armored end gaskets shall be provided for the full area of the sleeve flanges. Sleeves shall be as manufactured by A.P. Smith Division of U.S. Pipe; Mueller; Clow or equal. Nuts and bolts shall be Type 304 or Type 316 stainless steel.

B. Tapping valves shall conform to the requirements specified above for gate valves except that one end shall be flanged and one mechanical. Tapping valves shall be provided with an oversized opening to permit the use of full size cutters.

2.05 RUBBER-SEATED BUTTERFLY VALVES

A. Valves shall be manufactured in strict accordance with AWWA C504. Valves shall be bubble tight at rated pressures. Valve discs shall rotate 90 degrees from full closed to open. Operators shall be assembled to the valve by the valve manufacturer. The valve/operator shall be tested as a complete assembly by the valve manufacturer. The manufacturer shall have produced AWWA butterfly valves for a minimum of 5 years.

B. Valve bodies shall be constructed of cast iron ASTM A126, Class B. Valves in vaults shall be flanged. Flange drilling shall be in accordance with ANSI B16.1, Class 150. Laying length shall be short body as listed in AWWA C504. Buried valves shall be mechanical joint end conforming to ANSI C111.

C. Valve discs shall be constructed of cast iron ASTM A126 or A48, ductile iron ASTM A536. Material mating with the seat shall be either Type 304 or Type 316 stainless steel.

D. Rubber valve seats shall be Buna-N, Buna-S, or EPDM. If the seat is on the disc it shall be mechanically retained by Type 304 stainless steel fasteners. If the seat is in the valve body and seat retaining hardware such as screws and segments are used they shall be monel. If screws are used, monel plugs shall be affixed in the valve body and tapped to receive these screws.

E. Valve shafts shall be Type 304 stainless steel, ASTM A276 and shall be of a diameter not less than those listed in AWWA C504, Class 150B.

F. Shaft seals shall be furnished where the shaft projects thru the valve body. Shaft seals shall be standard split-v type packing or of an O-ring design.

G. Valves shall be fitted with sleeve type bearings contained in the trunions of the valve body. Bearing material shall be nylon for valves thru 20-in and fiberglass with teflon lining for valves 24-in and larger.

H. Valve manufacturer shall furnish and mount operator suitable for buried service. Operators shall be self-locking and suitable for submergence to 20-ft. A 2-in square operating nut shall be furnished. Operator stops shall be capable of withstanding an input of 450 ft-lbs.

I. All valves shall be hydrostatically and leak tested.

J. Valve class shall be AWWA Class 150B with operators sized for bi-directional flow.

K. Valves shall be manufactured by Henry Pratt; DeZurik; or approved equal.

2.06 AIR RELEASE AND VACUUM RELIEF VALVES:

A. All valves shall be supplied with shutoff gate or ball valves with operator handle or lever in place. Valves shall be properly vented and piped to drain.

B. Valve pressure rating shall be at least 250 psi or equal to the attached pipeline rating.

C. Combination Air and Vacuum Relief Valves: Tag Type CAV

1. Valves shall be designed to release large amounts of air during pipeline filling, release small amounts of air accumulated during pipeline operation, and allow large volumes of air during pipeline drainage or pipe break. Valve shall be combination double orifice air/vacuum type for general service in sizes 1 to 6 inches housed in a conical body. Valve shall have an intake orifice area equal to the nominal size of the valve.

2. Air release/vacuum valves shall be compact single body design. When the pipeline is filled and pressurized, air shall be discharged through the small diameter orifice. Venting of large quantities of air during pipeline filling shall be accomplished through the large orifice at the top of the valve. Vacuum relief shall be accomplished through the large orifice when the control floats fail due to negative pressure in the pipeline.

3. Valves shall be rated for 150 psi service. Materials of construction shall be as follows: barrel- Cast Iron ASTM A126 GR. B; float - Stainless Steel ASTM A240 T304 or T316; small orifice nozzle seat - Buna-N; studs, nuts, washers - 316 stainless steel. End Connections shall be NPT up to 2 inch, 125 lb flange 3 to 6 inch.

4. Valves shall be manufactured by APCO (Dezurik) Series 440, Val-Matic Series 800, or Equal. Vent-O-Mat Series RGX and International Valve SWG-C are approved equals.

D. Combination Air and Vacuum Relief Valves: Tag Type CAV/SP

1. Valves shall be designed to release large amounts of air during pipeline filling, release small amounts of air accumulated during pipeline operation, and allow large volumes of air during pipeline drainage or pipe break. Valve shall be combination double orifice air/vacuum type for general service in sizes 1 to 6 inches housed in a conical body. Valve shall have an intake orifice area equal to the nominal size of the valve.

2. Air release/vacuum valves shall be compact single body design. When the pipeline is filled and pressurized, air shall be discharged through the small diameter orifice. Venting of large quantities of air during pipeline filling shall be accomplished through the large orifice at the top of the valve. Vacuum relief shall be accomplished through the large orifice when the control floats fail due to negative pressure in the pipeline.

3. Valves shall be rated for 150 psi service. Materials of construction shall be as follows: barrel- Cast Iron ASTM A126 GR. B; float - Stainless Steel ASTM A240 T304 or T316; small orifice nozzle seat - Buna-N; studs, nuts, washers - 316 stainless steel. End Connections shall be NPT up to 2 inch, 125 lb flange 3 to 6 inch.

4. A throttling device shall be placed on the orifice to regulate and restrict air venting and to establish a pressure loading to eliminate shock.

5. Valves shall be manufactured by APCO (Dezurik) Series 440DAT, Val-Matic Series 800-S, or Equal. Vent-O-Mat Series RGX and International Valve SWG-C are approved equals.

2.07 CHECK VALVES

A. Check valves for 4-inch and larger diameter pipelines shall be swing type and shall meet the material requirements of AWWA C508. The valves shall be iron body, bronze mounted, single disc, matching or exceeding pipeline working pressure, non-shock and hydrostatically tested at 300 psi. Ends shall be 125 lb ANSI B16.1 flanges.

1. When there is no flow through the line the disc shall hang lightly against its seat in practically a vertical position. When open, the disc shall swing clear of the waterway.

2. Check valves shall have bronze seat and body rings, extended bronze hinge pins and bronze nuts on the bolts of bolted covers.

3. Valves shall be so constructed that disc and body seat may easily be removed and replaced without removing the valve from the line. Valves shall be fitted with an extended hinge arm with outside lever and spring. Springs with various tensions shall be provided and springs approved by the ENGINEER shall be installed.

4. Check valves shall have bronze seat and body rings, bronze or ductile clapper arm and bronze nuts on the bolts of bolted covers. Shaft assembly and key shall be A582 type 416 stainless steel. Hinge shaft shall extend from the body of the valve, sealed with stuffing box, packing and gland. Shaft side plug bearing, stuffing box and gland shall be bronze, packing shall be reinforced Teflon, both side plug and stuffing box shall be provided with grease fittings.

5. Check valves shall be manufactured by Henry Pratt; DeZurik; or approved equal.

2.08 PLASTIC SWING OR WYE-CHECK VALVES

A. General: Plastic swing or wye-check valves for corrosive fluids, in sizes up to 8 inches or as available, may be used for horizontal or vertical up-flow conditions.

B. Construction: The valve bodies and discs or piston shall be of PVC, PP, or PVDF construction, as best suited for each individual service condition. They shall have flanged ends conforming to ANSI/ASME B16.5 Class 150, and flanged top access covers, and they shall shut positively at no-flow conditions. The seats and seals shall be of EPDM, Teflon, or Viton. The PVC valves shall be rated for a maximum non-shock working pressure of 150 psi at 73 degrees F for sizes 3-inch and smaller. For larger sizes and other materials and temperatures the pressure rating may be lower.

C. Manufacturers, or Equal

1. ASAHI-AMERICA;

2. George Fischer, Inc.;

3. Spears Mfg. Co. (Plastic Swing Check only).

2.09 SOLENOID VALVES

A. Solenoid valves shall be of the size, type, and class indicated and shall be designed for not less than 150 psi water-working pressure. Valves for water, air, or gas service shall have brass or bronze body with screwed ends, stainless steel trim and spring, Teflon or other resilient seals with material best suited for the temperature and fluid handled. Unless otherwise indicated, for chemicals and all corrosive fluids, solenoid valves with PVC, CPVC, polypropylene (PP), polyvinylidene fluoride (PVDF), or Teflon materials of construction, suitable for the specific application shall be provided. Enclosures shall be NEMA rated in accordance with the area designations of section 16000 – Electrical- Work, General Provisions – Pump Stations. All coil ratings shall be for continuous duty. For electrical characteristics see electrical drawings or specifications.

B. Manufacturers, or Equal

1. For general duty

a. Automatic Switch Co. (AXCO), Model “RED HAT”;

b. Skinner Valve (Parker Hannifin corporation):

c. Magnatrol Valve Corporation;

d. J. D. Gould Co.

2.10 SOLENOID FLOW CONTROL VALVE

A. Solenoid control valve shall be an on-off control valve which either opens fully or closes drip-tight upon receiving an electrical signal to the solenoid pilot control. This shall be of the size shown on the drawings and shall consist of a main valve, a three way solenoid and a high capacity three-way pilot valve. The solenoid control shall operate the three-way valve which alternately applies pressure to or relieves pressure from the diaphragm chamber of the main valve. The valve shall be furnished normally closed (energize solenoid to open). The valve shall have a check feature that upon pressure reversal, the downstream pressure shall be admitted into the main valve cover chamber and the valve closes to prevent return flow.

B. The valve materials shall be selected for use with reclaimed treated wastewater effluent. The diaphragm, disc and o-ring shall be Viton. The body and cover shall be ductile iron, with bronze trim. The valve shall be coated with fusion bonded epoxy meeting NSF 61.

C. Manufacturers, or Equal

1. Cla-Val Model 100-01

2.11 SURFACE PREPARATION AND SHOP COATINGS

A. The interior ferrous metal surfaces, except finished or bearing surfaces, shall be blast cleaned in accordance with SSPC SP-10 and painted with two coats of an approved two component epoxy coating specifically formulated for potable water use. The coating shall be NSF certified to Standard 61.

B. Exterior ferrous metal surfaces of all buried valves shall be blast cleaned in accordance with SSPC SP-6 and given two shop coats of an approved two component coal tar epoxy paint.

C. Exterior ferrous metal surfaces of all non-buried valves shall be shop painted with one coat of primer in accordance with the requirements of Section 09901.

2.12 PROTECTIVE WRAPPING FOR BURIED METALIC ITEMS

A. The wax tape protective wrapping for flanged joints, flexible or mechanical couplings, flanged coupling adapters, valves, special areas and other exposed appurtenances and joints below final grade shall be protected by a primer, mastic, wrapping, and overwrapping system, Denso, Trenton, or equal.

2.13 FLEXIBLE (FLEX), MECHANICAL, OR SLEEVE COUPLINGS

A. This Specification and the Drawings use the terms flexible, flex, mechanical, sleeve, and Dresser couplings interchangeably. Standard and insulated flexible couplings shall be rated at the working pressure of the pipe joined or at a minimum of 150 psig, whichever is greater. Couplings shall also be designed for the actual soil loads for each installation condition if buried.

B. Couplings 12-inches in diameter and smaller shall have steel sleeves 7 inches long. Couplings 14-inches to 36-inches in diameter shall have steel sleeves at least 10 inches long. Couplings larger than 36-inches in diameter shall have steel sleeves at least 18 inches long. Sleeve type couplings shall not have pipe stops.

C. All couplings shall be factory cleaned and given a fusion bonded epoxy coating in accordance with AWWA C213. Anchor studs shall be provided if indicated on the Drawings.

D. Insulating sleeve type couplings shall have an insulating rubber boot adequate to stop the flow of electrical current across the coupling and piping. If couplings are restrained, the rods and nuts shall be insulated with dielectric sleeves and washers to maintain insulation.

E. Standard sleeve type flex couplings shall be Smith-Blair Style No. 411, Dresser Style No. 38, JCM 201, Romac 400, or equal. Insulated sleeve type couplings shall be Dresser 416, Romac, or equal.

F. Restrained Joints: Sleeve type couplings on pressure lines shall be harnessed unless thrust restraint is provided by other means. Harnesses shall be designed by the pipe manufacturer in accordance with Manual M11, or as indicated. Harness sets shall be designed for the maximum test pressure of the pipe in which they are installed. Where harness sets are installed near the suction and discharge of the pump, harness bolts hall have zero elongation to prevent misalignment of the pump imparted by the thrust within the piping system.

G. Dismantling Joints shall be rated at a minimum working pressure of 150 psig and have restraint tie-rods. Dresser Style No. 131, Romac Style No. DJ 400, Smith-Blair Style No. 975, or equal.

2.14 STRUCTURE PENETRATION MECHANICAL SEALS FOR PIPING

A. Seals around piping and tubing shall be modular mechanical type, consisting of interlocking synthetic rubber links shaped to fit in the annular space. Tightening of bolts in each link shall cause the link to expand and seal the space. Hardware shall be Type 316 stainless steel. Mechanical seals shall be Innerlynx by Advance Products & Systems, Linkseal by Thunderline Corp., or equal.

2.15 MISCELLANEOUS ITEMS

A. Insulating Fittings: Fittings shall be of type to provide control of electrolysis and equal to "Dielectric" as manufactured by Watts Regulator Co., Ebco, or equal.

B. Quick Disconnect (Connect) for Pressure Cleanout Piping: Materials (including, but not limited to, body, gaskets, levers, and pins) shall be compatible with raw sewage service or as specifically indicated on the Drawings. Disconnects shall use a minimum of two cam action locking levers to complete connections. Unless otherwise noted, disconnects shall be a male coupler with socket weld, threaded, or solvent welded end as required for the connecting piping. Disconnect dimensions shall comply with the specifications of MIL-C-27487. Provide a dust cap of the same material (as the disconnect) for each disconnect. Quick disconnects shall be by PT-Hunt, OPW, Aeroquip, Harrington Plastics, or equal.

2.16 LUBRICATED PLUG VALVES (1/2-inch to 36-inch)

A. Construction: Lubricated plug valves shall be the tapered plug top or bottom entry type, with flanged ends for sizes 3-inch and larger, and flanged or screwed ends for smaller valves, as indicated. The body and top plate shall be of cast steel conforming to ASTM A 216 - Steel Castings, Carbon, Suitable for Fusion Welding for High- Temperature Service, or other acceptable cast or forged steel. The plug shall be of steel or cast iron and the stem shall be of stainless steel or alloy steel, with weather seal and Teflon impregnated packing. Valves up to and including 20-inch in size shall have an unobstructed port area of not less than 80 percent of full pipe area, and not less than 70 percent for larger valves. The valve body and plug shall have smoothly-finished water passages free from sharp corners when the plug is in the wide-open position. The valve shall be rated for ANSI class 300 or as indicated, between service temperatures of minus 20 to plus 100 degrees F.

B. Sealant System: The valves shall be provided with fittings designed to feed a sealant through a check-valve protected passage in the stem, through the side, or through a stainless steel tube for worm-gear actuated or buried valves. There shall be ducts or grooves in the face of the plug to insure the maintenance of a closed, pressurized sealant system between all contact surfaces of moving parts. All surfaces of the plug shall be coated with a dry film lubricant, such as polyfluoride or equal, to suit the service, permanently bonded to the metal surfaces. Sealant for LP gas service shall be the manufacturer’s recommended type. The plug shall be held toward the seat by factory- adjusted gland assemblies set for proper sealing and operating torque. The gland assemblies shall be adjustable from the valve exterior and shall utilize either spring washers or gland deflection to allow plug unseating when pressurized sealant is injected.

C. Actuators: Unless otherwise indicated, valves 3-inch and smaller shall be lever actuated; larger valves shall be equipped with manual worm-gear actuators.

D. Lubricating Gun: The CONTRACTOR shall furnish a manual lubricating gun for lubricated plug valves in sizes up to 6-inch, inclusive. For larger valves, the CONTRACTOR shall furnish a pneumatically-operated lubricating gun and a manual lubricating gun. For installations of more than 6 lubricated plug valves, the number of guns shall be doubled. The guns shall be from the same manufacturer as the valves. Guns shall each be equipped with flexible connectors, pressure gauge, safety valve, and be furnished in labeled tool boxes with operating instructions.

E. Manufacturers, or Equal

1. Nordstrom Audco Valves, Inc.;

2. Rockwell.

2.17 ECCENTRIC PLUG VALVES (1/2-inch to 72-inch)

A. Construction: Eccentric plug valves shall be of the non-lubricated, eccentric plug design with cast iron bodies conforming to ASTM A 126 - Gray Iron Castings for Valves, Flanges, and Pipe Fittings, with ANSI 125 lb. flanged ends for valves 3-inch and larger, and screwed or flanged ends for smaller sizes. The plugs and shafts shall be of cast iron or ductile iron conforming to ASTM A 536 - Ductile Iron Castings, and the plugs shall be lined with a resilient coating, best suited for the specific service. The body shall be lined with a suitable elastomer, where required for a special service, or it shall be epoxy- lined in accordance with Section 09800 - Protective Coating. The seats shall be of nickel or stainless steel welded to the body. All top and bottom shaft bearings shall be of permanently lubricated stainless steel or Teflon coated stainless steel. Grit seals of Teflon, Nylatron, or similar suitable material shall be at the top and bottom plug journals. Valves up to and including 20-inch in size shall have an unobstructed port area of not less than 80 percent of full pipe area, and not less than 70 percent for larger valves. All eccentric plug valves shall have a pressure rating of not less than 150 psi WOG, for bubble-tight shut-off in the standard flow direction, and 25 psi WOG in the reverse flow direction. When equipped with worm gear actuator, the pressure rating shall be 150 psi WOG in both directions. The stem seal shall consist of field adjustable packing, replaceable without removal of the actuator, or of self-adjusting U-cup packing.

B. Actuators: Unless otherwise indicated, eccentric plug valves 3-inch and smaller shall have operating levers; larger valves shall have worm-gear actuators.

C. Manufacturers, or Equal

1. DeZurik Corporation;

2. Clow Valve Company;

3. Pratt Valve;

4. Victaulic.

2.18 REDUCED PRESSURE ZONE BACKFLOW PREVENTER (RPZ)

A. Shall be of the size shown on the Drawings and body shall be constructed of bronze for sizes less than 2-1/2-in and epoxy coated cast iron for sizes 2-1/2-in and larger..

B. Each unit shall be complete with two companion OS&Y gate valves equipped with test connections. Valves shall be of similar material as that of the backflow device body, including epoxy coating. Unit shall have replaceable bronze seats and captured springs.

C. Each unit shall be provided with a complete set of spare parts, which shall be stored adjacent to the unit in a wood crate labeled with list of contents.

D. Each unit shall be supported on galvanized steel floor stanchions with floor flange secured to floor.

E. Each unit shall be of the manufacture that meets the approval of the authority having jurisdiction.

F. Acceptable manufacturers shall include, or Equal

1. Febco.

2. Cla-Val Co.

3. Watts Regulator.

G. Provide enclosure equivalent to "GuardShack Model# The Protector" for each backflow preventer shown on the drawings. Provide enclosure pad and enclosure suitable for backflow preventer.

PART 3 EXECUTION

3.01 INSPECTION AND PREPARATION

A. During installation of all valves and appurtenances, verify that all items are clean, free of defects in material and workmanship and function properly.

B. All valves shall be closed and kept closed until otherwise directed by the ENGINEER.

3.02 INSTALLATION OF BURIED VALVES AND VALVE BOXES

A. Buried valves shall be cleaned and manually operated before installation. Buried valves and valve boxes shall be set with the stem vertically aligned in the center of the valve box. Valves shall be set on a firm foundation and supported by tamping pipe bedding material under the sides of the valve. The valve box shall be supported during backfilling and maintained in vertical alignment with the top flush with finish grade. The valve box shall be set so as not to transmit traffic loads to the valve.

B. Before backfilling, all exposed portions of any bolts shall be coated with two coats of bituminous paint.

C. Install valve floor stand operators with stainless steel bolts.

D. Apply wax tape protective wrapping to all exposed metal appurtenances and joints below final grade in accordance with the manufacturer's written instructions. Apply primer to all surfaces. Fill void areas with mastic to produce a uniform surface for subsequent tape wrapping.

3.03 INSTALLATION OF TAPPING SLEEVES AND VALVES

A. The proper authority shall be contacted and their permission granted prior to tapping a "live" line. The required procedures and time table shall be followed exactly.

B. Installation shall be made under pressure and flow shall be maintained. The diameters of the tap shall be not less than 1/4-in less than the inside diameter of the branch line.

C. The entire operation shall be conducted by workers experienced in the installation of tapping sleeves and valves. The tapping machine shall be furnished by the CONTRACTOR.

D. Determine the location of the line to be tapped to confirm that the proposed location will be satisfactory and that no interference will be encountered such as joints or fittings. No tap or sleeve will be made closer than three feet from a pipe joint.

E. Tapping sleeve and valve with boxes shall be set squarely centered on the line to be tapped. Adequate support shall be provided under the sleeve and valve during the tapping operation. Thrust blocks or other permanent restraint acceptable to the ENGINEER shall be provided behind all tapping sleeves. Proper tamping of supporting pipe bedding material around and under the valve and sleeve is mandatory for buried installations.

F. After completing the tap, the valve shall be flushed to ensure that the valve seat is clean. All proper regulatory procedures (including disinfection) shall be followed exactly.

3.04 FIELD TESTS AND ADJUSTMENTS

A. Conduct a functional field test of each valve, including actuators and valve control equipment, in presence of ENGINEER to demonstrate that each part and all components together function correctly. All testing equipment required shall be furnished by the CONTRACTOR.

3.05 MANUFACTURER'S SERVICE

A. Furnish the services of a qualified representative of the tapping equipment manufacturer to provide on-site instruction during wet tapping of the existing water mains indicated on the Drawings.

B. Following installation of the butterfly valves, furnish the services of a qualified, factory-trained representative of the manufacturer of the respective valves, to check the installations before they are placed in operation, supervise initial operations and testing in the presence of the ENGINEER, instruct the plant personnel in care and maintenance of the equipment, and make all necessary field adjustments. A minimum of one 8-hour day shall be provided for these services. In the event of trouble with the equipment, the representative of the respective manufacturer shall revisit the site as often as necessary until all troubles are corrected and the installation is entirely satisfactory.

3.06 INSTALLATION OF ECCENTRIC PLUG VALVES

A. Plug valves shall be installed in strict accordance with the manufacturer's published recommendations and the applicable provisions of Section 15100.

B. Eccentric Plug Valves: Unless otherwise directed, the following rules shall be observed for the installation of eccentric plug valves on sewage, sludge, or other liquid systems containing solids, silt, or fine sand:

1. The valves shall be positioned with the stem in the horizontal direction.

2. In horizontal pipelines, the plug shall swing upwards when opening, to permit flushing out of solids.

3. The orientation of the valve shall prevent the valve body from filling up with solids when closed; however, where the pressure differential through the valve exceeds 25 psi, the higher pressure for valves without worm gear, electric, or air operators shall be through the valve to force the plug against the seat.

4. Valves which may be closed for extended periods (stand-by, bypass, or drain lines) and valves with reversed flow (higher pressure on downstream side, forcing the plug away from its seat), shall be equipped with worm gear operators for all sizes.

5. For special applications or when in doubt, consult with the manufacturer prior to installation.

END OF SECTION

SECTION 15140

PIPE HANGERS AND SUPPORTS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals and install required pipe hangers, pipe supports, concrete inserts and anchor bolts for supporting non-buried piping as shown on the Drawings and as specified herein.

B. The absence of pipe supports and details on the Drawings shall not relieve the CONTRACTOR of the responsibility for providing them. Pipe supports indicated on the Drawings are shown only to convey the intent of the design for a particular location and are not intended to represent a complete system.

1.02 RELATED WORK

A. Concrete is included in Division 3.

B. Miscellaneous metal is included in Section 05500.

C. Pipe and fittings are included in respective sections of Divisions 13 and 15.

D. Valves and appurtenances are included in Section 15100.

E. Hangers and supports pertaining to HVAC and Plumbing systems are included in their respective Sections.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, complete sets of shop drawings of all items to be furnished under this Section. Submittals shall include complete layouts, schedules, location plans and complete total bill of materials for all pipe support systems.

B. Submittals shall include a representative catalog cut for each different type of pipe hanger or support indicating the materials of construction, important dimensions and range of pipe sizes for which that hanger is suitable. Where standard hangers and/or supports are not suitable, submit detailed drawings showing materials and details of construction for each type of special hanger and/or support. Provide detailed information on anti-seize compound.

C. Submittals shall include complete piping drawings as submitted for each piping submittal indicating type of hanger and/or support, location, magnitude of load transmitted to the structure and type of anchor, guide and other pipe supporting appurtenances including structural fasteners.

D. Types and locations of pipe hangers and/or supports shall also be shown on the piping layouts for each piping submittal as specified in the respective Division 13 and 15 pipe sections.

Service conditions for each piping system, including service temperatures, and operating and test pressures, are tabulated in the piping sections.

E. Submit complete design data for pipe support systems to show conformance with this Section.

F. Support System Design

1. Engage the services of an independent registered Professional Engineer licensed in the State of California ordinarily engaged in the business of pipe support systems analysis, to analyze system piping and service conditions and to develop a detailed support system, specific to the piping material, pipe joints, valves and piping appurtenances proposed for use.

2. The support system design shall include:

a. Criteria by piping system.

b. Summary of CONTRACTOR-selected related components including joints, class, valves appurtenances, etc, and commercial supports and especially including pipe materials.

c. All aspects of the analysis and design shall comply with the provisions of ANSI B31.1 and the referenced standards.

d. Support arrangements shall be coordinated to eliminate interference with similar systems to be installed under HVAC, Plumbing and Electrical; to account for structural expansion joints and to maintain access for both personnel and for the removal of equipment. Support systems shall not include the use of monorail or bridge crane support. Nor shall they rely on the horizontal structural struts.

e. Commercial hardware and custom supports shall comply with the requirements of this Section.

f. Expansion joints shall comply with the provisions of Section 15120.

g. Calculations and drawings for the structural supports shall be prepared and sealed by a Professional Civil or Structural Engineer registered in the State of California.

1.04 REFERENCE STANDARDS

A. Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS)

1. MSS SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture.

2. MSS SP-69 - Pipe Hangers and Supports - Selection and Application.

B. American Society for Testing and Materials (ASTM)

1. ASTM A36 - Standard Specification for Carbon Structural Steel.

2. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

C. American National Standards Institute (ANSI)

1. ANSI B31.1 - Power Piping.

D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. All hangers, supports and appurtenances shall conform to the latest applicable requirements of ANSI B31.1, except as supplemented or modified by the requirements of this Section.

B. All hangers, supports and appurtenances shall be of approved standard design where possible and shall be adequate to maintain the supported load in proper position under all operating conditions. The minimum working factor of safety for all supporting equipment, with the exception of springs, shall be five times the ultimate tensile strength of the material, assuming 10-ft of waterfilled pipe being supported.

C. All pipe and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall not be transmitted to their equipment, submit certification stating that such requirements have been complied with.

1.06 DELIVERY, STORAGE AND HANDLING

A. All supports and hangers shall be crated, delivered and uncrated so as to protect against any damage.

B. All parts shall be properly protected so that no damage or deterioration shall occur during a prolonged delay from the time of shipment until installation is completed.

C. Finished metal surfaces not galvanized, that are not of stainless steel construction, or that are not coated, shall be grease coated, to prevent rust and corrosion.

PART 2 PRODUCTS

2.01 GENERAL

A. All of the equipment specified herein is intended to support the various types of pipe and piping systems shown on the Drawings. It shall be the responsibility of the CONTRACTOR to develop final details and any details associated with special conditions not already covered to meet the system conditions (in particular system temperatures and pressures) specified in the respective Division 13 and 15 Pipe Sections.

B. All pipe and tubing shall be supported as required to prevent significant stresses in the pipe or tubing material, valves, fittings and other pipe appurtenances and to support and secure the pipe in the intended position and alignment. All supports shall be designed to adequately secure the

pipe against excessive dislocation due to thermal expansion and contraction, internal flow forces and all probable external forces such as equipment, pipe and personnel contact. Any structural steel members required to brace any piping from excessive dislocation shall conform to the applicable requirements of Section 05500 and shall be furnished and installed under this Section.

C. The CONTRACTOR may propose minor adjustments to the piping arrangements in order to simplify the supports, or in order to resolve minor conflicts in the work. Such an adjustment might involve minor change to a pipe centerline elevation so that a single trapeze support may be used.

D. Where flexible couplings are required at equipment, tanks, etc., the end opposite to the piece of equipment, tank, etc., shall be rigidly supported, to prevent transfer of force systems to the equipment. No fixed or restraining supports shall be installed between a flexible coupling and the piece of equipment.

E. All pipe and appurtenances connected to the equipment shall be supported in a manner to prevent any strain from being imposed on the equipment or piping system.

F. All rods, clamps, hangers, inserts, anchor bolts, brackets and components for interior pipe supports shall be furnished with galvanized finish, hot dipped or electro-galvanized coated, except where field welding is required, where cold-applied galvanizing may be used. Interior clamps on plastic pipe shall be plastic coated. Supports for copper pipe shall be copper plated or shall have a 1/16-in plastic coating. All rods, clamps, hangers, inserts, anchor bolts, brackets and components for exterior pipe, submerged pipe and pipe within outdoor structures shall be of Type 316 stainless steel.

G. Supports shall be sufficiently close together such that the sag of the pipe is within limits that will permit drainage and avoid excessive bending stresses from concentrated loads between supports.

H. All uninsulated non-metallic piping such as PVC, CPVC, etc, shall be protected from local stress concentrations at each support point. Protection shall be provided by galvanized steel protection shields or other method as approved by the ENGINEER. Where pipes are bottom supported 180 degrees, arc shields shall be furnished. Where 360 degree arc support is required, such as U bolts, protection shields shall be provided for the entire pipe circumference. Protection shields shall have an 18 gauge minimum thickness, not be less than 12-in in length and be securely fastened to pipe with stainless steel or galvanized metal straps not less than 1/2-in wide.

I. All insulated pipe shall be furnished with a rigid foam insulating saddle at each pipe support location as specified under respective pipe insulation. Provide protection shields as specified in at each support location.

J. Where pipe hangers and supports come in contact with copper piping provide protection from galvanic corrosion by; wrapping pipe with 1/16-in thick neoprene sheet material and galvanized protection shield; isolators similar to Elcen, Figure No. 228; or copper plated or PVC coated hangers and supports. All stainless steel piping shall be isolated from all ferrous materials, including galvanized steel by use of neoprene sheet material and protection shields, similar to above methods.

K. Pipe supports shall be provided as follows:

1. Cast iron and ductile iron, steel and stainless steel piping shall be supported at a maximum support spacing of 10-ft with a minimum of one support per pipe section at the joints.

2. Insofar as is possible, floor supports shall be given preference. Typical concrete supports are shown on the structural drawings. Base elbow and base tees shall be used where possible.

3. Support spacing for steel and stainless steel piping 2-in and smaller diameter and copper tubing shall not exceed 5-ft.

4. For all stainless steel piping, provide neoprene isolators between the pipe and support components.

5. Supports for multiple PVC plastic piping shall be continuous wherever possible. Individually supported PVC pipes shall be supported as recommended by the manufacturer except that support-spacing shall not exceed 3-ft. Multiple, suspended, horizontal plastic PVC pipe runs, where possible, shall be supported by ladder type cable trays such as the Electray Ladder by Husky-Burndy; the Globetray by the Metal Products, a Division of United States Gypsum, or equal. Ladder shall be of galvanized steel construction. Rung spacing shall be 12-in. Tray width shall be approximately 6-in for single runs and 12-in for double runs. Ladder type cable trays shall be furnished complete with all hanger rods, rod couplings, concrete inserts, hanger clips, etc, required for a complete support system. Individual plastic pipes shall be secured to the rungs of the cable tray by strap clamps or fasteners similar to Globe, Model M-CAC; Husky-Burndy, Model SCR or equal. Spacing between clamps shall not exceed 9-ft. The cable trays shall provide continuous support along the length of the pipe. Individual clamps, hangers and supports in contact with plastic PVC pipe shall provide firm support but not so firm as to prevent longitudinal movement due to thermal expansion and contraction.

6. All vertical pipes shall be supported at each floor or at intervals of not more than 12-ft by approved pipe collars, clamps, brackets, or wall rests and at all points necessary to insure rigid construction. All vertical pipes passing through pipe sleeves shall be secured using a pipe collar.

7. Pipe supports shall not induce point loadings but shall distribute pipe loads evenly along the pipe circumference.

8. Supports shall be provided at changes in direction and elsewhere as shown in the Drawings or as specified herein. No piping shall be supported from other piping or from metal stairs, ladders and walkways, unless specifically directed or authorized by the ENGINEER.

9. Pipe supports shall be provided to minimize lateral forces through valves, both sides of split type couplings and sleeve type couplings and to minimize all pipe forces on pump housings. Pump housings shall not be utilized to support connecting pipes.

10. Effects of thermal expansion and contraction of the pipe shall be accounted for in the pipe support selection and installation.

L. Unless otherwise specified herein, pipe hangers and supports shall be standard catalogued components, conforming to the requirements of MSS-SP-58 and -69; and shall be as manufactured by Grinnell Co., Inc., Providence, RI; Carpenter & Patterson, Inc., Woburn, MA; F&S Central, Brooklyn NY; Elcen Metal Products Co., Franklin Park, IL and Unistrut Northeast, Cambridge, MA or equal. Any reference to a specific figure number of a specific manufacturer is for the purpose of establishing a type and quality of product and shall not be considered as proprietary.

M. Any required pipe supports for which the supports specified in this Section are not applicable shall be fabricated or constructed from standard structural steel shapes, concrete and anchor hardware similar to items previously specified herein and shall be subject to the approval of the ENGINEER.

N. See Section 05500 for anchor products.

O. Hanger rods shall be hot rolled steel, machine threaded and galvanized after fabrication. The strength of the rod shall be based on its root diameter. Hanger rods shall be attached to concrete structures using concrete inserts similar to F&S, Figures 180, 571 or 150; or continuous concrete inserts per F&S. Inserts shall be malleable iron, or steel with galvanized finish. Beam clamps, C clamps or welded beam attachments shall be used for attaching hanger rods to structural steel members. Where necessary and approved by the ENGINEER, expansion anchors shall be used for attaching to concrete structures.

2.02 SINGLE PIPE HANGERS

A. Single pipes shall be supported by hangers suspended by hanger rods from structural steel members, concrete ceilings, bottom of trapeze hangers and wall mounted steel angle brackets.

B. Except as otherwise specified herein, pipe hangers shall be steel, of the adjustable clevis type similar to Grinnell, Figure No. 65, 260 and 590 as required.

C. Where pipes are near walls, beams, columns, etc., and located an excessive distance from ceilings or underside of beams, welded steel wall brackets similar to Carpenter and Patterson, Figure No. 69-68, 84 or 139 shall be used for hanging pipe. Where single pipes rest on top of bracket pipe supports, attachments shall meet requirements as specified under multiple pipe hangers.

2.03 MULTIPLE PIPE HANGERS

A. Suspended multiple pipes, running parallel in the same horizontal plane, which are adjacent to each other shall be suspended by trapeze type hangers or wall brackets. Trapeze hangers shall consist of galvanized structural steel channel supported from galvanized threaded rod or attached to concrete walls, columns or structural steel support members as required to meet the intent of this Section. Channel shall be similar to F&S, Figure 710, rods, concrete inserts, "C" clamps, beam clamps, welded beam attachments and expansion shields shall be as specified in Paragraph 2.02 above.

B. Except as otherwise specified herein pipe anchors used for attaching pipe to trapeze or multiple pipe wall brackets shall be anchor or pipe chairs similar to F&S, Figures 158, 419, 160A, 160B

as required. Material of construction shall be galvanized steel. Chair "U" bolts shall be tightened to allow freedom of movement for normal expansion and contraction except where pipe must be anchored to control direction of movement or act as a thrust anchor.

2.04 SINGLE AND MULTIPLE PIPE SUPPORTS

A. Single pipes located in a horizontal plane close to the floor shall be supported by one of the methods as shown on the Drawings and as specified herein.

B. Pipes 3-in in diameter and larger shall be supported by adjustable stanchions similar to F&S, Figure 427. Stanchions shall provide at least 4-in adjustment and be flange mounted to floor.

C. Pipes less than 3-in in diameter shall be held in position by supports fabricated from steel "C" channel, welded post base similar to Unistrut, Figure P2072A and pipe clamps similar to Unistrut, Figures P1109 thru P1126. Where required to assure adequate support, fabricate supports using two vertical members and post bases connected together by horizontal member of sufficient load capacity to support pipe. Wherever possible supports shall be fastened to nearby walls or other structural member to provide horizontal rigidity. More than one pipe may be supported from a common fabricated support.

D. Where shown on the Drawings, pipe shall be supported using concrete anchor posts. Pipe shall be securely fastened to the posts using suitable metal straps as required and as approved.

2.05 WALL SUPPORTED PIPES

A. Single or multiple pipes located adjacent to walls, columns or other structural members, whenever deemed necessary, shall be supported using welded steel wall brackets similar to Carpenter and Patterson, Figure No. 69-78, 84, or 134; or "C" channel with steel brackets similar to Unistrut pipe clamps. All members shall be securely fastened to wall, column, etc, using double expansion shields or other method as approved by the Engineer. Additional wall bearing plates shall be provided where required.

B. Pipe shall be attached to supports using methods specified herein to meet the intent of this Section.

2.06 BASE ANCHOR SUPPORT

A. Where pipes change direction from horizontal to vertical via a bend, a welded or cast base bend support shall be installed at the bend to carry the load. The base bend shall be fastened to the floor, pipe stanchion, or concrete pedestal using expansion anchors or other method as approved by the Engineer.

B. Where shown on the Drawings, pipe bends shall be supported using concrete anchor posts. Pipes shall be securely fastened to the concrete supports with suitable metal bands as required and approved by the ENGINEER. A felt insert shall be used to isolate the piping from the poured concrete.

2.07 VERTICAL PIPE SUPPORTS

A. Where vertical pipes are not supported by a Unistrut system as specified in Paragraph 2.08 below, they shall be supported in one of the following methods.

1. For pipes 1/4-in to 2-in in diameter, an extension hanger ring shall be provided with an extension rod and hanger flange. The rod diameter shall be as recommended by the manufacturer for the type of pipe to be supported. The hanger ring shall be steel or PVC clad depending on the supported pipe. The hanger ring shall be equal to Carpenter & Paterson, Figure No. 81 or 81CT. The anchor flange shall be galvanized malleable iron similar to Carpenter and Patterson, Figure No. 85.

2. For pipes equal to or greater than 2-in in diameter extended pipe clamps similar to Carpenter and Patterson, Figure No. 267 may be used. The hanger shall be attached to concrete structures using double expansion shields, or to steel support members using welding lugs similar to Carpenter and Patterson, Figure No. 220.

3. Pipe riser clamps shall be used to support all vertical pipes extending through floor slabs. Riser clamps shall be steel similar to Carpenter and Patterson, Figure No. 126. Copper clad or PVC coated clamps shall be used on copper pipes. Insulation shall be removed from insulated pipes prior to installing riser clamps. Insulation shall not be damaged by clamp installation.

4. Unless otherwise specified, shown, or specifically approved by the ENGINEER, vertical runs exceeding 12-ft shall be supported by base elbows/tees, clamps, brackets, wall rests and pipe collars, all located as required to ensure a rigid installation.

2.08 SPECIAL SUPPORTS

A. Pipe supports shall be provided for closely spaced vertical piping systems required to provide a rigid installation. The interval of vertical support spacing shall be as specified, but in no case shall vertical interval exceed 10-ft. The support system shall consist of a framework suitably anchored to floors, ceilings or roofs.

B. Vertical and horizontal supporting members shall be U shaped channels similar to Unistrut, Series P1000. Vertical piping shall be secured to the horizontal members by pipe clamps or pipe straps. All components shall be of steel.

C. For piping 3-in and smaller, the framework shall be as manufactured by the Unistrut Corporation; Globe-Strut as manufactured by the Metal Products Division of U.S. Gypsum or equal. For piping larger than 3-in, the support frame shall be fabricated from structural steel shapes and secured through the use of expansion anchors.

D. The assemblies shall be furnished complete with all nuts, bolts and fittings required for a complete assembly including end caps for all unistruts members.

E. The design of each individual framing system shall be the responsibility of the CONTRACTOR. Shop drawings, as specified above shall be submitted and shall show all details of the installation, including dimensions and types of supports. In all instances the

completed frame shall be adequately braced to provide a complete rigid structure when all the piping has been attached.

F. Supports not otherwise described in this Section shall be fabricated or constructed from standard structural steel shapes in accordance with applicable provisions of Section 05500, or unistrut-type frame; have anchor hardware similar to items previously specified herein, shall meet the minimum requirements listed below and be subject to the approval of the ENGINEER.

1. Pipe support systems shall meet all requirements of this Section and all related Sections.

2. Complete design details of the pipe support system and system components shall be submitted for review and approval as specified in PART 1. No hanger or support shall be installed without the written approval of the ENGINEER.

3. The pipe support system shall not impose loads on the supporting structures in excess of the loads for which the supporting structure is designed.

2.09 SUPPORTS FOR GROOVED DUCTILE IRON PIPING

A. Grooved ductile iron piping systems proposed by the CONTRACTOR as substitute to the flanged ductile iron piping system shown on the Drawings and specified in Section 15072 shall be acceptable, in part, subject to the following hanger and support system revised requirements.

1. Take extreme caution in any and all field cut grooves, due to the criticality of the dimensions and location of the grooves. No field grooved piping shall be assembled without the inspection and verification of the groove by the CONTRACTOR and in the presence of the ENGINEER. All couplings connected to a field groove shall be spot-painted.

2. At each change in direction the piping shall be restrained against the axial direction of movement and against resultant pressure thrust, due to potential joint movement due to out-of-spec grooving.

B. If, in the course of testing or operation there is any pipe movement, it shall require the removal of the length of pipe.

2.10 SURFACE PREPARATION AND SHOP PRIME PAINTING

A. All surfaces shall be prepared and shop painted as part of the work of this Section. Surface preparation and shop painting shall be as specified in Section 09901.

PART 3 EXECUTION

3.01 INSTALLATION

A. Proceed with the installation of piping and supports only after any building structural work has been completed and new concrete has reached its 28-day compressive strength.

B. The installation of pipe support systems shall in no way interfere with the operation of the overhead bridge cranes, monorails, access hatches, etc.

C. The installed systems shall not interfere with maintenance and operational access to any equipment installed under this Section, or any other related Section.

D. All pipes horizontal and vertical, requiring rigid support shall be supported from the building structure by approved methods. Supports shall be provided at changes in direction and elsewhere as shown in the Drawings or as specified herein. No piping shall be supported from metal stairs, ladders and walkways unless specifically directed or authorized by the ENGINEER.

E. All pipe supports shall be designed with liberal strength and stiffness to support the respective pipes under the maximum combination of peak loading conditions to include pipe weight, liquid weight, liquid movement and pressure forces, thermal expansion and contraction, vibrations and all probable externally applied forces. Prior to installation, all pipe supports shall be approved by the ENGINEER.

F. Pipe supports shall be provided to minimize lateral forces through valves, both sides of split type couplings and sleeve type couplings (within four pipe diameters) and to minimize all pipe forces on pump housings. Pump housings shall not be utilized to support connecting pipes.

G. Inserts for pipe hangers and supports shall be installed on forms before concrete is placed. Before setting these items, all Drawings and figures shall be checked which have a direct bearing on the pipe location. Responsibility for the proper location of pipe supports is included under this Section.

H. Continuous metal inserts shall be embedded flush with the concrete surface.

I. Apply anti-seize compound to all nuts and bolts. Supports installed without the approved compound shall be dismantled and correctly installed, at no additional cost to the OWNER.

3.02 TESTING

A. All pipe support systems shall be tested for compliance with this Section. After installation, each pipe support system shall be tested in conjunction with the respective piping pressure tests. If any part of the pipe support system proves to be defective or inadequate, it shall be repaired or augmented under this Section to the satisfaction of the ENGINEER.

END OF SECTION

SECTION 15400

PLUMBING - GENERAL PROVISIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment, services and incidentals required and install and test a complete plumbing system as specified and shown on the Drawings and Specifications:

1. 15410 - Plumbing - Piping Systems

B. More specifically the work shall include, but shall not be limited to the following:

1. All items included under the Scope of Work of other Plumbing Sections.

2. Cutting, coring and rough patching in accordance with Section 01045.

3. All parts necessary to make a complete Plumbing System ready for continuous operation.

4. The absence of pipe supports and details on the Drawings shall not relieve the CONTRACTOR of the responsibility for providing them.

1.02 RELATED WORK

A. The following work related to, but not covered under the plumbing work will be done under other related Sections.

1. All piping systems in the building other than the plumbing work specified in the Plumbing Sections.

2. Yard piping for sanitary and storm drains beyond 10-ft-0-in outside the building unless otherwise indicated.

3. Source for potable and protected water and gas services shall terminate as hereinafter specified.

4. Valve tags are furnished under Section 01170, but installed on Plumbing items under this Section.

5. Excavating and backfilling is included under Division 2.

6. Manholes, catch basins, gasoline trap and buried pipe encasement are included under Division 2.

7. Concrete is included under Division 3.

8. Painting is included under Division 9.

9. Ductwork is included elsewhere in Division 15.

10. Electrical work is included under Division 16.

1.03 SUBMITTALS

A. Inspection by the ENGINEER's representative or failure to inspect shall not relieve the CONTRACTOR of responsibility to provide materials and perform the work in accordance with the documents.

B. Submit, in accordance with Section 01300, shop drawings and product data to establish compliance with this Section. Submittals shall include the following:

1. Shop drawings and technical literature covering details of all equipment, fixtures and accessories being furnished under this Section prior to fabrication, assembly or shipment.

2. Provide a list of recommended spare parts as well as spare parts being provided.

3. Furnish no less than 15 days before start-up, a schedule of all exposed valves installed under this Section. The schedule shall include for each valve the location, type, a number, words to identify the valve function, and the normal operating position.

4. Detailed layout drawings of piping in mechanical rooms and other congested areas shall be provided. Drawings shall show the locations of piping appurtenances, specialties, and all valve banks.

5. For units that will be shipped exposed, provide a description of the protective packaging that will be used during transit.

6. All submittals shall contain a statement that Section 15400 and all other referenced Sections have been read and complied with. The certification statement shall be made by all of the following that are applicable; the CONTRACTOR, sub-contractor and the vendor. The statement shall be an individual statement for each party involved, and shall be included with every submittal and resubmittal.

C. Operation and Maintenance Data

1. Operating and maintenance manuals shall be furnished to the ENGINEER as provided in 01730. The manuals shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc, that are required to assist operation and maintenance personnel unfamiliar with such equipment. The following information shall be considered a minimum. Where applicable, provide information required for specific pieces of equipment.

a. Personnel familiar with the operation and maintenance of the specific information shall prepare manuals.

b. Equipment shall be identified with the ENGINEER's Equipment Numbers and Identification as shown in the Schedules and on the Drawings.

c. Provide information in three ring binders. All sheets shall have reinforced punches. Tabbed dividers shall separate all sections. Drawings will be bound in the manual, or contained in envelopes bound into the manual.

2. Contents - Each volume shall contain the following minimum contents:

a. Installation including instructions for unpacking, installing, aligning, checking and testing. Foundation data, allowable piping loads, and electrical design shall be included.

b. Operating Instructions to provide pre-operational checks, start up and shut down, and description of all control modes. Include emergency procedures for all fault conditions and actions to be taken for all alarms. Procedures for long term storage shall be included.

c. Maintenance shall include preventive, and corrective. Schedules for test of other functions are to be included. Provide a list of tools required to service the equipment. Trouble shooting instructions to include a trouble-shooting guide shall be included.

D. In general, corrections or comments or lack there of, made relative to submittals during review shall not relieve the CONTRACTOR from compliance with the requirements of the drawings and specifications. Submittals are for review of general conformance with the design concepts of the project and general compliance with the contract documents. The CONTRACTOR is responsible for the final design conforming and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction, coordinating the work of all trades, and performing the work in a safe and satisfactory manner.

1.04 MANUFACTURERS SERVICES

A. A representative of the manufacturer who has complete knowledge of proper operation and maintenance shall be provided for the number of 8 hour days as listed below to instruct representatives of the OWNER and the ENGINEER on proper operation and maintenance. With the OWNER's permission, this work may be conducted in conjunction with the inspection and the installation and test run as provided under PART 3. If there are difficulties in operation of the equipment due to the manufacturer's design or fabrication, additional service shall be provided at no additional cost to the OWNER.

B. Provide manufacturer's services for testing and start-up of the following equipment:

1. Reduced Pressure Backflow Preventers (1-Day).

1.05 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

B. American National Standards Institute (ANSI)

C. American Water Works Association (AWWA)

D. National Fire Protection Association (NFPA)

E. National Electrical Manufacturers Association (NEMA)

F. Plumbing and Drainage Institute (PDI)

G. Cast Iron Soil Pipe Institute (CISP)

H. Underwriters Laboratories (UL)

I. Factory Mutual (FM)

J. American Society of Plumbing Engineers Data Book (May be used as a design guide.)

K. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.06 QUALITY ASSURANCE

A. The CONTRACTOR shall be fully responsible for the proper execution and performance of the work described herein. It shall be their responsibility to inspect all installation conditions and bring to the attention of the ENGINEER any conditions which may affect their work adversely. They shall report to the ENGINEER, prior to commencing any portion of this work, any conditions unsuitable for the installation of their portion of the work.

B. Mention herein or indication on the Drawings of equipment, materials, operation or methods shall require that each item mentioned or indicated be provided to make a complete system of plumbing ready for continuous operation.

C. The location of all equipment, fixtures and piping shall be considered as approximate only and the right is reserved by the ENGINEER to change at any time, before the work is installed, the position of such equipment and piping to meet structural conditions and to provide proper headroom clearance or for other sufficient causes and such changes shall be made without additional expense to the OWNER.

D. Attention is called to the necessity for elimination of transmission of vibration from mechanical equipment to building structures. All equipment, therefore, shall be carefully selected and installed to meet this condition and isolators and water hammer arrestors shall be provided where required.

E. Instruct such persons as designated by the OWNER in the care and use of all plumbing equipment and piping systems installed.

F. Comply with all the laws, ordinances, codes, rules and regulations of the State, local or other authorities having jurisdiction over any of the work specified herein.

G. Obtain all required permits and pay all legal fees for the same and in general take complete charge and responsibility for all legal requirements pertaining to this Section of the work.

H. Requirements set forth in this Section and indicated on the Drawings shall be followed when in excess of the required or minimum regulations.

I. If any work is performed and subsequent changes are necessary to conform to the regulations, such change shall be made as part of this work at no additional cost to the OWNER.

J. All work shown on the Drawings is intended to be approximately correct to scale, but figured dimensions and detailed drawings shall be followed in every case. The Drawings shall be taken in a sense as diagrammatic. Size of pipes and general method of running them are shown, but it is not intended to show every offset and fitting nor every structural difficulty that may be encountered. To carry out the true intent and purpose of the Drawings all necessary parts to make complete working systems ready for use shall be furnished without extra charge.

K. Refer to the Structural and Architectural Drawings which indicate the type of construction in which the work shall be installed. Locations shown on the Plumbing Drawings shall be checked against the general and detailed drawings of the construction proper. All measurements must be taken at the building.

L. All equipment of a given type included in this Section shall be furnished by or through a single manufacturer or as specified on the schedules

M. Inspection by the ENGINEER's representative or failure to inspect shall not relieve the CONTRACTOR of responsibility to provide materials and perform the work in accordance with the documents.

N. The piping manufacturer shall furnish an affidavit of compliance certifying that all materials used and work performed complies with the specified requirements. The CONTRACTOR shall provide copies of mill test confirming the type of material used in the various components.

O. The OWNER and ENGINEER reserve the right to sample and test any materials after delivery and to reject all components represented by a sample that fails to comply with the specified requirements.

P. An authorized representative of the manufacturer shall perform the initial startup of the equipment. The OWNER and ENGINEER shall witness startup. The use of local sales representatives to perform this work is not acceptable, unless the manufacturer provides documented evidence that the sales representative has been specifically trained for this work.

Q. All rotating parts of equipment shall be statically and dynamically balanced at the factory.

1.07 ENGINEERING SERVICES

A. When engineering services are specified to be provided by the CONTRACTOR, the CONTRACTOR shall retain a licensed professional engineer to perform the work. The engineer shall be licensed at the time the work is done and in the state in which the project is located. If the state issues discipline specific licenses, the engineer shall be licensed in the applicable discipline. In addition, the ENGINEER shall be experienced in the type of work being provided.

B. All work is to be done according to the applicable regulations for professional engineers, to include signing, sealing and dating documents. When submittals are required by a professional engineer, in addition to state required signing and sealing, a copy of the current wallet card or wall certificate indicating the date of expiration shall be included with the submittal.

1.08 SERVICE AND UTILITY CONNECTIONS

A. Sanitary Water

1. The sanitary waste and drainage systems shall terminate at the sump pits or at points 10-ft-0-in outside the building or as otherwise shown on the Drawings.

B. Water Service

1. The source of water for potable and protected use in the building will be brought to the building under another Division of the work and left as a flanged connection 8-in to 12-in outside of the foundation wall or above the finish floor, except where noted otherwise.

2. The water meter and backflow preventer units shall be furnished and installed complete with all components as shown on Water Piping Diagrams. The water connections shall be made to these units as shown and from these points furnish and install all water to the equipment as shown on the Drawings.

C. Natural Gas Services

1. Will be brought to exterior locations adjacent to building where shown on the Drawings, complete with meters and pressure regulators.

2. Make the final connection to each meter and regulator outlet and extend each service into the building. From each point, extend the service and make all final valved connections to each demand as shown on the Drawings.

1.09 DELIVERY, STORAGE AND HANDLING

A. Refer to requirements of Section 01600.

B. All materials shall be inspected for size, quality and quantity against approved shop drawings upon delivery.

C. Delivery schedule of all equipment shall be coordinated with the CONTRACTOR. Equipment ready for shipment prior to the agreed on shipping date shall be stored without cost to the OWNER by the manufacturer.

D. All materials shall be suitably packed for shipment and long term storage. Each package shall be labeled to indicate the project and the contents of each package. Where applicable, equipment numbers shall be marked on the container.

E. All equipment shipped that is exposed such as on a flat bed truck shall be protected during transit. The equipment shall be protected from moisture, road salt, dirt and stones or other materials thrown up from other vehicles. Electrical components shall be protected as above, but with special attention to moisture. The method of shipment protection shall be defined in the submittals.

F. Instructions for the servicing and startup of equipment in long term or prolonged storage shall accompany each item.

G. All materials shall be stored in a covered dry location off of the ground. When required to protect the materials they shall be stored in a temperature-controlled location.

1.10 COORDINATION

A. The Drawings indicate the extent and general arrangement of the systems. If any departures from the drawings or specifications are deemed necessary, details of such departures and the reasons therefore shall be submitted as soon as practical for review. No such departures shall be made without the prior written concurrence of the ENGINEER.

B. The CONTRACTOR shall coordinate the location and placement of all concrete inserts and welding attachments with the structural engineer.

C. The CONTRACTOR shall assume full responsibility for coordination of the Plumbing systems, including; scheduling, and verification that all structures, piping and the mounting of equipment are compatible.

D. The CONTRACTOR shall start up each piece of equipment and system and shall make all adjustments so that the system is placed in proper operating condition.

1.11 ELECTRICAL EQUIPMENT

A. Electric motors in NEMA frame sizes shall conform to the requirements in Section 01171, unless otherwise specified herein.

B. Electrical equipment which is furnished under this Section shall meet the requirements specified in Division 16:

1. Disconnect switches, motor starters and combination motor starters (starters with disconnecting means and short circuit protection) shall be as specified in Section 16191.

2. Cord-connected controls for hazardous areas shall be provided with intrinsically safe relays, which shall be as specified in Section 16191.

3. Raceways, boxes, fittings and supports shall be as specified in Section 16110.

4. Wires and cables shall be as specified in Section 16120.

C. Electrical enclosures, panels and components shall be suitable for the environment and electrical classification for the space they are located in. The type of enclosure for the various spaces shall be as specified in Division 16 unless otherwise specified. Refer to the electrical drawings for the space classifications.

1.12 SUPPORTS

A. All components shall be provided with lugs, brackets or field supplied devices to allow the components to be firmly attached to the structure. The lugs, brackets or field supplied devices shall be sized to withstand the seismic loads for the area and type of application.

1.13 SEISMIC RESTRAINTS

A. Seismic restraints shall be provided for all piping and equipment as required by applicable codes. All seismic criteria and design shall comply with Seismic Design Category D.

B. Materials of construction for seismic supports shall be the same as those specified for equipment supports and hangers, and pipe hangers. All bolts shall be stainless steel regardless of the specified support material.

C. Where the seismic criteria and size of piping are within the limits of the latest edition of the SMACNA Seismic Restraint Manual, the restraints as defined in the manual can be used. Restraints shall meet the seismic design criteria in Section 01615.

D. The CONTRACTOR shall retain a professional structural engineer registered in the State of California to provide seismic loadings and designs of seismic restraints. This will include but not be limited to the following:

1. Provide seismic loadings to the vibration isolation supplier based on actual equipment being used to allow the proper selection of vibration isolators.

2. Provide sizing of bolts for attachment of non-vibrating equipment to the structure based on the actual equipment being used.

3. Provide design of required additional bracing for equipment when vibration isolators or bolts are not adequate to withstand seismic forces.

4. Provide design of bracing for all suspending equipment.

E. Provide design of bracing for all piping that exceeds the limitations of the SMACNA Seismic Restraint Manual.

F. Signed and sealed calculations and details shall be submitted for record purposes.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 INSTALLATION

A. All the items specified in Section 15410 under PART 2 shall be installed according to the applicable manufacturer's recommendations, the details shown on the Drawings and as specified herein and in other related Sections.

B. The CONTRACTOR shall start up each piece of equipment and system and shall make all adjustments so that the system is placed in proper operating condition.

C. The CONTRACTOR shall not install any equipment or materials until the OWNER and ENGINEER have approved all submittals. If any equipment or materials are installed prior to approval of the submittals, it shall be at the CONTRACTOR's risk.

D. All work shall be installed in accordance with the manufacturer's printed instructions and shall be rigid, plumb and true to line, with all parts in perfect working order. Maintain protective covers on all units until final cleanup time and at that time remove covers and clean and polish all surfaces.

3.02 VALVE TAGS

A. The work of this Section shall also include the installation of valve tags furnished by the CONTRACTOR. All valves provided under this Section shall be tagged.

3.03 PROTECTION

A. Materials, fixtures and equipment shall be properly protected at all times and all pipe openings shall be temporarily closed so as to prevent obstruction and damage.

3.04 COORDINATION SKETCHES

A. It shall be the responsibility of the subcontractor to have employed a competent coordinator of mechanical systems and as such to provide all coordination of drawings or sketches as may be required or deemed necessary by the ENGINEER to obtain the required ceiling heights and eliminate conflicts with all piping, ducts and electrical installation.

END OF SECTION

SECTION 15410

PLUMBING - PIPING SYSTEMS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The areas where work is to be accomplished is described in Section 15400.

B. This Section specifies the basic Plumbing Systems of Piping and the materials of each system, including valves and associated appurtenances.

C. Furnish all labor, materials, equipment, services and incidentals required and install complete interior Plumbing Piping Systems as shown on the Drawings and as specified herein.

1. Sanitary - Waste and Vent Systems

2. Potable Cold Water Systems

3. Service Water Systems (Non Potable)

4. Natural Gas System

5. Furnishing and installing all piping, valves, dielectric fittings, floor drains, cleanouts, sleeves, hangers and insulation in conjunction with the above listed piping systems.

6. Furnishing of Roof Drains for installation under Division 7.

7. All piping, and equipment shown on the Drawings is intended to be approximately correct to scale, but figured dimensions and detailed drawings of the actual equipment furnished shall be followed in every case. The Drawings shall be taken in a sense as diagrammatic. Size of piping is shown, but it is not the intent to show every offset or fitting, nor every hanger or support, or structural difficulty that may be encountered. To carry out the intent and purpose of the Drawings all necessary parts to make a complete working system ready for use shall be furnished without extra charge. The CONTRACTOR shall be responsible to coordinate the system installation and routing with the work of all trades.

1.02 RELATED WORK

A. Refer to Section 15400.

1.03 SUBMITTALS

A. Submit, in accordance with Sections 15400 and 01300, shop drawings and technical literature covering details of all plumbing-piping systems being furnished under this Section prior to fabrication, assembly or shipment.

B. For units that will be shipped exposed, provide a description of the protective packaging that will be used during transit.

C. All submittals shall contain a statement that Sections 15400, 15410 and all other referenced Sections have been read and complied with. The certification statement shall be made by all of the following that are applicable; the CONTRACTOR, sub-contractor and the vendor. The statement shall be an individual statement for each party involved, and shall be included with every submittal and resubmittal.

D. Detailed layout drawings of piping in mechanical rooms and other congested areas shall be provided. Drawings shall show the locations of piping appurtenances, specialties, and all valve banks.

E. Provide manufacturers catalogs, literature, and engineering data on all hangers and supports. Load ratings, materials, and installation shall be in accordance with the recommendations of MSS SP-58 and MSS SP-69.

1.04 REFERENCE STANDARDS

A. Refer to Section 15400.

1.05 SERVICE AND UTILITY CONNECTIONS

A. Refer to Section 15400.

1.06 QUALITY ASSURANCE

A. Refer to Section 15400.

1.07 DELIVERY, STORAGE AND HANDLING

A. Refer to Section 15400.

1.08 COORDINATION

A. Refer to Section 15400.

1.09 SEISMIC RESTRAINTS

A. Refer to Section 15400.

PART 2 PRODUCTS

2.01 PIPING SYSTEM MATERIALS

A. Sanitary Waste Water Systems

1. The pipe and fittings shall be SV (Service) hub and spigot cast iron soil pipe and fittings conforming to ASTM A74 and ANSI A112.5.1 tarred inside and out at the foundry.

2. Joints for below grade piping shall be installed with compression gaskets conforming to ASTM C564 or shall be installed with lead and oakum.

3. Piping above grade shall be of the above mentioned hub and spigot type or of the No-Hub type conforming to the Cast Iron Soil Pipe Institute Standards 301. Pipe shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.

4. The No-Hub coupling shall be Anaheim Foundry Co. Husky SD4000, Clamp-All 125 or by MG Coupling Co.

5. Copper piping may be used for sanitary waste and vent in sizes 2-in and smaller. Pipe shall be Type "L" used with either cast or wrought DWV fittings. Solder Alloy 95TA (95 percent Tin, 5 percent Antimony), ASTM B32. No solder containing lead shall be utilized on the project.

B. Water Systems (Potable)

1. Piping shall be Type "L" copper with cast bronze or wrought copper, solder type fittings for above grade and Type "K" for where buried or shall be flanged end, ductile iron. Solder Alloy 95TA (95 percent Tin, 5 percent Antimony), ASTM B32. No solder containing lead shall be utilized on the project.

2. All copper piping 2-1/2-in and larger and all buried copper piping shall be Type S-2 brazed. Brazing filler metal classified as BCu4 or BCu5, with minimum melting point of 1300 degrees F. Use wrought fittings for brazing.

C. Natural Gas Systems

1. Low pressure (less than 14-in water column) piping 2-in and smaller shall be Schedule 40, black steel with malleable iron fittings.

2. High pressure (greater than 14-in water column) piping shall be Schedule 40, black steel with welded fittings.

3. Piping larger than 2-in diameter shall be schedule 40 black steel pipe and fittings with welded joints.

4. Gas train vent piping shall be of the same material as that specified for low pressure piping systems.

D. Dielectric Fittings

1. On all water piping systems, provide dielectric fittings at all locations between piping and components of dissimilar metals.

E. Piping Specialties

1. Equipment Connections

a. Connectors shall be corrugated bronze metal with brazed inverted flare-type brass fittings complete with transition for ips connection. Maximum length shall be six feet. Connectors shall be AGA-approved type.

2. Pressure Regulator

a. Pressure regulator shall be service-type, complete with automatic low-pressure cutoff and automatic pressure relief. Shop drawing shall be submitted and shall include performance curves. Body shall be cast iron. Valve shall be capable of shutting off under supply pressures to 100 psi. Valve spring range shall be 7 to 10 inches water gage (wg), and set point shall be 8 inches. Outlet pressure shall vary by not more than ½-in wg from the set point over the capacity range of the regulator. Pressure relief shall be diaphragm-operated, spring-loaded type with vent for relief of excess pressure. Release set point shall be 12 inches wg.

b. Low-pressure cutoff regulator shall be adjustable to shut off gas supply entirely if pressure drops below set point. Supply shall remain shut off until manual reset of regulator takes place.

c. Pressure regulator diaphragm vent and pressure relief vent shall be run as separate, jointless, full size vent lines connected to the vent tapping and terminating at an approved outside location with weatherproof, bugproof, screened vent cap.

3. Pressure Gages

a. Pressure gages shall conform to ASME B40.100, Type I, Class 1. Pressure gage size shall be 3-1/2-inch nominal diameter. Case shall be corrosion-resistant steel conforming to any of the AISI 300 series of ASTM A 666, with a No. 4 standard commercial polish or better. All gages shall be equipped with adjustable red marking pointer and damper screen adjustment in inlet connection.

4. Line Strainers

a. Strainers shall be Y-type with removable basket. Strainers in sizes 2-inch ips and smaller shall have screwed ends; sizes 2-1/2-inch ips and larger shall have flanged ends. Body working pressure rating shall exceed maximum service pressure of system in which installed by at least 50 percent. Body shall have cast-in arrows to indicate direction of flow. All strainer bodies fitted with screwed screen retainer shall have straight threads and shall be gasketed with nonferrous metal. Strainer bodies fitted with bolted-on screen retainers shall have offset blowdown holes. Body material shall be cast bronze conforming to ASTM B 62 or cast iron conforming to Class 30 ASTM A 278/A 278M. Where system material is nonferrous, strainer body material shall be nonferrous.

b. Minimum free hole area of strainer element shall be equal to not less than 3 times the internal area of connecting piping. Strainer screens for natural gas service shall have mesh cloth not to exceed 0.006 inch. Strainer screens shall have finished ends fitted to machined screen chamber surfaces to preclude bypass flow. Strainer element material shall be AISI Type 304 corrosion-resistant steel.

2.02 VALVES

A. General

1. It is the intention of the Plumbing Drawings and this Section to require control valves at the bottom of all water service risers and as shown on the Drawings.

2. Install drawoff valves on the house side of main control valves, at the bottom of all risers, at all low points and where shown on the Drawings. Drawoffs shall consist of a hose end valve as hereinafter described.

3. Group and locate control valves in all locations so they may be easily operated, through access panels, doors, or adjacent to equipment.

4. Valves, in general, shall be of the same manufacture throughout unless noted otherwise. All valves, except as noted otherwise, shall be made for 125 lb steam working pressure and shall have round iron wheel handles.

B. Water Valves

1. All water valves 2-in and smaller shall be full port ball type similar to Watts FBV/FBVS; Apollo 77-200, Nibco T/S 585-70 or Hammond 8301/8311.

2. All check valves 3-in and smaller shall be Hammond IB-912; Stockham B-309 or Nibco Inc. S-413.

3. Hose end valves (HEV) shall be a ball valve with hose end adapter. Units on potable water systems shall be equipped with a hose connection vacuum breaker similar to Watts No. 8A or equal.

C. Gas Valves

1. Gas valves 2-in and smaller shall be three-piece bronze ball valve with threaded ends equal to Hammond 8604; Watts B-6800 (YRPV) or Apollo 82-100, modified with tee handles.

2. Gas valves larger than 2-in shall be lubricated plug valves equal to valves manufactured by Powell; Homestead and Rockwell.

3. Gas valves shall be listed suitable for natural gas service.

2.03 DRAINS

A. For the purpose of explanation and description only, the following drain catalog numbers are taken from the catalogs of Zurn Industries, Inc. unless otherwise noted. Those drains as manufactured by J.R. Smith Mfg. Co. or Josam Mfg. Co. and determined by the Engineer to be equal in every respect to those specified will be acceptable for installation. All drains shall be of sizes, shown on the Drawings.

B. Floor Drains (FD) / Trench Drains (TD)

1. All floor drains and open ended drains shall be fitted with a deep seal cast iron "P" type or "running" type trap to suit drain outlet. Traps shall be acid resisting material where noted.

2. Floor drains shown on the Drawings as (AW) and installed in corrosive resistant piping systems shall be of same material as the acid resisting pipe and fittings described above.

3. All floor drains shall have cast iron or acid resisting drainage flange, seepage control, ½-in trap primer connection where required, clamping collar and inside caulk outlet or resilient gasket pipe connection, unless noted otherwise to be IPS outlet.

4. Schedule of Floor Drains

Type	Cat. No.	Remarks
"B"	Z-415B	Type B strainer with nickel bronze 6-in diameter top

2.04 CLEANOUTS

A. For the purpose of explanation and description only, the following cleanout catalog numbers are taken from the catalogs of Zurn Industries, Inc. unless otherwise noted. Those drains manufactured by J.R. Smith Mfg. Co. or Josam Mfg. Co. as and determined by the ENGINEER to be equal in every respect to those specified will be acceptable for installation. All cleanouts shall be of size shown on the Drawings.

B. In cast iron bell and spigot pipe, cleanouts shall consist of a cast iron ferrule and extra heavy brass tapered screw cleanout plug with square or hexagonal nuts.

C. In threaded pipe, (galvanized steel with recessed drainage pattern fittings) cleanouts shall consist of standard iron pipe size (IPS) brass plugs screwed into drainage fittings.

D. In copper tubing they shall consist of copper to IPS adapters with IPS brass plugs screwed into female threaded portion of the adapter.

E. Acid resisting pipe terminal cleanouts shall be of acid resisting material and of the type recommended by the manufacturer of the pipe and fittings.

F. Flush Floor Cleanouts

1. Flush floor cleanouts (FCO) shall be Zurn Z-1400 or equal.

G. Exterior Cleanouts

1. Exterior cleanouts shown as Exterior FCO shall consist of cast iron floor cleanout with serrated cutoff sections and brass screwed raised head plug, Zurn Z-1449, with heavy cast iron access box and gasketed cover, Zurn Z-1474, or equal. Set flush with concrete slab.

2.05 SLEEVES AND CASTINGS

A. Sleeves

1. Sleeve all piping through walls, beams and partitions. All wall sleeves shall finish flush with the finish line.

2. Sleeve all piping passing through floor slabs. All sleeves shall extend 2-in above the finish floor slab.

3. All sleeves for exterior emergency shower eye wash units shall be packed with insulation.

4. Materials and installation conforming to the requirements of Section 01172 shall be furnished under this Section.

5. Refer to "Typical Detail Sheets" for additional information.

B. Castings

1. Provide waterproof castings on each plumbing pipe penetrating walls of wet wells, tanks or pits. Castings shall be of size and length to suit pipe and wall thickness.

2. Materials and installation conforming to the requirements of Section 01172 shall be furnished under this Section.

2.06 HANGERS, SUPPORTS AND ANCHORS

A. Piping support systems shall include restraints as required by the applicable building codes to withstand seismic loading. Design shall be provided by a professional engineer hired by the CONTRACTOR as specified in Section 15400.

B. The absence of pipe supports and details on the drawings shall not relieve the CONTRACTOR of the responsibility for providing them.

C. In certain locations, pipe supports, anchors, guides, and expansion joints may be indicated on the drawings. The CONTRACTOR shall be responsible to provide a complete system of supports, expansion joints, and anchors. Additional supports may be required adjacent to expansion joints, couplings, and valves.

D. Hangers supporting horizontal piping at ceilings shall be of the clevis type and spaced 8-ft apart for supply and service pipe 1-1/2-in diameter and larger; and 6-ft apart for pipe smaller than 1-1/2-in diameter.

E. Horizontal piping buried in earth under lowest floor slabs shall be supported with the hanger types shown on the Drawings except where otherwise required to be encased in concrete.

F. All hangers shall be of a type to permit vertical adjustment after installation.

G. Supports and hangers for cast iron soil piping shall be installed in accordance with the latest addition of the cast iron soil pipe handbook unless noted otherwise.

2.07 INSULATION

A. All water piping of every description specified herein including rainwater, drinking fountain waste and pressure waste piping shall be completely insulated throughout with 1-in thick Heavy Density Pipe Insulation.

B. All fittings, flanges, roof drain bodies and valves shall be covered with permanently non-combustible, one-piece, factory premolded, insulated fitting covers.

C. Provide at each hanger location a rigid insulation insert with a galvanized metal covering protector shield, equal to items as manufactured by Pipe Shields Inc. or equal. Protector shields shall be of length as recommended by the manufacturer and shall be the same thickness and jacket material as the adjoining insulation.

D. Insulation material shall be of molded rigid fiberglass sectional pipe insulation rated to 500 degrees F. The insulation shall have a minimum density of 3.5 lbs/cu ft and a maximum "K" factor of 0.24 at 75 degrees F mean temperature. Jacket shall be kraft paper bonded to aluminum foil reinforced with fiberglass yarn and self sealing lap with maximum permeability of 0.02 perms.

E. Supplies, drain and trap on handicapped lavatories shall be insulated with fully molded, white, closed cell vinyl insulation kit, Truebro, Model 120W-105 or equal.

2.08 PIPE MARKING AND COLOR CODING

A. Pipe marking is included in Division 9, but it shall be part of the work of this Section to assist as required by the ENGINEER to identify the pipe contents, direction of flow and all pertinent data required for proper marking of pipe.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install all piping, valves, hangers and appurtenances as specified herein and in the referenced Sections above.

B. The CONTRACTOR shall not install any equipment or materials until the OWNER and ENGINEER have approved all submittals. If any equipment or materials are installed prior to approval of the submittals, it shall be at the CONTRACTOR's risk.

C. In general, corrections or comments or lack there of, made relative to submittals during review shall not relieve the CONTRACTOR from compliance with the requirements of the drawings and specifications. Submittals are for review of general conformance with the design concepts of the project and general compliance with the contract documents. The CONTRACTOR is responsible for the final design conforming and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction, coordinating the work of all trades, and performing the work in a safe and satisfactory manner.

D. Valves

1. Install control valves to all locations grouped and located to be easily operated, through access panels, doors, or adjacent to equipment.

2. Install all final Water connections to Process equipment. Each connection shall be preceded by a ball valve directly adjacent to the unit.

3. Install all valves in a horizontal to upright position. Valves shall not be installed in down position from the horizontal.

E. Screwed Connections

1. All screwed connections shall have full thread of true taper, accurate to gauge and conform to ANSI.

2. Reduction in size shall be made using reducing fittings.

3. The use of bushings or close nipples is prohibited. Nipples shorter than 4-in in length shall be Schedule 80.

4. Plugs shall be steel or brass with square head.

5. Screwed joints shall be made with an approved joint compound applied to the male thread only. Caulking of screwed joints will not be allowed.

F. Soldering (Copper Tubing)

1. Tubing shall be cut with square ends and reamed to prevent burrs, out-of-round or improperly sized ends.

2. After cutting, all surfaces to be soldered shall be thoroughly cleaned to a metal-bright finish, free from dirt, grease or other material before fluxing and soldering. This cleaning shall be performed by using emery cloth, sandpaper or steel wool. Clean the outside end of the tubing for a length of 1/2-in greater than the depth of the fitting. The inside of the fittings shall be cleaned in a similar manner. Apply non-corrosive flux and assemble the joint. Acid solder or acid flux will not be allowed.

3. The surfaces to be joined shall be heated up slowly and uniformly to the melting point of the solder. The surface being soldered shall be maintained above the melting point of the solder for sufficient time to draw the solder completely into the joint. When the solder congeals to a plastic state the excess metal shall be removed with a cloth brush, leaving a fillet around the end of the fitting. Full penetration of the solder uniformly throughout the entire socket is required. The soldered joints shall be allowed to cool in still air until only warm to the hand after which the work may be quenched.

4. Any type of crack, pinhole, area of incomplete penetration, or similar defect will not be accepted. Peening for closing up defects shall not be permitted.

5. Heating torches of sufficient size shall be used for heating of large fittings prior to soldering. Multiple tips or ring burners for use on combination torches may be used.

6. Remove all external and internal loose solder and flux after joint cools.

G. Brazing

1. Cutting and cleaning of tubing shall be as specified for soldering operations.

2. Apply flux in accordance with recommendations of manufacturer of brazing filler material being used. Apply to outside of fitting and heat affected area of tubing. Avoid getting flux inside tube. Flux may be omitted when joining copper tubes to wrought copper fittings but is required for joining to cast (bronze) fittings.

3. Assemble joint by inserting tube into socket hard against stop and turning.

4. Heat parts to be joined beginning 1-in from edge of fitting, continuously moving the flame. When flux has become transparent, begin to heat the fitting at the base of the cup, still continuously moving the flame. When flux at fitting is quiet and transparent, maintain heat along joint by moving flame along axis between fitting and tubing.

5. Apply brazing material at point were tubing enters socket of fitting. Avoid putting flame on brazing material. Heated joint should melt brazing material and capillary action will draw material into the joint. When joint is properly made, a fillet of filler metal will be visible completely around the joint. Stop adding filler metal when fillet is formed.

6. After brazing material has solidified, clean off flux residue. Fittings must cool naturally. Quenching will not be allowed.

7. Any type of crack, pinhole, area of incomplete penetration, or similar defect will not be accepted. Penning for closing up defects will not be permitted.

H. Insulation

1. Do not apply insulation until pipes and tanks have been tested and accepted by all parties making inspection. All insulated covering shall be guaranteed for a period of one year.

   a. Insulate piping to hose bibs and hose outlets to a point six feet above the floor.

I. Cleanouts

1. Install cleanouts as directed by applicable code, at end of each branch soil and waste line where waste and soil lines change direction, at the bottom of every riser either as a cleanout tee above floor or end cleanout in the horizontal below the floor.

3.02 FIELD TESTING

A. Provide all air and water necessary for testing the piping systems as specified under this Section of the work. Provide all connections for testing under this Section. Remove all debris resulting from testing. Use the water in an efficient and economical manner.

B. Provide all apparatus and all other supplies or materials which may be necessary for testing the systems and operating the apparatus during the period while tests of any kind are being made, or for carrying out the work of the Contract.

C. The various piping systems shall be subjected to water, smoke, or air tests as noted and shall hold tight at pressures stated without extra pumping or water addition for the time intervals stated.

D. All additional tests, methods or materials that may be required by the local ordinances and not specifically specified herein, shall be made as directed by the ENGINEER or the local inspection authority.

E. Provide for all repeated tests as necessary to make systems tight as required.

F. Test soil, waste, drain, vent piping as follows:

1. Test rough drainage of soil, waste, drain, vent and rainwater leader by plugging piping where it terminates in the building or where it leaves the building by filling each system completely with water to the outlets on the roof after all outlets in section have been plugged or capped, for at least 1 hour duration.

2. If it becomes necessary during the construction of the building to test a part of a section for any reason or to cover permanently any pipe before piping above the part or section has been completed, apply a water test to such part or section of the piping by maintaining a 10-ft head of water on the highest section of the piping and the test shall hold tight for 1 hour.

G. Test water piping as follows:

1. Test all interior potable hot, cold and protected water piping to a water pressure of 150 psi to the lowest level and maintain this pressure without additional pumping for 2 hours.

H. Test gas piping as follows:

1. Test all gas piping with air under pressure as required and recommend by the NFPA Pamphlet Nos. 54 and 58 Regulations which shall be considered as part of this Section.

3.03 CLEANING

A. At the completion of the work, clean all piping, fixtures, equipment, apparatus and exposed trim for same included in this Section and, where required, polish ready for use.

B. Thoroughly disinfect the entire potable water distribution systems with a solution of not less than 50 ppm of available chlorine. Allow the disinfecting solution to remain in the system for a period of 3 hours after which time, open all valves and faucets and flush the system with clean water until the residual chlorine content is not greater than 0.2 ppm, unless otherwise directed.

END OF SECTION

SECTION 15450

PLUMBING - EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The areas where work is to be accomplished is described in Section 15400.

B. Furnish all labor and materials required and install the following Plumbing Equipment complete as specified herein and as shown on the drawings.

1. Caution Sign

2. Reduced Pressure Zone Backflow Preventer (RPZ)

3. Wall Hydrants

1.02 RELATED WORK

A. Refer to Section 15400.

1.03 SUBMITTALS

A. Submit, in accordance with Sections 15400 and 01300, shop drawings and product data, showing materials of construction and details of installation for:

1. Specific items of plumbing equipment as tabulated above under "SCOPE OF WORK".

1.04 REFERENCE STANDARDS

A. Refer to Section 15400.

1.05 QUALITY ASSURANCE

A. Refer to Section 15400.

1.06 DELIVERY, STORAGE AND HANDLING

A. Refer to Section 15400.

PART 2 PRODUCTS

2.01 GENERAL

A. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

B. Similar items of materials/equipment shall be the end products of one manufacturer in order to provide standardization for, appearance, operation, maintenance, spare parts and manufacturer's service.

C. Attention is particularly called to the fact that written approval of all specified equipment proposed for purchase shall be received from the ENGINEER before purchase of any equipment or components of the equipment.

2.02 ELECTRICAL EQUIPMENT

A. Refer to Section 15400.

2.03 ATTACHMENTS

A. All equipment shall be provided with lugs, brackets, or field supplied devices to allow all equipment to be firmly attached to the structure. The lugs, brackets or field supplied devices shall be sized to withstand the seismic loads for the area and type of application.

2.04 REDUCED PRESSURE ZONE BACKFLOW PREVENTER (RPZ)

A. Shall be of the size shown on the Drawings and body shall be constructed of bronze for sizes less than 2-1/2-in and epoxy coated cast iron for sizes 2-1/2-in and larger.

B. Each unit shall be complete with two companion full bore ball valves equipped with test connections. Valves shall be of similar material as that of the backflow device body, including epoxy coating. Unit shall have replaceable bronze seats and captured springs.

C. Each unit shall be provided with a complete set of spare parts, which shall be stored adjacent to the unit in a wood crate labeled with list of contents.

D. Unit shall be supported on galvanized steel floor stanchions with floor flange secured to floor.

E. Unit shall be of the manufacture that meets the approval of the authority having jurisdiction.

F. Acceptable manufacturers shall include Watts Regulator; Cla-Val Co.; Febco or equal.

2.05 YARD HYDRANTS

A. Hydrants shall be of the size shown on the Drawings and of a length to suit building wall thickness construction.

B. Provide Dura-coated cast-iron head and lift handle with lock option. Slotted lines provide adjustable, locking flow control. Complete with bronze interior parts and galvanized steel casing with bronze valve housing and 1/8 IP drain port in housing. Provide vacuum breaker.

C. Unit shall be a Zurn Industries, Inc., Model Z-1397 or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install all the items specified under PART 2 according to the applicable manufacturer's instructions and the details shown on the Drawings.

B. Install protected water hose outlets approximately 4-ft-0-in above the finished floor.

C. The CONTRACTOR shall not install any equipment or materials until the OWNER and ENGINEER have approved all submittals. If any equipment or materials are installed prior to approval of the submittals, it shall be at the CONTRACTOR's risk.

D. Install water hammer arresters on all water lines, at top of all risers and immediately adjacent to all quick closing mechanical and electrical operating valves and on all flush valve headers.

3.02 CLEANING

A. Properly protect all materials and equipment at all times to prevent obstruction and damage. Maintain protective covers on all units until final clean-up time.

B. At the completion of the work, all equipment and exposed trim for the same included in this Section shall be thoroughly cleaned and, where required, polished ready for use.

END OF SECTION

SECTION 15500

HVAC

PART 1 GENERAL

1.01 SCOPE OF WORK

A. These Sections and Drawings cover(s) the requirements of the HVAC Work to be performed and shall not void any of the requirements specified under the General Conditions or General Requirements.

B. The areas where work is to be accomplished are specified and shown on the Drawings and Specifications.

C. The requirements specified herein shall be modified only if specified otherwise for particular application in other Divisions.

D. This HVAC specification is incomplete without the information contained on the Drawings and in the Schedules.

E. Work included under the "Scope of Work" of this HVAC Section includes all labor, material, equipment, tools and services necessary to furnish, deliver, unload, install, test and place in satisfactory operation, the equipment, services and systems as called for under the HVAC Section(s) including any incidental work not shown, or not specified but which can reasonably be inferred as belonging to the various systems and necessary in good practice to provide complete and fully operational systems.

F. The following work descriptions are not intended to in any way limit the above broad statement, but are intended as a more specific mention of the most important items included therein.

G. The functions of the HVAC systems is heat removal ventilation.

Outdoor Design Conditions

Summer:	88ºF Dry-bulb, 70ºF Wet-bulb
Winter	35ºF Dry-bulb, 7.1 mph wind velocity
Site Elevation	315 ft. Above Sea Level

Indoor Design Conditions

	Summer Space Temp. ºF	Outdoor Air Vent.	Winter Space Temp. ºF	Outdoor Air Vent.
Standby power buildings (generator not running)	95ºF	N/A	Ambient	N/A

H. This Section is incomplete without the information contained in the HVAC equipment schedules. Provide equipment of the type, size, capacity and arrangement as shown on the Drawings and as scheduled. Equipment shall consist of the particular components listed in the

schedules in addition to those components normally required for the type of unit. The order of component assembly will be as stated in the schedule. Particular attention must be paid to the remarks and notes in the schedules and on the Drawings.

I. All ductwork, piping, and equipment shown on the Drawings is intended to be approximately correct to scale, but figured dimensions and detailed drawings of the actual equipment furnished shall be followed in every case. The Drawings shall be taken in a sense as diagrammatic. Size of ductwork and piping are shown, but it is not the intent to show every offset or fitting, nor every hanger or support, or structural difficulty that may be encountered. To carry out the intent and purpose of the drawings all necessary parts to make a complete working system ready for use shall be furnished without extra charge. The CONTRACTOR shall be responsible to coordinate the system installation and routing with the work of all trades.

1.02 RELATED WORK

A. Cutting and patching is included in Division 1, except for items specified herein.

B. Temporary heating, electric power and lighting is included in Division 1.

C. Seismic design requirements of HVAC equipment, ductwork, and other items specified herein are included in Division 1.

D. Trenching, excavation and backfill is included in Division 2, except for items specified herein.

E. Concrete work is included in Division 3, except for required HVAC anchor bolts, sleeves and templates which shall be furnished under this Section.

F. Structural steel and miscellaneous metal is included in Division 5, except for supplementary steel required for HVAC hangers, equipment supports, anchors and guides, which shall be furnished under this Section.

G. Flashing and counterflashing is included in Division 7, except for items specified herein.

H. Painting is included in Division 9, except for factory finished HVAC equipment, HVAC shop painting and HVAC identification labeling.

I. Exterior louvers are included in Division 10.

J. Plumbing work is included under the Plumbing Section of this Division except for water and drain closing in connections to HVAC equipment.

K. Gas piping to all required HVAC equipment items is included under the Plumbing Section of this Division.

L. Electrical field wiring is included in Division 16, except for field wiring for automatic temperature controls as specified herein or as shown on the HVAC Drawings.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, shop drawings and product data for the following:

1. Catalog cuts and data sheets for all equipment.

2. Automatic control drawings with composite wiring diagrams, including bills of material and descriptions of operation for all systems. Panel layouts and name plate lists for all local and central panels. Data sheets for all control system components.

3. Software licensing and user agreements will be submitted for approval with the shop drawings for the equipment using the software. The submittal shall be a copy of the final agreement document that is to be signed.

4. Complete valve and damper schedules for damper submittals including the following for each type or model of damper to be furnished for the project: materials of construction for blades, frames, bearings, linkages and seals; flow and leakage characteristics; typical operating torque requirements or characteristics; options to be furnished; general installation and maintenance instructions. Damper schedules shall include damper type; unit served; damper service; damper size; duct size; drive linkage location; installation arrangement (flanged or in duct) and damper operator type.

5. All fans, submit in accordance with Sections 01300 and 15500, all data on the fan schedules. In addition the submittal shall include catalog data, fan data sheets with a description of the proposed fan, fan size, type, arrangement, materials of construction, weight, motor horsepower, motor type, power supply, and frame size. Provide catalog data and selections for vibration isolators, include materials of construction. For belt drive equipment; provide drive data indicating the sheave sizes, belts size, number and length. Each submittal shall include pertinent equipment dimensional data, fan performance (operating data information, and a performance curve showing the fan operating point and range. Minimum curve size shall be 8-in by 6-in. Faxed copies of curves are not acceptable. A list of accessories to be furnished shall be included on each submittal. Copies of operating and maintenance manuals shall be submitted. Significant dimensional differences between the specified equipment and the proposed equipment shall be noted on the equipment submittal. The contractor shall provide data to show the dimensionally different equipment will fit within the space and still provide suitable clearance. Where corrosion resistance is required, provide conformation of material suitability for the specified service.

6. Detailed equipment, ductwork and piping layout drawings; minimum scale 1/4-in = 1-ft-0-in for interior systems and equipment, dimension clear service spaces for motors and drives, filter, coils and spacer section access doors, and ductwork access panels and doors. (Site layout drawings and roof plans showing HVAC equipment and systems may be prepared and submitted at scales smaller than 1/4-in = 1-ft-0-in, subject to ENGINEER's prior approval.)

7. Standard shop and field installation details for transitions, elbows, takeoffs, discharge nozzles, turning vanes, access panels and doors, volume control and splitter dampers and extractors.

8. Piping and appurtenances, materials and joining methods. Pipe hanger materials and methods.

9. Ductwork materials, joining methods, reinforcing and material gauges. Where options are allowed by SMACNA, the proposed option shall be clearly defined. Indicate proposed materials and methods for ductwork and equipment hangers.

10. Prepare dimensional comparisons between proposed equipment and scheduled equipment when the proposed equipment is dimensionally larger than that scheduled. Do not propose dimensionally larger equipment from an alternate manufacturer for installation in confined areas, or when the installation of alternate equipment will result in reduction of service access below that recommended by the manufacturer.

11. For units that will be shipped exposed, provide a description of the protective packaging that will be used during transit.

12. All submittals shall contain a statement that Section 15500 and all other referenced Sections have been read and complied with. The certification statement shall be made by all of the following that are applicable; the CONTRACTOR, sub-contractor and the vendor. The statement shall be an individual statement for each party involved, and shall be included with every submittal and resubmittal.

13. Submit air (and water) system testing, adjusting and balancing reports for review and approval.

14. Operation and Maintenance Data

    a. Submit to the ENGINEER as provided in Section 01730, Operating and Maintenance Manuals. The following information shall be considered a minimum. Where applicable, provide information required for specific pieces of equipment.

        1) Personnel familiar with the operation and maintenance of the specific information shall prepare manuals.

        2) Equipment shall be identified with the ENGINEER's Equipment Numbers and Identification as shown in the Schedules and on the Drawings.

        3) Provide information in three ring binders. All sheets shall have reinforced punches. Tabbed dividers shall separate all sections. Drawings will be bound in the manual, or contained in envelopes bound into the manual.

    b. Contents - Each volume shall contain the following minimum contents:

        1) Installation including instructions for unpacking, installing, aligning, checking and testing. Foundation data, allowable piping loads, and electrical design shall be included.

        2) Operating Instructions to provide pre-operational checks, start up and shut down, and description of all control modes. Include emergency procedures for all fault conditions and actions to be taken for all alarms. Procedures for long term storage shall be included.

3) Maintenance shall include preventive, and corrective. Schedules for test of other functions are to be included. Provide a list of tools required to service the equipment. Trouble shooting instructions to include a trouble-shooting guide shall be included.

c. Spare Parts List

d. Shop Drawing Data to include performance curves, data sheets, flow diagrams, wiring diagrams, and descriptive drawings.

15. Submit the following for each insulation by System: manufacturer's product data showing conformance with this Section for all required insulation, jackets, covers, coatings, adhesives, fasteners, supports and appurtenances; complete manufacturer's instructions for installation of all required items.

16. All materials deliveries must have accompanying manufacturer's certifications attesting to satisfactory results of product testing showing conformance with this Section.

17. Provide a recommended list of spare parts to be provided

18. In general, corrections or comments or lack thereof, made relative to submittals during review shall not relieve the CONTRACTOR from compliance with the requirements of the drawings and specifications. Submittals are for review of general conformance with the design concepts of the project and general compliance with the contract documents. The CONTRACTOR is responsible for the final design conforming and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction, coordinating the work of all trades, and performing the work in a safe and satisfactory manner.

1.04 REFERENCE STANDARDS

A. These standards shall be considered as minimum requirements. This is a general list and not all standards listed are necessarily referenced elsewhere in this Section. Specific requirements of this Section and/or Drawings shall have precedence. In case of conflict between published requirements, the ENGINEER shall determine which is to be followed.

B. Abbreviation and the title of Federal, State and industry standards, technical societies, associations and institutes and other organizations which may be used are as follows:

1. Associated Air Balance Council (AABC)

2. American Conference of Governmental Industrial Hygienists (ACGIH)

3. Air Diffusion Council (ADC)

4. American Bearing Manufacturers Association (ABMA)

5. Air Movement and Control Association (AMCA)

6. American National Standards Institute (ANSI)

7. Air Conditioning and Refrigeration Institute (ARI)

8. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)

9. American Society of Mechanical Engineers (ASME)

10. American Society for Testing and Materials (ASTM)

11. Factory Mutual (FM)

12. Institute of Electrical and Electronic Engineers (IEEE)

13. National Institute of Standards and Technology (NIST)

14. National Environmental Balancing Bureau (NEBB)

15. National Electrical Code (NEC)

16. National Electrical Manufacturers Association (NEMA)

17. National Fire Protection Association (NFPA)

18. Occupational Safety and Health Administration (OSHA)

19. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

20. Underwriters Laboratories (UL)

C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. Provide single source supplier/installer responsibility for the following systems or services:

1. ATC Equipment

2. Thermal Insulation

3. Testing and Balancing

B. Provide single source supplier/installer responsibility for systems where specified in other related Sections.

C. The insulation materials to be furnished under this section shall be essentially the standard products of manufactures regularly engaged in the manufacture of insulation systems.

D. Several manufacturers are indicated as acceptable for each type of insulation in these specifications. The insulation sub-contractor shall be responsible for determining that all insulation supplied for the project is suitable for installation in the spaces indicated. The

insulation sub-contractor shall also insure that all materials used are compatible and in compliance with applicable codes and standards.

E. All equipment of a given type included in this section shall be furnished by or through a single manufacturer or as specified on the schedules.

F. Inspection by the ENGINEER's representative or failure to inspect shall not relieve the CONTRACTOR of responsibility to provide materials and perform the work in accordance with the documents.

G. The OWNER and ENGINEER reserve the right to sample and test any materials after delivery and to reject all components represented by a sample that fails to comply with the specified requirements.

H. An authorized representative of the manufacturer shall perform the initial startup of the equipment. The OWNER and ENGINEER shall witness startup. The use of local sales representatives to perform this work is not acceptable, unless the manufacturer provides documented evidence that the sales representative has been specifically trained for this work.

I. All rotating parts of equipment shall be statically and dynamically balanced at the factory.

1.06 DELIVERY, STORAGE AND HANDLING

A. All materials shall be inspected for size, quality and quantity against approved shop drawings upon delivery.

B. Delivery schedule of all equipment shall be coordinated with the CONTRACTOR. Equipment ready for shipment prior to the agreed on shipping date shall be stored without cost to the OWNER by the manufacturer.

C. All materials shall be suitably packed for shipment and long term storage. Each package shall labeled to indicate the project and the contents of each package. Where applicable, equipment numbers shall be marked on the container.

D. All equipment shipped that is exposed such as on a flat bed truck shall be protected during transit. The equipment shall be protected from moisture, road salt, dirt and stones or other materials thrown up from other vehicles. Electrical components shall be protected as above, but with special attention to moisture. The method of shipment protection shall be defined in the submittals.

E. Instruction for the servicing and startup of equipment in long term or prolonged storage shall accompany each item.

F. All materials shall be stored in a covered dry location off of the ground.

1.07 PROJECT/SITE REQUIREMENTS

A. Environmental Requirements

B. Existing Conditions

C. Field Measurements

1.08 COORDINATION

A. The Drawings indicate the extent and general arrangement of the systems. If any departures from the drawings or specifications are deemed necessary, details of such departures and the reasons therefore shall be submitted as soon as practical for review. No such departures shall be made without the prior written concurrence of the ENGINEER.

B. The CONTRACTOR shall coordinate the location and placement of all concrete inserts and welding attachments with the structural engineer.

C. The CONTRACTOR shall assume full responsibility for coordination of the HVAC systems, including; scheduling, and verification that all structures, ducts, piping and the mounting of equipment are compatible.

1.09 ENGINEERING SERVICES

A. When engineering services are specified to be provided by the CONTRACTOR, the CONTRACTOR shall retain a licensed professional engineer to perform the services. The engineer shall be licensed at the time the work is done and in the State in which the project is located. If the State issues discipline specific licenses, the ENGINEER shall be licensed in the applicable discipline. In addition, the engineer shall be experienced in the type of work being provided.

B. All work is to be done according to the applicable regulations for professional engineers, to include signing, sealing and dating documents. When submittals are required by a professional engineer, in addition to state required signing and sealing, a copy of the current wallet card or wall certificate indicating the date of expiration shall be included with the submittal.

1.10 MAINTENANCE

A. Maintain and service all equipment and systems until the particular equipment or the system has been accepted by the OWNER.

B. Maintenance shall include compliance with the manufacturers operating and maintenance instructions as well as periodic checking and cleaning of piping system strainers and cleaning or replacement of air handling system filters.

C. Compile records of all maintenance and lubrication work performed on OWNER or CONTRACTOR furnished equipment. Maintain records at the construction or installation site and make available at all times for review by the OWNER or ENGINEER. At the request of the OWNER or ENGINEER submit copies of these records to the OWNER for information and/or review.

D. Provide all special tools required for normal maintenance. Tools shall be packaged in a steel case, clearly and indelibly marked on the exterior to indicate equipment for which tools are intended.

E. Provide to the OWNER a list of all spare and replacement parts with individual prices and location where they are available. Prices shall remain in effect for a period of not less than 1 year after start-up and final acceptance.

1.11 SPARE PARTS

A. Spare parts shall include all special items on the manufacturer's standard list of spare parts

B. In addition to special items, the following spare parts shall be provided:

1. Furnish all special tools required for normal operation and proper servicing of the equipment.

2. Spare parts shall include all items on the manufacturer's standard list of spare parts and the following for each unit:

a. One complete set of drive belts for each piece of belt driven equipment

b. One complete shaft seal for all fans with shaft seals.

c. One complete set of gaskets for each unit.

3. Provide a minimum of 1 or 5 percent of the total units rounded to the next full unit whichever is greater for each size and rating of the following components.

a. Thermostats

b. Control relays

c. Damper operators

d. Control transformers

C. Pack spare parts in containers suitable for extended storage without deterioration of the parts. Containers shall be clearly labeled designating contents, pieces of equipment for which intended and equipment identification numbers.

1.12 WARRANTY

A. In the event that the equipment or components fail to perform satisfactorily at any time within the Defects Liability Period, the CONTRACTOR shall replace it with one capable of operating as specified, and shall comply with the requirements in Division 1. The CONTRACTOR shall be responsible for all cost incurred in furnishing and installing the replacement equipment.

1.13 DEFINITIONS

A. Particular terminology used under this Section is defined as follows:

1. Exhaust Air Ductwork - Ductwork carrying air from a space to a fan and then to be discharged to the outdoors. Exhaust air ductwork extends from the registers of grills at the

end of the ductwork to the fan. From the fan exhaust ductwork extends to the discharge point, exhaust air damper, or exhaust air plenum, whichever comes first.

2. Outdoor Air Ductwork - Ductwork carrying untreated air from the outside to a fan or air handling unit. Outdoor air ductwork starts at the intake point, outdoor air damper, or outdoor air plenum, whichever comes last. The outdoor air ductwork extends to the fan, air handling unit, or connection with a return air duct, whichever comes first.

PART 2 PRODUCTS

2.01 ELECTRICAL EQUIPMENT

A. Electric Motors

1. Electric motors in NEMA frame sizes shall conform to the requirements in Section 01171, unless otherwise specified herein.

2. The motor manufacturer shall confirm that motors used to power equipment are provided with bearings that will provide a bearing life equal to the driven equipment or better. Confirmation shall be included with shop drawing submittal.

3. Motors will be selected to be non-overloading over the entire operating range of the equipment. A safety factor of 25 percent will be added to all motors up to and including 50 horsepower. A safety factor of 15 percent will be added to all motors over 50 horsepower. Motors indicated on the schedules are to be considered a minimum. This sizing is not to limit compliance with the above requirements

B. Electrical Equipment

1. Electrical equipment which is furnished under this Section shall meet the requirements specified in Division 16:

a. Disconnect switches, motor starters and combination motor starters (starters with disconnecting means and short circuit protection) shall be as specified in Section 16191.

b. Cord-connected controls for hazardous areas shall be provided with intrinsically safe relays, which shall be as specified in Section 16191.

c. Raceways, boxes, fittings and supports shall be as specified in Section 16110.

d. Wires and cables shall be as specified in Section 16120.

C. Electrical enclosures and panels to include automatic temperature control panels and components shall be suitable for the environment and electrical classification for the space they are located in. The type of enclosure for the various spaces shall be as specified in Division 16. Refer to the electrical drawings for the space classifications.

D. Where noted in the HVAC equipment schedules, or when shown on the Drawings, provide fan speed control switches and integral unit thermostats.

2.02 SEISMIC RESTRAINTS

A. Seismic restraints shall be provided for all piping and equipment as required by applicable codes. All seismic criteria and design shall comply with Seismic Design Category D.

B. Materials of construction for seismic supports shall be the same as those specified for equipment supports and hangers, and duct and pipe hangers. All bolts shall be stainless steel regardless of the specified support material.

C. Where the seismic criteria and size of piping and ductwork are within the limits of the latest edition of the SMACNA Seismic Restraint Manual, the restraints as defined in the manual can be used. Restraints shall meet the seismic design criteria in Section 01615.

D. The CONTRACTOR shall retain a professional structural engineer registered in the State of California to provide seismic loadings and designs of seismic restraints. This will include but not be limited to the following:

1. Provide seismic loadings to the vibration isolation supplier based on actual equipment being used to allow the proper selection of vibration isolators.

2. Provide sizing of bolts for attachment of non-vibrating equipment to the structure based on the actual equipment being used.

3. Provide design of required additional bracing for equipment when vibration isolators or bolts are not adequate to withstand seismic forces.

4. Provide design of bracing for all suspending equipment.

E. Provide design of bracing for all piping and ductwork that exceeds the limitations of the SMACNA Seismic Restraint Manual.

2.03 EQUIPMENT VIBRATION ISOLATOR AND MOUNTINGS

A. General

1. Unless otherwise specified in this Division all machinery or vibrating mechanical equipment shall be isolated from the building structure by vibration isolators with a minimum deflection as specified. Operating equipment that can transmit objectionable vibration and noise must be installed with special types of vibration isolators such as flexible connectors to ductwork, piping and wiring. In more critical areas and under particular conditions, additional vibration isolators shall be installed as specified in other related Sections in this Division, or in specific equipment schedules.

2. All equipment shall be provided with attachment points for floor or suspended mounting that will safety transmit all loads including seismic to the supports.

3. The vibration isolator manufacturer shall be responsible for the proper selection of vibration isolators suitable for the particular application. Selection of the vibration isolator shall include the following factors.

a. Equipment Weight

b. Equipment operating frequencies

c. Type of building support structure

d. Seismic forces as required by the applicable building codes to include shear, tension and compression due to the code specified loads.

4. All floor mounted vibration isolators shall be bolted to the floor or framing on which they rest. Bolts shall be arranged to prevent transmission of vibration through the bolts.

5. All isolation devices for a single piece of equipment shall be selected for a uniform static deflection according to distribution of weight in the equipment.

6. All pieces of equipment that have a variation in weight during operation or maintenance such as, but not limited to, cooling towers and hoppers, shall have built-in vertical limit restraints to limit motion to a maximum of 1/4-in.

B. Types - The following types of vibration isolators may be used.

1. Isolation for Suspension

a. Isolation hangers for suspension of equipment and piping shall have a single element of elastomer for 1/4-in deflection, a double or a single molded element of 1/2-in deflection, a single spring element with an elastomer grommet for up to 3/4-in deflection and a combination of an elastomer and spring elements in series for 1-in deflection and up contained within a structural rigid one piece steel hanger box. Springs shall have a minimum ratio of outside diameter to operating spring height of 0.8 and an additional travel to solid equal to 50 percent of the specified deflection.

b. The neoprene element shall have a bushing to prevent hanger rod contact with the housing box. The lower rod shall be free to swing in a 30 degree arc without touching the spring or the housing.

C. Rigidly Mounted Equipment

1. When equipment doesn't require vibration isolation, it shall be firmly attached to the building structure. Bolts and support structure shall include allowances for seismic loads as required by the applicable building codes to include shear and moment loads.

D. Vibration Isolation For Ducts

1. Furnish flexible connectors in the exhaust systems for exhaust fans (typ) at each inlet and outlet of fan and in the duct runs where required for expansion, contraction and movement, and where called for on the Drawings. Flexible connections shall be integrally flange molded arch type units constructed of EPDM rubber ¼-in thick, reinforced with a strong synthetic asbestos-free fabric suitable for corrosive service. The flexible connections shall be designed to minimize the transmission of vibration from the fans to the ductwork at the suction and discharge connections. Expansion or CONTRACTOR flexible connections shall be designed to allow 1-in movement. Working length or “live” length shall be as

designed by the manufacturer to allow up to 1-in of movement. Ends shall be flanged, with flanges matching duct connection flanges. Corners on rectangular expansion joints shall be molded and free of patches or splices. The flexible connections shall be suitable for outdoor service and temperature ranges from minus 10 up to 125 degrees F, and pressure to 5 psig. Specially fabricated split Type 316 stainless steel retaining back-up bars shall be supplied to prevent damage to the EPDM rubber flanged with Type 316 stainless steel bolts are tightened.

2. Furnish Type 1 fixed flanges (125-150# A36 steel) each end for connection between generator and ductwork plenum. Flanges shall be heli-arc welded directly to the flex hose. Furnished ½" thick stainless steel flanges. Flanges shall be equal to DME Model Type 1 – Fixed Flanges each end.

3. Manufacturer:

   a. Holz Rubber Company.

   b. Mercer Rubber Company.

   c. Proco Products Incorporated.

   d. Or equal.

2.04 FLAME AND SMOKE RATINGS

A. All materials, including adhesives, surface coatings, sealers, assemblies of several materials, insulation, jacketing, finish, etc, shall have flame spread ratings not over 25 (fire resistive), and smoke development ratings not over 50 and fuel contributed rating not over 50, as established by tests conducted in accordance with the Federal Standard 00136B, National Bureau of Standards Radiant Energy Fire Test and the National Fire Code of the NFPA.

B. These requirements apply to all circumstances whether the materials are field applied or applied by a manufacturer in his/her shop, or elsewhere, prior to delivery to the project.

2.05 V-BELT DRIVES

A. V-belt drives shall consist of the driver and driven sheaves and one or multiple matched V-belts. Select V-belt drives with belt horsepower ratings equal to or greater than 1.5 times the driving motor nameplate horsepower. Provide sheaves with steel, cast iron, or malleable iron split taper bushings and keyways on driven shafts of 3/4-in and larger diameter.

2.06 NOISE CRITERIA

A. The selection of pumps, fans, air handling equipment, air conditioners, heating ventilating and air conditioning machinery and mechanical equipment and the installation of the system components such as duct work and piping shall be such as not to exceed to maximum permissible noise for non-equipment spaces as defined in Table 2, Design Guidelines for HVAC System Noise in Unoccupied Spaces contained in the 1995 edition of the ASHRAE Application Handbook. Under no conditions shall the noise created by equipment exceed the levels of permissible noise exposures of occupational areas as established by the OSHA and other Federal, State and local safety and health standards, codes and ordinances.

B. The following sound criteria shall be met for all of the following listed equipment. Data shall be the sound pressure level (reference 20 micro pascals per octave band) and to include the dBA at 5 feet.

Equipment	Sound Power (Radiated)							
	63	125	250	500	1000	2000	4000	8000
EF-A-1	76	83	78	73	64	62	59	55
EF-B-1	76	83	78	73	64	62	59	55
EF-A-2	76	83	78	73	64	62	59	55
EF-A-3	76	83	78	73	64	62	59	55
EF-B-2	76	83	78	73	64	62	59	55
EF-B-3	76	83	78	73	64	62	59	55
EF-C-1	76	83	78	73	64	62	59	55
EF-D-1	76	83	78	73	64	62	59	55

1. The equipment supplier shall provide actual data for the equipment submitted. If the space does not meet the required criteria, and the noise level of the equipment is found to be the cause, the equipment supplier shall be responsible for the modifications required to correct the condition.

2.07 BEARINGS

A. General - Furnish equipment bearings suitable for the intended equipment service. Furnish bearings designed to carry both thrust and radial loads for equipment designed for all angle operation.

B. Provide extended lube lines with pressure relief equipped grease fittings for all bearings which are not readily accessible from outside the equipment.

C. Belt driven fans, including air handling unit fans shall be equipped with self aligning single row ball bearings, double row tapered or spherical roller bearings.

1. Furnish bearings to give 100,000 average life hours (ABMA-L50) for the following services:

a. Fan impellers greater than 10-in diameter.

b. Intermittent duty.

D. Provide seals for bearings installed in airstreams, exposed outdoors, and for applications in corrosive or dusty atmosphere.

E. Bearings for all equipment in the schedule below shall have heavy-duty grease lubricated ball or roller bearings. Bearings shall have ample thrust provision to prevent end play during the normal life of the bearing. Unless specifically noted otherwise, all fans and pumps shall have bearings for both the equipment and motors with the following ABMA L-10 life.

1. Fans over 3000 cfm - 40,000 hours.

2.08 HANGERS, SUPPORTS AND ANCHORS

A. General

1. Furnish supports, hangers and other devices necessary to support firmly and substantially the piping, equipment, exhaust plenums, and ductwork described in this Section. Support systems shall include restraints as required by the applicable building codes to withstand seismic loading. Design shall be provided by a professional civil or structural engineer hired by the CONTRACTOR as specified in other sections of the specifications. Signed and sealed calculations shall be submitted for record purposes.

3. All equipment shall be provided with lugs or brackets to allow the equipment to be firmly fastened to the structure or slab below. The lugs and brackets shall be sized to withstand the expected seismic loads for the area and type of application. Location of the attachments shall be based on the equipment being hung or base mounted as shown on the Drawings and the schedules.

4. Furnish and install all metalwork in accordance with Division 5 requirements.

5. Where C-clamp type hangers are used, furnish with a retainer strap.

6. Hangers shall not be supported from roof decking or bulb tees. Where required, provide supplemental steel to span between the building structure

B. Piping

1. All piping supported at a maximum of 10-ft-0-in intervals. Hangers or rings, sized to fit outside the insulation.

2. All piping 2-in diameter and smaller supported by pipe rings or bands with one 3/8-in adjustable steel rod hanger and one concrete insert.

3. Anchor piping mains where indicated or wherever necessary to limit pipe expansion and to prevent vibration.

C. Ductwork

1. Rectangular Ductwork - Spacing and size of hangers shall be as called for in the SMACNA standards, except as detailed below:

   a. The following methods of hanger attachment to the building structure are NOT allowed. The numbers and letters refer to hanger methods shown in Figure 4-1, 4-2 and 4-3 of the 1985 edition of the HVAC Duct Construction Standards Metal and Flexible as published by SMACNA.

      "T" wrap around straps of open web joist.

      "W" bent over band on open web joist.

      "14" Friction clamps

"17" Bent wire in metal deck.

2. All hanger and fastener material shall be of same finish as ductwork which they serve, e.g., galvanized, aluminum, black steel, etc, except for PVC ductwork which shall be galvanized steel. When a material other than the duct construction material must be used, the material used must be as corrosion resistant or greater than the duct material.

3. Perforated band iron or wire for supporting ducts shall not be permitted.

4. Support flexible duct by band hangers, 1-in wide minimum, attached so as not to crush the ductwork. The use of wire to hang flexible ductwork shall not be permitted.

5. Duct supports at flexible connections shall be adjustable.

D. Design of hangers shall include the effect of all loads applied to the duct as well as the load of the duct. These loads include, but are not limited to wind, snow and internal dirt or liquid buildup.

2.09 TESTING, ADJUSTING AND BALANCING

A. Testing, balancing and operation of the systems shall be performed by competent and experienced personnel, having formerly done similar work and whose qualifications and performance shall be subject to the approval of the ENGINEER. Test and balance air and water system and submit testing and balancing reports to the ENGINEER for review and approval. Re-balance when required by the ENGINEER, incorporating all changes and certify the systems have been tested and balanced to meet specified requirements.

B. To perform required professional services, the balancing agency shall have a minimum of two test-and-balance engineers certified by the AABC or NEBB. This certified test-and-balance engineer shall be responsible for supervision and certification for the total work specified herein.

C. The balancing agency shall furnish all necessary calibrated instrumentation to adequately perform the specified services. An inventory of all instruments and devices in possession of the balancing agency may be required by the ENGINEER to determine the balancing agency's performance capability.

D. Forms: Furnish test report data on 8-1/2-in by 11-in bond AABC or NEBB form paper in accordance with Section 01300. Submit format for recording data and receive approval prior to use.

2.10 FANS

A. General

1. Fans shall be factory assembled, complete with fan wheel, fan housing or cabinet, bearings, drives, drive guard, motor, motor base, unit base, vibration isolators and bird screens, unless otherwise specified.

2. All fans shall be statically and dynamically balanced before shipment.

3. Where belt drives are used, motors shall be provided with adjustable slide bases with jack screws.

4. All fans shall be AMCA rated for sound and air performance per AMCA 210-85 and 330-86.

5. Inlet and/or discharge screens shall be provided for fans that are not directly duct connected.

6. Fans shall be of steel construction.

7. Electric motors and electrical disconnects shall be provided as specified elsewhere in this Section.

8. Fans shall be UL listed when noted in the schedules or when code required for the specific application.

B. Inline Centrifugal Fans

1. Inline centrifugal fans shall have flanged inlet and discharge, wheel inspection door, and direct drives. Wheel shall be backward inclined airfoil type. Mounting brackets shall be provided per specific fan mounting orientation. Provide fan with spark resistant construction and steel construction with steel or aluminum wheel. Manufacturers shall be Loren Cook Co.; Aerovent, Inc.; Buffalo Forge Co.; Hartzell Fan Inc.; New York Blower Co.; Clarage Fan Co.; or equal.

2.11 DUCTWORK

A. Sheet metal ductwork shall be constructed of the materials specified using the gauges or thicknesses and reinforcing called for by SMACNA for the material specified. Unless otherwise specified, all components of duct systems shall be constructed of the same material as the ductwork. This is to include braces and turning vanes.

1. Galvanized steel ductwork shall be constructed of hot-dip galvanized sheet steel, per ASTM, A525 and A527.

B. Ductwork shall be constructed of the following materials and to the following standards:

System	Location	Static Pressure	Construction Material	SMACNA Standard
Exhaust	Standby Power Facilities	+2.0”	GS	M&F

Abbreviations

M&F - SMACNA HVAC Duct Construction Standards - 1st Ed. - Metal & Flexible

* *except where listed otherwise in this table*

GS = Galvanized Steel

C. Design of ductwork shall include all loads applied to the ductwork, in addition to the load of the duct. These loads include but are not limited to wind, snow and internal dirt or liquid buildup.

D. Construction

1. All ductwork shall be substantially built with joints and seams smooth on the inside and given a neat appearance on the outside. Inside surfaces and joints shall be smooth and free from pockets, burrs and projections. All joints shall be substantially air tight with laps made in the direction of air flow and no flanges projecting into the air stream. All changes in direction and duct transitions shall be shaped to permit the easiest possible air flow.

2. Pressure Classes

   a. Pressure classes for determination of sheet metal gauge and reinforcing shall be as defined by the latest issue of the SMACNA standards for duct construction.

   b. For ductwork with a static pressure higher than 2-in water gauge, pressure class shall be as shown on the Drawings. For ductwork with a static pressure 2-in water gauge or less pressure class shall be equal to the maximum pressure indicated for the fans or air handling units on the Schedules and the pressure class shall be the same for the entire length, including branches, of the specific duct system.

3. Rectangular Ductwork

   a. Ductwork shall be constructed as shown on the Drawings in accordance with the specified SMACNA Construction Standard, latest edition.

   b. Cross-breaking shall conform to SMACNA Standard. Cross-breaking shall be applied to the sheet metal between the standing seams or reinforcing angles. The center of the cross-break shall be of the required height to assure rigidity for each panel.

   c. All square elbows for rectangular ductwork shall be provided with turning vanes unless otherwise noted on the Drawings. Turning vanes shall be as detailed in the SMACNA Manual and or as shown on the Drawings.

4. Access Doors

   a. Unhinged access panels are not acceptable, except where shown on the Drawings. Access doors shall be of the same material as the duct, pan type construction for metal ductwork, with smooth edges and fitted seals, constructed and installed for air-tight fit with ease of opening and closing. Doors shall be substantially butt hinged, with heavy sash locks and substantial door pulls. Door openings and door frames shall be reinforced with bar stock or angle. Where ductwork is installed with duct liner or exterior duct insulation, the access door shall be of the insulated type. Access doors may be factory fabricated. Where ductwork is constructed of aluminum or stainless steel, access door hardware shall be of similar material.

5. Fasteners

   a. Sheet metal screws, drive cleats, cinch bands and other fasteners shall be fabricated from materials with an equal of greater corrosion resistance than the ductwork in which they are installed. Where a material other than the duct material is used, it shall be approved by the ENGINEER before installation.

2.12 ATC EQUIPMENT

A. Area Classification

1. Where specific area classifications are called for or shown on the electrical drawings, all equipment and wiring shall be in conformance with the requirements for that classification as specified in Division 16. Special attention shall be given to hazardous areas specifically "Class I Div. 1 Group D" and "Class I Div. 2 Group D" to comply with code requirements for equipment selection and installation procedures.

B. Room Thermostats

1. Electric room thermostat shall be of the heavy duty all metal type, provided with concealed adjustment and exposed thermometer.

2. Room thermostat and temperature sensors mounted on exterior walls shall be provided with insulated mounting plates.

3. All room thermostats and sensors shall be mounted 5-ft-6-in above finish floor except where otherwise indicated on the Drawings or specified herein.

C. Local ATC Panels

1. Where shown on the Drawings or required by the control sequence, provide local ATC panels.

2. All controllers, relays, switches, etc., for equipment shall be mounted within ATC cabinets with hinge lock type doors where shown on the Drawings. All temperature settings, adjustments and calibrations shall be made at the system control panel.

3. Submit details of each ATC panel for approval prior to fabrication. Locations of each panel are to be convenient for adjustment and service. Provide engraved nameplates beneath each panel mounted control device clearly describing the function of said device and range of operation. All manual switches and dial thermometers shall be flush mounted on the hinged door, with permanent labels showing the function of each item. All other devices shall be located within the cabinet mounted to a sub panel.

4. All electrical devices within the panels shall be factory pre-wired to a numbered terminal strip. All wiring within the panel shall be in accordance with NEMA and UL standards and shall meet all local codes.

5. Unless otherwise specified herein or shown on the Drawings, control panels shall meet the requirements for Electrical Products specified elsewhere in this Section.

6. Electrical power supplied to automatic temperature control panels shall be 120V, single phase, 60Hz. Where 24V power is required, a 120/24 transformer shall be provided. The transformers shall be sized for their control system electrical loads. Transformers shall be mounted in the local control panel.

7. Provide a 110V power receptacle in each panel.

8. Provide a copy of the wiring and control diagram for all work in each panel. The diagram is to be stored in a pocket on the door.

D. Miscellaneous Devices - Provide all the necessary relays, limit switches, positioners, clocks, transformers, etc., to make a complete and operable system. Locate these devices on local ATC panel unless specified otherwise.

E. Name Tags - All sensing devices, transmitters, controllers, not mounted in a clearly labeled panel, or which are not an obvious part of a clearly labeled device, shall be provided with an engraved plastic plate containing the name, function and system or system number for the device.

F. Set points on thermostats and temperature controllers, shown on the Drawings are indicative only and devices shall be adjustable above and below such set points. If a set point is not stated, the control range of devices shall be suitable for the intended service. Range of devices shall be approximately 50 percent greater in both directions than span of variable, with a minimum of 25 degrees and a maximum of 100 degrees F for air systems.

2.13 SEQUENCE OF CONTROLS

A. General

1. HVAC equipment will operate with the following sequences of operation.

2. The following will apply to all sequences.

a. All sequences are reversible unless otherwise noted.

b. Manual reset of control functions with manual reset will be at the local control panel unless otherwise noted.

c. Where required to prevent nuisance shut downs of systems, provide time delay of sensors to allow system start up before the sensors are activated. This would include, but not be limited to low temperature freeze protection on 100 percent outdoor air units.

d. Where control sequences refer to activation of an alarm indicator, it will be understood to mean activation of a labeled pilot light at the local ATC panel. A dedicated pilot light will be provided for each alarm unless a common alarm light is specified.

e. The ATC contractor shall provide all connections, relays and other devices required to operate the system under the control of the firefighter control panel.

B. Control Sequence for All Exhaust Fans

1. Exhaust Fan with Exhaust Motorized Damper Hand-Off-Auto Switch and Thermostat

a. When the Hand-Off-Auto switch is in the hand position, the fan shall run and the motorized exhaust damper shall be open.

b. When the Hand-Off-Auto switch is in the off position, the fan shall be off and the motorized exhaust damper shall be closed.

c. When the Hand-Off-Auto switch is in the auto position and the temperature sensed by the space thermostat is above set point, the fan shall run and the motorized exhaust damper shall be open.

d. When the Hand-Off-Auto switch is in the auto position and the temperature sensed by the space thermostat is below set point, the fan shall be off and the motorized exhaust damper shall be closed.

e. The fan shall be interlocked with generator such that when the generator turns on, the exhaust fan shall be overridden to turn off, and the motorized exhaust damper closed.

PART 3 EXECUTION

3.01 INSTALLATION

A. The CONTRACTOR shall start up each piece of equipment and system and shall make all adjustments so that the system is placed in proper operating condition.

B. The CONTRACTOR shall not install any equipment or materials until the OWNER and ENGINEER have approved all submittals. If any equipment or materials are installed prior to approval of the submittals, it shall be at the CONTRACTOR's risk.

C. Equipment

1. Install equipment in accordance with manufacturer's recommendation. Provide piping and ductwork connections in accordance with the requirements as specified elsewhere in this Section.

D. Insulation – General

1. Do not apply insulation prior to testing and acceptance of piping, ductwork and/or equipment. Insulation shall not be applied to damp or frosty surfaces. Clean dust, dirt, grease and moisture from surfaces of pipe and ducts before applying insulation or insulation adhesives. Install all insulation in a neat and workmanlike manner. Nameplates and equipment certification and data tags affixed to any piece of apparatus must remain exposed to view. Where two layers of insulation are used, stagger all joints both ways. Secure each layer independently. Continue insulation through walls, partitions, floors and pipe sleeves.

2. The recommendations and instructions of the manufacturers of products used in the work are hereby made part of this Section except as they may be superseded by other requirements of this Section.

3. Adhesives, coatings and vapor barrier materials shall be applied as specified by the manufacturer. Do not apply these materials when ambient temperature is above or below the maximum and minimum ambient temperature respectively, specified as limits by the manufacturer. In general, these limits are 90 degrees F and 40 degrees F, however, the limitations are to be checked for each product.

4. All penetrations through a vapor barrier for hangers, instruments, etc., shall be sealed to provide a complete vapor barrier. The use of staples or other fasteners that penetrate the vapor barrier shall not be permitted.

5. Insulation systems that require a vapor barrier shall be installed with an intact vapor barrier that covers the entire pipe, duct, or piece of equipment to be insulated. All edges of insulation that do not abut another piece of insulation shall have the vapor barrier extended, and sealed to the item being insulated. All penetrations through the insulation such as for thermowells, test ports, dampers, nameplates, or other items shall have the vapor barrier extend over the edges of the insulation and sealed to the item being insulated. Where items are mounted on ductwork a standoff shall be provided to protect the vapor barrier. The vapor barrier shall be sealed to the standoff.

6. For insulated items exceeding 100 square feet, or 20 feet in length, extend the vapor barrier to the item being insulated to reduce the area or length within a single enclosed area to the dimensions listed above.

E. Ductwork Insulation

1. For purposes of insulation, flexible ductwork shall be treated as sheet metal ductwork.

2. Provide all cold ductwork with a vapor barrier. Where the method of attachment causes penetrations of the vapor barrier, seal such penetrations with vaporseal adhesive and vapor barrier tape.

3. Clips, pins, washers, staples, and other metal components shall be of the same material as the duct to be insulated. Where items of the same material are not available, a material of equal corrosion resistance may be used. If a different material of equal corrosion resistance is to be used, it must be approved by the ENGINEER.

4. All outside corners of ductwork in the traffic level shall be protected by sheet metal angles. Angles shall be 22 gauge galvanized steel with 2-in legs. When the duct is constructed of materials other than galvanized steel, the protective angle shall be fabricated of the same material as the duct, or of equal corrosion resistance. If a different material of equal corrosion resistance is to be used, it must be approved by the ENGINEER. Angles shall be attached to the outside of the vapor barrier with adhesive. The entire inside surface of the corner angle shall be coated with adhesive before being installed.

5. All joints in insulation shall be compressed 0.25-in. Corner insulation shall be lapped with the overlap extending over the full thickness of the insulation layers. Open spaces in joints are not acceptable. A minimum of two layers of insulation shall be used when the required

insulation thickness is greater than 2-in. Joints in adjacent layers shall be staggered a minimum of 3-in.

F. Ductwork Insulation – Fiberglass Board Type

1. Hot Ductwork

a. Installation – Apply insulation in the thickness listed below. Impale the insulation over suitable mechanical fasteners, such as welded pins or approved adhered pins, applied to duct surface on 12-in to 18-in centers. Use a minimum of two rows of fasteners on each side of duct. Secure insulation in place with suitable self-locking caps pushed onto the pins. Seal all joints and breaks in insulation and pin heads with tape. Seal all insulation raw edges and butt joints with either pressure sensitive duct tape or lagging adhesive. Groove insulation to cover standing seams or stiffeners or butt to the standing seams or stiffeners. Extend facing continuously over standing seams or stiffeners to provide a continuous finish.

b. Insulation Thickness – Exposed rectangular hot ductwork.

1) Supply ducts in unheated spaces 2-in

G. Sealing of Ductwork

1. General - Unless otherwise indicated, seal all ductwork joints and seams using sealant in accordance with the instructions of the sealant manufacturer and this Section. All transverse seams, joints and fitting connections, both shop and field assembled, shall be sealed in accordance with this Specification. Not more than one longitudinal seam shall be unsealed in each section of duct.

2. Application of Sealant - Thoroughly clean all seams, joints, etc., of dirt, oil, grease, or other coatings which might interfere with the adhesion of the duct sealant before the sealant is applied.

3. Uncured sealant may be forced into the slotted side of the seam or joint before shop or field assembly, and the joint or seam completed while the sealant is still uncured. Excess sealant shall be removed from both the inside and outside of the duct before it sets.

4. Duct Tape - The use of duct tape alone for sealing ductwork is prohibited. Duct tape may be used primarily for the purpose of retaining the uncured duct sealant in seams and joints until it has cured. Duct tape shall not be applied to the inside of any duct nor shall it be applied to standing type joints at any time. All duct tape used shall be compatible with the sealant.

5. Sealant shall be either in liquid form or a mastic with a maximum flame spread of 25 and a maximum rate of fuel contributed and smoke developed of 50 when tested in accordance with ASTM E84, NFPA 255 and UL 723.

6. Sealing systems shall be suitable for the environment. The following schedule is to be used to select the sealant.

a. Indoor, dry galvanized round and rectangular duct is to be sealed with Iron Grip 601 or equal.

b. All sealers listed or manufactured by Hardcast Inc. and are to define the type of sealer. Other equal sealants are acceptable.

H. Ductwork Fittings and Accessory Items

1. Duct Elbows - For rectangular ductwork where full radius elbows cannot be installed, provide abrupt elbows equipped with shop-installed hollow, air foil turning vanes.

2. Flexible Connectors

a. Install flexible connectors at all duct connections to fans, fan units or blowers, air handling units and air conditioning units. Make connections substantially air tight at all seams and joints.

b. Where the construction of the flexible connection or vibration isolator results in a cross sectional area of the connection which is less than 90 percent of the adjacent ductwork, the size of the connection shall be increased to provide a cross sectional area equal to or greater than 90 percent of the adjacent duct.

c. Provide flexible duct connections at both the intake and discharge connections for all fans and air handling units except as noted below:

1) Wall and roof fans that have integral motor/fan wheel isolation.

2) Air handling units where the fan is isolated from the intake and discharge connections by internal flexible connections or separations, and the unit is mounted without vibration isolators between the unit and the support structure.

3. Dampers

a. Automatic dampers shall be parallel or opposed blade as specified under “Sequence of Operation”.

b. All damper frames are to be constructed of the same material as the duct or a material with greater corrosion resistance sheet metal and shall have flanges for duct mounting. Damper blades shall not exceed 6 in. in width. All blades are to be of corrugated type construction, fabricated from two sheets metal spot welded together. Blades are to be suitable for high velocity performance. Maximum blade length in any section shall be 48 in. Additional stiffening or bracing shall be provided for sections exceeding 48 in. in height. Multi-section dampers shall be provided with sufficient interconnecting hardware to provide unison operation of blades in the entire assembly.

c. All damper bearings are to be made of nylon.

d. Replaceable butyl rubber or bulb vinyl seals are to be provided with the damper. Seals are to be installed along the top, bottom and sides of the frame and along each blade edge. Seals shall provide a tight closing, low (1 percent) maximum leakage damper.

Leakage and flow characteristics shall be submitted to the ENGINEER prior to approval of dampers.

e. Dampers shall be selected for the velocity and pressure differential required without excessive deflections.

f. Modulating dampers shall be of opposed blade construction. Dampers for two position operation may be single direction multiple leaf type.

g. Dampers shall have flanged connections.

h. All Smoke Dampers shall be UL555S approved.

i. All dampers integral to the manufacturer's equipment as indicated in the control sequence shall be provided by the unit manufacturer.

4. Access Doors

a. Provide access doors at the following locations (minimum requirements):

1) Automatic dampers - linkage side.

2) As shown on Drawings.

I. Duct Liner

1. Duct liner shall be shop installed on the interior surfaces of ductwork, where shown on the Drawings or as specified herein. Installation shall be made using a single thickness of duct liner and shall be in accordance with Duct Liner Application Standard by SMACNA. Liner shall be adhered with adhesive having a minimum of 90 percent coverage. Fasteners shall be spaced in accordance with SMACNA. After the duct has been formed the leading edges of the insulation that will be abutting another lined duct shall be spray-coated with fire-resistive adhesive. For ductwork with velocities exceeding 4000 fpm a metal nosing shall be installed at all transverse edges to secure the duct liner.

J. Flexible Ductwork

1. Make connections, joints and terminations air tight as recommended by the manufacturer. Where joints are made to rigid sheet metal ductwork, apply 3M Company EC-800 sealer and the joint shall be drawn tight with a drawband. Collars shall be 2-in long minimum and sleeves shall be 4-in long minimum.

2. Install flexible ducts with one duct diameter-radius elbows and cut as short as possible. Duct shall not be compressed and the length shall be kept short so minimum hangers or supports are required and static pressure losses are kept to a minimum. Sag in flexible duct shall not exceed ½-in/ft between duct supports.

K. Filling in Space Around Ductwork

1. To prevent sound passing through the area between the duct and the framed or cut opening in the floors, walls or partitions, pack mineral wool to completely fill the space the full

depth of the opening. Whenever a fire-rated wall or floor is penetrated, fill the space around the duct with a locally approved type of fireproof rope.

2. At firewalls, apply galvanized sheet metal escutcheon plates on both faces of the wall to close the gap between the structure and the sides of the insulated or bare duct.

L. Quality of Ductwork Installation

1. All ductwork shall be free from pulsation, chatter, vibration or objectionable noise. After system is in operation, should these defects appear, correct by removing, replacing or reinforcing the work. Sound levels shall not exceed the minimum requirement as specified in ASHRAE 1980 Systems Volume, page 35.16, Table 23. No discreet tones will be allowed.

2. The maximum allowable leakage of low pressure system shall be 5 percent of air volume.

M. Plenums

1. Seal fresh air inlet and exhaust air plenums at louvers or otherwise subject to weather entrainment watertight at all bottom joints and seams and up all vertical seams for a minimum of 12-in. After application, remove excess sealant before it sets hard. Where possible, pitch fresh air inlet and exhaust air plenums down towards the louver. Where it is not possible to pitch the plenum, provide a 1-in capped drain connection at the low point of the plenum.

N. Test Ports

1. Where shown on the Drawings and where required for testing and balancing, provide instrument insertion ports. Size and location of ports shall be coordinated with the CONTRACTOR performing air balancing. Seal ports with plastic snap lock plugs. When the ductwork will be insulated, extend the port to the face of the insulation and seal the vapor barrier to the port. When the ductwork is lined, extend the port into the duct to the inner surface of the duct liner.

2. In round ductwork provide 2 ports 90 degrees on centers. In rectangular ductwork provide ports are required by AABC or NEBB for a full traverse measurement.

3. As a minimum, ports shall be provided in the following connections:

   a. All duct mains.

   b. All duct branches unless all connections are diffusers, registers, or grilles and the total can be calculated by summing the readings for all of the connections.

   c. All connections to tanks or hoods where there is no other access for taking a measurement.

4. A main duct is defined as one of the following:

   a. A duct serving five or more outlets.

b. A duct serving two or more branch ducts.

c. A duct emanating from a fan or plenum.

d. All remaining ducts are considered branch ducts.

O. Piping

1. Pipe and Fittings

a. Install piping in a neat manner with lines straight and parallel or at right angles to walls or column lines and with risers plumb. Run piping so as to avoid passing through ductwork or directly under electric light outlets and/or interference with other lines or extending beyond furring lines as determined by Architectural Drawings. Accomplish all work using the best methods and procedures of recognized pipe fabrication in a good and workmanlike manner in accordance with the latest revision of applicable ANSI Standards, ASME Codes and PFI Standards.

b. Cut pipe square, not upset, undersize or out of round. Carefully ream ends and clean before installing.

c. Bending of pipe shall not be permitted. Use fittings for all changes in direction.

d. Do not remove end caps on pre-cleaned pipe until immediately before assembly. Cap all open ends immediately after completion of installation.

e. Thoroughly clean all piping interiors after installation and keep them clean by approved temporary closures on all openings until the system is put in service. Closures shall be suitable to withstand the hydrostatic test.

2. Soldering (Copper Tubing)

a. After cutting, thoroughly clean all surfaces to be soldered to a metal-bright finish, free from dirt, grease or other material before fluxing and soldering. Perform this cleaning by using emery cloth, sandpaper or steel wool. Clean the outside end of the tubing for a length of 1/2-in greater than the depth of the fitting. Clean the inside of the fittings in a similar manner. Apply non-corrosive flux and assemble the joint. Acid solder or acid flux will not be accepted.

b. Heat the surfaces to be joined slowly and uniformly to the melting point of the solder. Maintain the surface being soldered above the melting point of the solder for sufficient time to draw the solder completely into the joint. When the solder congeals to a plastic state, remove the excess metal with a cloth brush, leaving a fillet around the end of the fitting. Full penetration of the solder uniformly throughout the entire socket is required. Allow the soldered joints to cool in still air until only warm to the hand, after which the work may be quenched.

c. Any type of crack, pinhole, area of incomplete penetration, or similar defect will not be accepted. Peening for closing up defects shall not be permitted.

d. Use heating torches of sufficient size for heating of large fittings prior to soldering. Multiple tips or ring burners for use on combination torches may be used.

e. Remove all external and internal loose solder and flux after joint cools.

3.02 START-UP AND TEMPORARY OPERATION

A. Properly maintain and service all equipment and systems until the particular equipment or the system has been accepted by the OWNER.

3.03 BALANCING OF ROTATING EQUIPMENT

A. All machines shall be balanced both statically and dynamically by the manufacturer within the limits of best commercial practices. The term machine, as used above, is to be considered as any piece of equipment, which contains rotating components. All machines furnished shall have operating speed not exceeding 80 percent of the first critical speed.

3.04 ACCEPTANCE OF AUTOMATIC CONTROL SYSTEM

A. During the acceptance inspections, the manufacturer shall provide the required personnel to operate the system and show complete functionality. The manufacturer will also provide the required communication devices to allow simultaneous observations at multiple points. In general, each system will be run through its complete operating sequence.

B. Systems that are found to be operating incorrectly will be bypassed and not corrected during the inspection. If multiple systems are found to not be operating, the inspection will be canceled and rescheduled at the manufacturer's expense.

3.05 CLEANING

A. Leave all ductwork and equipment in a thoroughly cleaned condition.

B. Maintain all ductwork, fans, coils, air filters, outlets and other parts of the ductwork systems in a clean condition during installation.

C. Clean complete ductwork systems prior to testing and air balancing. Secure cheese cloth over all openings of the ductwork system for entrapment of dirt during the cleaning operation.

END OF SECTION

Division 16 Electrical

SECTION 16000

ELECTRICAL - GENERAL PROVISIONS – PUMP STATIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials and equipment required and install complete and make operational, electrical and process instrumentation systems as shown on the Drawings and as specified herein.

B. The work shall include furnishing, installing and testing the equipment and materials detailed in the following Sections:

Section No		Title
16000	-	Electrical - General Provisions
16015	-	Electrical Systems Analysis
16110	-	Raceways, Boxes, Fittings and Supports
16120	-	Wires and Cables (600 Volt Maximum)
16121	-	Medium Voltage Cable
16141	-	Wiring Devices
16191	-	Miscellaneous Equipment
16230	-	Diesel Engine Driven Generator
16231	-	Natural Gas Engine Driven Generator
16425	-	Main Switchboards (MSB) (Low Voltage)
16431	-	Pad Mounted Transformers
16460	-	Electric Motors to 250 HP
16470	-	Panelboards
16480	-	Low Voltage Motor Control Centers
16492	-	Automatic Transfer Switches
16500	-	Lighting System
16600	-	Underground System
16660	-	Grounding System
16800	-	Fiberoptic and Power Conduits Along Pipelines
16801	-	Fiber Optic Cable System
16950	-	Electrical Systems Testing & Settings

C. The work shall include the following:

1. Coordination of the electrical service requirements with the power company and providing the electrical services from the Power Company at the locations indicated.

2. Conduit, wire and field connections for all motors, motor controllers, control devices, control panels and electrical equipment furnished under Divisions 1, 11, 13 and 15.

3. Conduit, wiring and terminations for all field-mounted instruments furnished and mounted under other Divisions, including process instrumentation primary elements, transmitters,

local indicators and control panels. Lightning and surge protection equipment wiring at process instrumentation transmitters. Installation of vendor furnished cables specified under other Divisions.

4. Power wiring for all heating, ventilating, and air conditioning equipment furnished under other related Divisions, including power wiring for 120 Volt unit heater motors and thermostats. Refer to HVAC Drawings for the locations of 120 Volt unit heater thermostats and provide a 3/4-in C, 2 No. 12 and 1 No. 12 ground between each heater and its respective control thermostat.

5. Precast manholes, handholes and light pole bases.

6. Seismic restraints for electrical equipment and systems requiring restraints in conformance with Section 01615.

7. Perform testing of the electrical equipment in accordance with the requirements of the individual specification sections and in accordance with Section 16950.

8. Provide Short Circuit, System Protective Device Coordination Analysis and Arc Fault Analysis in accordance with Section 16015. Set the electrical protective devices in accordance with NETA standards and in accordance with the protective coordination study.

9. Furnish and install fiber optic and power cable in the underground conduit system provided under the Pipeline Contracts. Refer to Section 16800.

D. Review the electrical underground system and the civil yard piping. Install the electrical underground system in a manner that avoids conflicts with manholes, catch basins, etc. provided under other Divisions of the specifications.

E. Sequencing and Scheduling

1. Coordinate electrical equipment installation with other trades.

2. Arrange for chases, slots and openings in the building structures during the progress of construction to allow for the electrical installation.

3. Coordinate installing required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

4. Sequence, coordinate and integrate the installation of electrical materials and equipment for efficient flow of the work. Coordinate the installation of large equipment requiring position prior to closing in the building.

5. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

F. Excavation, bedding material, forms, concrete and backfill for underground raceways; forms and concrete for electrical equipment furnished under Division 16.

1.02 RELATED WORK

A. The following Sections apply to all Division 16 sections to the extent applicable.

1. Section 01300 – Contractor Submittals.

2. Section 01615 – Seismic Design Criteria.

3. Section 01730 – Operating and Maintenance Data.

4. Section 03305 – Electrical and Instrumentation Duct Encasement Concrete.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, shop drawings for equipment, materials and other items furnished under Division 16.

B. As a minimum all equipment specified in each Section of Division 16 shall be submitted at one time. As an example all lighting fixtures shall be submitted together, all motor control centers shall be submitted together, etc. Submittals that do not comply will be returned disapproved.

C. Submit engineering anchorage and seismic calculations for mounting electrical equipment in conformance with Section 01615.

D. Mark submittals to clearly identify proposed equipment including accessories, options, and features and to exclude parts not applicable to the project. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submittal piece of literature and each submittal drawing shall clearly reference the Project Specification and/or Contract Drawing that the submittal is to cover. General catalogs will not be accepted as cut sheets to fulfill submittal requirements.

E. All dimensions shall be field verified at the job site and coordinated with the work of all other trades.

F. Exceptions to the Specifications or Drawings shall be clearly defined by the Electrical Subcontractor in a separate section of each submittal package. The submittal shall contain the reason for the exception, the exact nature of the exception and the proposed substitution so that a proper evaluation may be made by the ENGINEER. The acceptability of any device or methodology submitted as an "or equal" or "exception" to the Specifications shall be at the sole discretion of the ENGINEER.

G. Operation and Maintenance Data

1. Submit operations and maintenance data for equipment furnished under this Division, in accordance with Section 01730. The manuals shall be prepared specifically for this installation and shall include catalog data sheets, drawings, equipment lists, descriptions, parts lists including replacement part numbers, to instruct operating and maintenance personnel unfamiliar with such equipment.

2. Manuals shall include the following as a minimum:

   a. A comprehensive index.

   b. A complete "As-Built" set of approved shop drawings.

   c. A complete list of the equipment supplied, including serial numbers, ranges and pertinent data.

   d. A table listing of the "as left" settings for all timing relays and alarm and trip setpoints.

   e. System schematic drawings "As-Built," illustrating all components, piping and electric connections of the systems supplied under this Section.

   f. Detailed service, maintenance and operation instructions for each item supplied.

   g. Special maintenance requirements particular to this system shall be clearly defined, along with special calibration and test procedures.

   h. The operating instructions shall also incorporate a functional description of the entire system, with references to the systems schematic drawings and instructions.

   i. Complete parts list with stock numbers, including spare parts.

1.04 REFERENCE STANDARDS

A. Electric equipment, materials and installation shall comply with the National Electrical Code (NEC) and with the latest edition of the following codes and standards:

   1. National Electrical Safety Code (NESC)

   2. Occupational Safety and Health Administration (OSHA)

   3. National Fire Protection Association (NFPA)

   4. National Electrical Manufacturers Association (NEMA)

   5. American National Standards Institute (ANSI)

   6. Insulated Cable Engineers Association (ICEA)

   7. The International Society of Automation Society (ISA)

   8. Underwriters Laboratories (UL)

   9. Factory Mutual (FM)

   10. International Electrical Testing Association (NETA)

   11. Local Building Codes

12. Institute of Electrical and Electronics Engineers (IEEE)

13. Joint Industrial Council (JIC)

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 ENCLOSURE TYPES

A. Unless otherwise required, electrical enclosures shall be NEMA Types as follows:

1. NEMA 1 in dry, non-process indoor above grade locations (i.e. administration areas, laboratories, control rooms, storage rooms).

2. NEMA 12 in damp locations and maintenance shops.

3. NEMA 4 in outdoor locations, rooms below grade including basements and buried vaults, and wet locations.

4. NEMA 4X in corrosive locations.

5. NEMA 7 in hazardous classified indoor locations.

6. NEMA 7 (gasketed) in hazardous classified outdoor locations. Provide enclosures labeled for such use.

1.06 SERVICE AND METERING

A. Multiple new electrical services from Pacific Gas and Electric (PG&E) are required for this project. The service shall be as indicated on the Drawings. The CONTRACTOR shall provide all coordination with PG&E to provide the complete and fully functional electrical service.

B. All CONTRACTOR furnished PG&E service equipment and installations shall be in full conformance with PG&E requirements, as defined in the most current edition of the PG&E "green book", and as required by the PG&E inspector for the project

C. Unless otherwise noted on the Drawings, the power company will be responsible for the following work:

1. Furnishing and installing all overhead primary and secondary conductors, poles and appurtenances.

2. Furnishing and installing all riser poles, primary cutouts, lightning arresters and grounding.

3. Furnishing and installing all underground primary cables.

4. Furnishing and installing all service transformers.

5. Termination of underground primary or secondary cables at riser pole.

6. Termination of underground primary cables at pad mounted transformers.

7. Furnishing metering current transformers (C.T.'s), meter and meter wiring.

8. Furnishing and installing secondary cables.

D. The CONTRACTOR shall be responsible for the following work:

1. Make all arrangements with the power company for obtaining electrical service, pay all power company charges and furnish all labor and material required for the electrical service.

2. Furnishing and installing all primary conduits.

3. Furnishing and installing all transformer pads and grounding.

4. Furnishing and installing all secondary conduits.

5. Furnishing and installing metering current transformer enclosure(s).

6. Furnishing meter base and enclosure.

7. Furnishing and installing an empty conduit with pull line from the metering C.T. enclosure to the building exterior for possibly WiFi antenna by the Power Company. Conduit size and type shall be approved by the power company.

E. Submit shop drawings for the switchboards and service entry type Local Control Panels to the power company for approval of the utility metering and pull sections.

1.07 HAZARDOUS AREAS

A. Equipment, materials and installation in areas designated as hazardous on the Drawings shall comply with NEC Articles 500, 501, 502 and 503.

B. Equipment and materials installed in hazardous areas shall be UL listed for the appropriate hazardous area classification.

1.08 CODES, INSPECTION AND FEES

A. Equipment, materials and installation shall comply with the requirements of the local authority having jurisdiction.

1.09 ELECTRICAL SYSTEMS ANALYSIS

A. Provide the electrical system analyses in accordance with Section 16015.

1. Provide a preliminary short circuit and coordination analysis prior to the initial submittal of the electrical service switchboard submittal to confirm the equipment being provided is appropriately rated for the short circuit duty available and to ensure that the protective devices being provided properly coordinate among themselves.

2. Provide a final short circuit, protective devices coordination and arc flash analysis to be used for setting the protective devices and for providing the appropriate safety arc flash labeling on all equipment. In addition, the final analysis report will be used by the OWNER as a bench mark for setting and testing protective devices in the future.

1.10 ELECTRICAL SYSTEM TESTING AND SETTINGS

A. Test and provide settings for systems and equipment furnished under Division 16 in accordance with section 16950 “Electrical Testing and Settings” and the individual equipment sections for additional specific testing requirements. If the testing results are not within acceptable limits repair or replace all defective work and equipment at no additional cost to the OWNER.

B. Make adjustments to the systems furnished under Division 16 in accordance with the equipment manufacturers requirements/recommendations and the system coordination study specified in Section 16015.

1.11 INTERPRETATION OF DRAWINGS

A. Unless specifically stated to the contrary, the Drawings do not show exact locations of conduit runs. Coordinate the conduit installation with other trades and the actual supplied equipment.

B. Install each 3 phase circuit in a separate conduit unless otherwise shown on the Drawings.

C. Conduit shown exposed shall be installed exposed; conduit shown concealed shall be installed concealed. Unless otherwise indicated install branch circuit conduits exposed in process/ industrial type spaces and concealed in finished spaces.

D. Where circuits are shown as "home-runs" all necessary fittings and boxes shall be provided for a complete raceway installation. Where home-runs indicate conduit is to be installed concealed or exposed the entire branch circuit shall be installed in the same manner.

E. Verify the exact locations and mounting heights of lighting fixtures, switches and receptacles prior to installation.

F. Except where dimensions are shown, the locations of equipment, fixtures, outlets and similar devices shown on the Drawings are approximate only. Exact locations shall be determined by the CONTRACTOR and approved by the ENGINEER during construction. Obtain information relevant to the placing of electrical work and in case of any interference with other work, proceed as directed by the ENGINEER and furnish all labor and materials necessary to complete the work in an approved manner.

G. Circuit layouts are not intended to show the number of fittings, or other installation details. Furnish all labor and materials to install and place in satisfactory operation all power, lighting and other electrical systems shown.

H. Redesign of electrical or mechanical work, which is required due to the CONTRACTOR's use of an alternate item, arrangement of equipment and/or layout other than specified herein, shall be done by the CONTRACTOR at his/her own expense. Redesign and detailed plans shall be submitted to the ENGINEER for approval. No additional compensation will be provided for changes in the work, either his/her own or others, caused by such redesign.

I. Raceways and conductors for lighting, switches, receptacles and other miscellaneous low voltage power and signal systems as specified are not shown on the Drawings. Raceways and conductors shall be provided as required for a complete and operating system. Homeruns, as shown on the Drawings, are to assist the CONTRACTOR in identifying raceways to be run exposed and raceways to be run concealed. Raceways shall be installed concealed in all finished spaces and may be installed exposed or concealed in all process spaces. Raceways installed exposed shall be near the ceiling or along walls of the areas through which they pass and shall be routed to avoid conflicts with HVAC ducts, cranes hoists, monorails, equipment hatches, doors, windows, etc. Raceways installed concealed shall be run in the center of concrete floor slabs, above suspended ceilings, or in partitions as required.

1.12 SEISMIC RESTRAINTS

A. Refer to Section 01615 for seismic restraint criteria.

1.13 SIZE OF EQUIPMENT

A. Investigate each space in the structure through which electrical equipment furnished under Division 16 must pass to reach its final location. Coordinate shipping splits with the manufacturer to permit safe handling and passage through restricted areas in the structure.

B. The equipment shall be kept upright at all times during storage and handling. When equipment must be tilted for passage through restricted areas, brace the equipment to ensure that the tilting does not impair the functional integrity of the equipment.

1.14 RECORD DRAWINGS

A. As the work progresses, legibly record all field changes on a set of Project Contract Drawings, hereinafter called the "Record Drawings."

B. Record Drawings shall accurately show the installed condition of the following items:

1. Single-line Diagrams.

2. Raceways and pull boxes.

3. Conductor sizes and conduit fills.

4. Panel Schedules.

5. Control schematic Diagrams.

6. Lighting Fixture Schedules.

7. Lighting fixture, receptacle and switch outlet locations.

8. Underground raceway and duct bank routing.

9. Plan view, sizes and locations of switchboard, distribution transformers, motor control centers and panelboards.

10. Fiber Optic Network system components, wiring and routing.

11. Grounding system.

1.15 EQUIPMENT INTERCONNECTIONS

A. Review shop drawings of equipment furnished under Divisions 11, 13 and 15 and prepare coordinated wiring interconnection diagrams. Submit copies of wiring diagrams or tables with Record Drawings.

B. Furnish and install all equipment interconnections.

1.16 MATERIALS AND EQUIPMENT

A. Materials and equipment furnished under this contract shall be new.

B. Material and equipment of the same type shall be the product of one manufacturer and shall be UL listed.

1.17 EQUIPMENT IDENTIFICATION

A. Identify equipment, disconnect switches, separately mounted motor starters, control stations, etc. furnished under Division 16 with the name of the equipment it serves. Motor control centers, control panels, panelboards, switchboards, switchgear, junction or terminal boxes, transfer switches, etc, shall have nameplate designations as shown on the Drawings.

B. Nameplates shall be engraved, laminated plastic, not less than 1/16-in thick by 3/4-in by 2-1/2-in with 3/16-in high white letters on a black background.

C. Nameplates shall be screw mounted to NEMA 1 enclosures. Nameplates shall be bonded to all other enclosure types using an epoxy or similar permanent waterproof adhesive. Two sided foam adhesive tape is not acceptable. Where the equipment size does not have space for mounting a nameplate the nameplate shall be permanently fastened to the adjacent mounting surface.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SLEEVES AND FORMS FOR OPENINGS

A. Provide and place all sleeves for conduits penetrating floors, walls, partitions, etc. Locate all slots for electrical work and form before concrete is poured.

B. Exact locations are required for stubbing-up and terminating concealed conduit. Obtain shop drawings and templates from equipment vendors or other subcontractors and locate the concealed conduit before the floor slab is poured.

C. Where setting drawings are not available in time to avoid delay in scheduled floor slab pours, the ENGINEER may allow the installations of such conduit to be exposed. Requests for this

deviation must be submitted in writing. No additional compensation for such change will be allowed.

D. Seal all openings, sleeves, penetration and slots as specified in Section 16110.

3.02 CUTTING AND PATCHING

A. Cutting and patching shall be done in compliance with generally accepted procedures.

B. Core drill holes in concrete floors and walls as required.

C. Install work at such time as to require the minimum amount of cutting and patching.

D. Do not cut joists, beams, girders, columns or any other structural members.

E. Cut opening only large enough to allow easy installation of the conduit.

F. Patching to be of the same kind and quality of material as was removed.

G. The completed patching work shall restore the surface to its original appearance or better.

H. Patching of waterproofed surfaces shall render the area of the patching completely waterproofed.

I. Remove rubble and excess patching materials from the premises.

J. When existing conduits are cut at the floor line of wall line, they shall be filled with grout of suitable patching material.

3.03 INSTALLATION

A. Work not installed according to the Drawings and Specification shall be subject to change as directed by the ENGINEER at CONTRACTOR's expense.

B. Electrical equipment shall be protected against mechanical and water damage. Store all electrical equipment in dry permanent shelters. Do not install electrical equipment in place until structures are weather-tight.

C. Damaged equipment shall be replaced or repaired by the equipment manufacturer, at the Engineer's discretion and at the CONTRACTOR's expense.

D. Repaint any damage to factory applied paint finish using touch-up paint furnished by the equipment manufacturer. The entire damaged panel or section shall be repainted in accordance with the field painting requirements specified in Section 09902 at the CONTRACTOR's expense.

3.04 MANUFACTURERS SERVICE

A. Provide manufacturer's services for testing and start-up of the equipment in accordance with the requirements of each individual specification section

B. Testing and startup shall not be combined with training. Testing and start-up time shall not be used for manufacturer's warranty repairs.

3.05 TRAINING

A. Provide manufacturer's services for training of OWNER's personnel in operation and maintenance of the equipment furnished under Division 13 and 16 in conformance with the requirements of Section 01730, and as specified in the individual section of Division 13 and 16.

B. The cost of training programs to be conducted with OWNER's personnel shall be included in the Contract Price. The training and instruction, insofar as practicable, shall be directly related to the system being supplied.

C. Provide detailed O&M manuals to supplement the training courses. The manuals shall include specific details of equipment supplied and operations specific to the project.

D. The training program shall represent a comprehensive program covering all aspects of the operation and maintenance of each system.

E. All training schedules shall be coordinated with and at the convenience of the OWNER. Shift training may be required to correspond to the OWNER's working schedule.

F. Submit an overview of the proposed training plan. This overview shall include, for each course proposed:

1. An overview of the training plan.
2. Course title and objectives.
3. Prerequisite training and experience of attendees.
4. Recommended types of attendees.
5. Course Content - A topical outline.
6. Course Duration.
7. Course Location - Training center or job site.
8. Course Format - Lecture, laboratory demonstration, etc.
9. Schedule of training courses including dates, duration and locations of each class.
10. Resumes of the instructors who will actually implement the plan.

G. The ENGINEER will review the training plan submittal with the OWNER.

END OF SECTION

SECTION 16015

ELECTRICAL SYSTEMS ANALYSIS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Provide both a preliminary and a final short circuit, selective coordination and arc flash study of each of the complete electrical distribution systems of 480 volts and higher as specified herein and as shown on the Drawings.

B. Obtain and pay for the services of the independent engineering specialty firm subject to the approval of the ENGINEER, to provide a complete fault current, distribution protective devices selective coordination and Arc Flash study. The selective coordination study shall begin with the utility company's feeder protective device and include all of the electrical protective devices down to and including the largest feeder circuit breaker and motor starter in the all low voltage motor control centers and power distribution panelboards. The study shall also include pad mounted and dry type transformers and protective devices associated with standby generators. The arc flash study shall begin with the utility company's feeder protective device and include all of the electrical distribution equipment down to and including low voltage motor control centers and power distribution panelboards and lighting panels, and the pad mounted transformers. All information required to perform the study shall be obtained by the entity performing the study.

C. Submit the preliminary short circuit, selective coordination and motor starting/running study prior to submittal of pad mounted transformers, motor control centers, and 480 Volt panelboards and switchboards shop drawings. The aforementioned shop drawings will not be reviewed until the preliminary power system study is approved by the ENGINEER. No exceptions will be allowed. The preliminary study shall include but not limited to:

1. Short circuit, and protective device coordination studies shall be performed on nationally recognized computer software such as SKM System Analysis, EDSA, ETAP, or approved equal.

2. Obtain and verify with the utility company all information needed to conduct the study.

3. Current transformers' ratio and burden calculations shall be based on a 10 percent maximum ratio error per ANSI C57.13. Identify current transformers that will not allow the protective devices to operate within acceptable ANSI error margins and recommend corrective action.

4. The preliminary study shall verify equipment is being applied within their design ratings and electrical protective devices will coordinate.

5. Recommend changes and/or additions to equipment as required providing adequate protection and coordination based on the actual equipment supplied and the results of the short circuit and protective device selective coordination studies. Submit any such changes and additions as a part of the study. Field settings of devices, adjustments, and minor modifications to equipment that are required to accomplish conformance with the approved

short circuit and protective device selective coordination studies shall be carried out by the CONTRACTOR at no additional cost to the OWNER.

D. After release of electrical equipment by the manufacturer, but prior to energizing the electrical equipment, submit the final short circuit and selective coordination study including all calculations, tabulations, protective devices coordination graphs, etc. as specified herein.

1. Provide a complete short circuit study and protective device selective coordination study for both the utility power distribution system and the emergency/standby power distribution system under the scope of this study. The study shall include but shall not be limited to:

a. Full compliance with applicable ANSI and IEEE Standards.

b. Preformed on nationally recognized computer software such as EDSA, SKM System Analysis, ETAP, or equal.

2. Provide a report summarizing the selective coordination including: one-line diagram of the system, relay and breaker setting tabulation, coordination curves, relay curves, circuit breaker curves, motor starting/running curves, protective device coordination and short circuit calculation, all prepared by the specialty firm.

3. Recommend changes and/or additions to equipment as required providing adequate protection and coordination based on the actual equipment supplied and the results of the short circuit and protective device selective coordination studies. Submit any such changes and additions as a part of the study. Field settings of devices, adjustments and minor modifications to equipment that are required to accomplish conformance with the approved short circuit and protective device selective coordination studies shall be carried out by the CONTRACTOR at no additional cost to the OWNER.

1.02 RELATED WORK

A. Section 16950 “Electrical Systems Testing and Setting”.

B. Motors are included under Division 11 and 15.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, the following:

1. The number of years the specialty firm has been in the business of performing coordination studies.

2. Professional Engineer certificate member, expiration date, and state of registration

3. Identification of each of the three qualifying projects for each of the past three years including:

a. A brief description of each study.

b. Name of owner of installation on which study was performed with address, telephone number, and contact person.

c. Date of study.

d. Any other information indicating the firm's experiences and ability to perform the work and business status.

B. Preliminary Short Circuit and Coordination Study Report shall include but not limited to:

1. The coordination study report shall be bound in a standard 8-1/2-in by 11-in size report.

2. Electrical distribution system one-line diagram.

3. Electrical distribution system impedance diagrams.

4. Provide current transformers' ratio and burden calculations to confirm that the current transformers will not saturate prior to operation of the protective relays and confirming the current transformers used with differential protection will not saturate under any fault condition.

5. Tabulation of each protective device, its short circuit rating, the available fault current available at the device and an indication whether or not the device is adequately rated for the available fault current and voltage at which it is applied.

6. Preliminary graphic time-current curves showing how the protective devices proposed by the equipment suppliers will coordinate as being applied.

C. Final Short Circuit and Selective Coordination Study Report shall include but not limited to:

1. The coordination study report shall be bound in a standard 8-1/2-in by 11-in size report. The selection of all protective relays types, current transformers, fuse types and ratings, shall be the responsibility of the manufacturer and shall be based on the preliminary coordination study, which shall be submitted prior to the equipment shop drawings in accordance with Section 01300. The complete study shall be approved by the ENGINEER before any equipment is shipped. The report shall include the following sections and information:

2. An executive summary outlining the distribution system, the information received from the power company, assumptions made to complete the report, statement of the adequacy of the distribution equipment to safely clear any fault currents, the adequacy of the distribution equipment to close in on a fault, identify any problem areas with recommendations for resolving the problem.

3. Electrical distribution system one-line diagram.

4. Electrical distribution system impedance diagrams.

5. Provide current transformers' ratio and burden calculations to confirm that the current transformers will not saturate prior to operation of the protective relays and to confirm the

current transformers used with differential protection will not saturate under any fault condition.

6. Transformer differential protection calculations including current transformer mismatch relay setting and charts. Provide differential current transformer wiring schematics including polarity and wiring connections based on the winding configuration of the actual power transformers being supplied.

7. Tabulation of all protective devices, circuit breakers, fuses, current transformers, etc. The tabulation shall indicate the device, manufacturer, catalog number, recommended setting, etc.

8. Industry standard graphic time current, protective relay and protective device curves, showing equipment and material damage curves, relay, circuit breaker, fuse curves, available fault currents at the equipment, transformer inrush currents, etc, for each piece of equipment.

9. Tabulation of each protective device, its short circuit rating the available fault current available at the device and an indication whether or not the device is adequately rated for the available fault current and voltage at which it is applied.

10. Calculations and required documentation

D. Preliminary Arc Flash Study Report shall include but not limited to:

1. The Arc Flash study report shall be bound in a standard 8-1/2-in by 11-in size report

2. An executive summary outlining the distribution system, the information received from the power company, assumptions made to complete the report and recommendations to reduce the arc flash values.

3. Recommendations to reduce the arc flash incident energy levels.

E. The Final Arc Flash Study report shall be bound in a standard 8-1/2-in by 11-in size report. The report shall include the following sections and information:

1. An executive summary outlining the distribution system, the information received from the power company, assumptions made to complete the report and recommendations to reduce the arc flash values.

2. Provide a detailed bus label for each fault location. Each label shall include a listing of the protective device settings and incident energy at several different working distances.

3. Provide an NFPA 70 E work permit form for each fault location.

4. Provide a bus label for each fault location. The label shall include a summary of the flash boundary, incident energy, PPE classification and the Limited, Restricted and Prohibited Approach boundaries based on the nominal system voltage.

5. PPE Table – Provide a PPE table that defines the Personnel Protective Equipment classes and clothing descriptions identified in the reports and labels.

1.04 REFERENCED STANDARDS

A. Institute of Electrical and Electronic Engineers, Inc. (IEEE):

1. Standard 141, Recommended Practice for Electrical Power Distribution for Industrial Plants

2. Standard 241, Recommended Practice for Electrical Power Systems in Commercial Buildings

3. Standard 242, Recommended Practice for Protection and Coordination of Industrial and Commercial Systems

4. Standard 399, Recommended Practice for Industrial and Commercial Power System Analysis

B. American National Standards Institute (ANSI):

1. Standard C37.90, IEEE Standard for Relays and Relay Systems Associated with Electric Power Apparatus

2. Standard C37.91, IEEE Guide for Protective Relay Applications to Power Transformers

3. Standard C37.95, IEEE Guide for Protective Relaying of Utility-Consumer Interconnections

4. Standard C37.96, IEEE Guide for AC Motor Protection

5. Standard C57.12.59, IEEE Guide for Dry-Type Transformer Through-Fault Current Duration

6. Standard C57.13, IEEE Standard Requirements for Instrumentation Transformers

7. Standard C57.109, IEEE Guide for Liquid-Immersed Transformer Through-Fault-Current Duration

1.05 QUALITY ASSURANCE

A. Independent Engineering Specialty Firm's Experience

1. Specialty firm shall have been in the business of the type of work specified, for at least the past five years.

2. The specialty firm shall have a minimum of three projects of equal or greater size, service, with the type of equipment specified for each of the past three years.

3. Performed and stamped by a professional electrical engineer registered in the state of California.

4. The registered professional engineer performing the study shall have a minimum of five years experience performing studies of comparable project complexity

1.06 SHORT CIRCUIT STUDY

A. Perform a short circuit study in accordance with ANSI Standards C37.010 and C37.13 to check the adequacy and to verify the correct application of circuit protective devices and other system components within the construction package. The study shall address the case when the system is being powered from the utility source as well as from the on-site generating facilities Minimum and maximum possible fault conditions shall be covered in the study.

B. Consider the fault contribution of all motors operating during the maximum demand condition of the motors.

C. Calculate short-circuit momentary duties and interrupting duties on the basis of an assumed bolted 3 phase short circuit at each medium voltage transformer, low voltage switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboard and other significant locations throughout the systems. The short circuit tabulations shall include X/R ratios, asymmetry factors, KVA and symmetrical fault-current. Provide a ground fault current study for the same system areas, including the associated zero sequence impedance diagram. Include in tabulations fault impedance, X/R ratios, asymmetry factors, motor contribution, short circuit KVA, and symmetrical and asymmetrical fault-currents.

D. The studies shall include representation of the site power system, the base quantities selected, impedance source data., calculation methods and tabulations, one-line and impedance diagrams, conclusions and recommendations.

E. Provide the following:

1. Overall system impedance diagram. The diagram shall include the power companies impedance and X/R ratio, circuit element impedances (e.g. transformers, generators, motors, feeders, distribution buses, etc.).

2. The available fault current at each bus within the limits of the study shall be identified and listed.

3. The momentary and interrupting rating of all elements of the distribution system shall be listed. The maximum available fault current available at each element shall be calculated.

4. Determine the adequacy of the electrical protective devices to withstand the maximum available fault at the terminals of the equipment. Provide an equipment list, the equipment rating (both momentary and withstand), the maximum available fault rating and the adequacy of the equipment to withstand the fault. Equipment that does not have adequate ratings shall be identified immediately and brought to the attention of the ENGINEER.

5. The short circuit portion of the report shall include:

a. Separate positive, negative and zero sequence impedance diagrams for the utility and emergency/standby distribution systems.

b. Executive summary describing the distribution system, the procedures used to develop the study, utility related information furnished by the utility company including the name and telephone number of the individual supplying the information, identify all assumptions made in the preparation of the study, identify any problem areas and provide a definitive statement concerning the adequacy of the distribution system to interrupt and withstand the maximum possible fault current.

c. Computer printout of the input data.

d. Computer printouts for the three phase and ground fault studies. Printouts shall indicate the fault current available at each major equipment, distribution bus within the medium and low voltage distribution systems.

e. Table listing all the electrical distribution and utilization equipment, the equipment interrupting and withstand ratings, the available fault current at the terminals of the equipment and the ability of the equipment to interrupt and/or withstand the fault.

f. The short circuit study shall be prepared using approved computer software and must include complete fault calculations as specified herein for each proposed and ultimate source combination. Source combinations may include present and future Power Company supply circuits, large motors, or generators.

F. Automatic Load Transfer

1. Provide a detailed study demonstrating the interrupting capacity of automatic transfer bus ties and switches, as well as the fault withstand capabilities. The following shall be considered:

a. X/R ratio fault-current of circuit at point of transfer.

b. X/R ratio and fault-current rating of the transfer device.

c. Length of time fault may persist prior to protective device opening.

d. Magnetic stress withstand rating.

e. I^2t withstand rating.

f. Transfer device maximum interrupting duty compared to load interrupting duty.

1.07 PROTECTIVE DEVICE COORDINATION

A. Provide a protective device time-current coordination study in accordance with ANSI/IEEE Std. 242, with coordination plots of protective devices plus tabulated data, including ratings and settings selected. In the study, balance shall be achieved between the competing objectives of protection and continuity of service for the system specified, taking into account the basic factors of sensitivity, selectivity and speed.

B. Provide separate plots for each mode of operation: (1) “utility mode” (single incoming utility feeder energized all systems); (2) “stand-by mode” (on-site generation solely providing power to

the system). Show maximum and minimum fault values in each case. Multiple power sources shown in one plot is not acceptable.

C. Each primary protective device required for a delta-to-wye-connected transformer shall be selected so the characteristic or operating band is within the transformer parameters, which, where feasible, shall include a parameter equivalent to 58 percent of the ANSI C37.91 withstand curve to afford protection for secondary line-to-ground faults. Separate low voltage power circuit breakers from each other and the associated primary protective device, by a 16 percent current margin for coordination and protection in the event of line-to-line faults. Separate the protective relays by a 0.3-second time margin for the maximum 3 phase fault conditions to assure proper selectivity. The protective device characteristics or operating bands shall be terminated to reflect the actual symmetrical and asymmetrical fault-currents sensed by the device. Provide the coordination plots for 3 phase and phase-to-ground faults on a system basis. Include at least all devices down to largest branch circuit and largest feeder circuit breaker in-each motor control center and/or power distribution panelboard. Include all adjustable setting ground fault protective devices.

D. Select relay types (i.e. inverse, very inverse, extremely inverse, over current with or without voltage restraint, timers, etc.), current transformer ratings and types, fuse, residually or zero sequence connected ground faults protection, etc., that will allow the system to be protected to within the equipment fault ratings and provide the maximum possible coordination between the protective devices.

E. Generator Protective Devices

1. The study shall address all of the protective devices provided for generator protection.

2. Protective relays requiring settings shall be included.

F. Motor Protection and Coordination

1. Provide a complete and independent set of current-time characteristic curves for all motors 50 Hp and above indicating coordination between the protective relays and the thermal and starting characteristics of the motor.

2. The CONTRACTOR shall obtain from the motor supplier the necessary information to perform the study. Certified curves for "Safe Time vs. Current at 100% Voltage" and "Accelerating Time vs. Current at 100% Voltage" are necessary and shall become part of the final report.

G. Call discrepancies to the attention of the ENGINEER in the conclusions and recommendations of the report.

H. The Time current Characteristic Curves shall include:

1. The coordination plots shall graphically indicate the coordination proposed for the several systems centered on full-scale log forms. The coordination plots shall include complete titles, representative one-line diagrams and legends, associated upstream power system relays, fuse or system characteristics, significant motor starting characteristics, significant generator characteristics, complete parameters for power, and substation transformers,

complete operating bands for low voltage circuit breaker trip devices, fuses, and the associated system load protective devices. The coordination plots shall define the types of protective devices selected, together with the proposed coil taps, time-dial settings and pick-up settings required. The short-time region shall indicate the relay instantaneous elements, the magnetizing inrush, and ANSI transformer damage curves, the low voltage circuit breaker and instantaneous trip devices, fuse manufacturing tolerance bands, and significant symmetrical and asymmetrical fault-currents.

2. No more than six devices shall be shown on one coordination plot. Of these six curves, two (the largest upstream device and the smallest downstream device) shall repeat curves shown on other coordination plots in order to provide cross-reference. Give each curve in the study a study-unique number or letter identifier to permit cross-reference between plots.

3. Include a detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings. A tabulation shall include settings for every overcurrent protective device, timer, power system relays (e.g. ANSI 25, 27, 32, 67, 87, etc), circuit breaker, recommended fuse and current transformer ratings, etc. Include C.T. ratio, burden and all other calculations required for the determination of settings. Provide recommended settings for all protective devices furnished under Division 16.

1.08 ARC FLASH

A. Provide an arc flash study that utilizes the fault current values calculated in the short circuit study and the minimum clear times of the upstream protective device selected in the coordination study to calculate the incident energy at each fault location.

B. The Arc Flash study shall be in accordance with the procedure outlined in IEEE Standard 1584 or NFPA 70E.

C. Calculate the incident energy levels at each faulted bus for each mode of operation: (1) "utility mode" (single incoming utility feeder energized); (2) “stand-by mode” (on-site generation solely providing power to the system; Determine arc flash incident energy values for both maximum and minimum fault values in each case.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 QUALITY ASSURANCE

A. Adjust relay and protective device settings according to values established by coordination study. Setting shall be made in accordance with Section 16950.

B. Make minor modifications to equipment as required to accomplish conformance with the short circuit and protective device coordination studies.

C. Notify ENGINEER in writing of any required major equipment modifications.

END OF SECTION

SECTION 16110

RACEWAYS, BOXES, FITTINGS AND SUPPORTS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install complete raceway systems as shown on the Drawings and as specified herein.

B. Conduit interconnections may not be shown completely on the Drawings, including but not limited to raceways and conductors: between lighting, switches, receptacles, other miscellaneous low voltage and signal systems Home runs indicated are to assist the CONTRACTOR in identifying raceways to be installed concealed or exposed. Raceways and conductors shall be provided for complete and operating systems. Raceways indicated to be run exposed on the Drawings shall be run near the ceilings or along the walls of the areas through which they pass and shall be routed to avoid conflicts with HVAC ducts, cranes and hoists, lighting fixtures, doors and hatches, etc. Raceways indicated to be run concealed shall be run in the below concrete floor slabs, in partitions, or above hung ceilings, as required.

C. Conduit and wire schedules (included on the Drawings) are prepared as a guide to the CONTRACTOR; however, omissions in the schedule shall not relieve the CONTRACTOR of the responsibility of furnishing and installing conduit and wire as required by the remainder of the Drawings and specifications.

1.02 RELATED WORK

A. Electrical General Provisions are included under 16000.

B. Underground duct system is included under Section 16600.

C. Conduit schedules are included on the Drawings.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300 and 16000, the manufacturers' names and product designation or catalog numbers with marked cut sheets of all materials specified.

PART 2 PRODUCTS

2.01 RACEWAYS AND FITTINGS

A. Rigid Steel Conduit and Fittings

1. Rigid metal conduit (GRS), couplings, factory elbows and fittings shall be heavy wall steel tubing with a hot-dipped galvanized finish inside and out after threading and shall comply with ANSI C 80.1 and UL/6.

2. Acceptable manufacturers:

    a. Allied Tube & Conduit Corp.

    b. LTV Steel Tubular Products Corp.

    c. Triangular PWC Inc.

    d. Or equal.

3. Rigid conduit fittings shall be of the threaded type, and shall be steel or malleable iron, with a hot-dipped galvanized finish. Threadless fittings and split couplings are not allowed except in specific applications as approved by the ENGINEER.

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4. Acceptable manufacturers:

    a. Appleton Electric Co.

    b. O-Z Gedney Co.

    c. RACO Inc.

    d. Gould/Efcor

    e. Steel City

    f. Or equal

B. PVC Coated Rigid Steel Conduit and Fittings

1. PVC coated rigid steel conduit shall be heavy wall steel tubing with a hot-dipped galvanized finish inside and out after threading with a minimum 0.040-in thick, polyvinyl chloride coating permanently bonded to it and an internal chemically cured urethane or enamel coating. The rigid steel conduit shall comply with ANSI C80.1 and UL/6 prior to coating.

2. PVC coated couplings, factory elbows and fitting shall be furnished with a PVC coating bonded to steel the same thickness as used on the PVC coated conduit. The ends of all couplings, fittings, etc. shall have a minimum of one pipe diameter in length of PVC overlap.

3. Acceptable manufacturers:

    a. “OCAL” as manufactured by Thomas & Betts

    b. "Plasti-Bond Red" as manufactured by Robroy Industries

    c. Triangle PWC Inc

    d. Or equal

C. Non Metallic Conduit and Fittings

1. PVC conduit shall be rigid polyvinyl chloride schedule 40. Rigid PVC conduit shall comply with NEMA TC-2 and UL/651 and shall be sunlight resistant, rated for use with 90 degree C conductors in exposed and direct or concrete encased applications.

2. Connectors, couplings, fittings and ancillary materials shall be supplied by the conduit manufacturer. Connectors, fittings and ancillary materials shall be rated for the environment for which they are installed.

3. Acceptable manufacturers:

   a. Carlon Corp.

   b. PW Eagle.

   c. Cantex Inc.

   d. Or equal.

D. Liquid-tight Flexible Metal Conduit, Couplings and Fittings

1. Liquid-tight flexible metal conduit shall be square locked, galvanized steel flexible conduit with a moisture proof, flame resistant, polyvinyl chloride jacket, for use with rigid metal conduit systems. Sealtite, Type UA, manufactured by the Anaconda Metal Hose Div.; Anaconda American Brass Co.; American Flexible Conduit Co., Inc.; Universal Metal Hose Co. or equal.

2. Liquid-tight conduit fittings shall be hot-dipped mechanically galvanized, positive grounding, screw in type. Provide external bonding lugs on sizes 1-1/4-in and larger. Box connectors shall have insulated throats as manufactured by the Thomas & Betts Co.; Crouse-Hinds Co. or equal.

3. Acceptable Manufacturers:

   a. American Flexible Conduit Co.

   b. Anaconda Metal Hose/ANAMET Inc.

   c. Electri-flex Co.

   d. Thomas & Betts

   e. O-Z Gedney

   f. Or equal

E. Flexible Metallic Tubing

1. Flexible metallic tubing shall be for use under the provisions of NEC Article 360.

2. Flexible metallic tubing shall be hot-dipped galvanized steel strips shaped into interlocking convolutions firmly joined to one another assuring a complete lock.

3. Flexible metallic tubing shall be used only indoors for connection to lighting fixtures in NEMA 1 administration and office areas.

4. Furnish and install insulated bushings at terminations for conductor protection.

5. Acceptable manufacturers:

a. Tristeel as manufactured by Triangle - PWC, Inc.

b. Or equal

2.02 BOXES AND FITTINGS

A. Dry and Damp Location Boxes and Fittings

1. Outlet boxes shall be zinc-galvanized, extra depth, pressed steel with knockouts and of size and type suitable for the intended application.

2. Boxes that are less than 100 cubic inches in size used for junction or pull boxes shall be zinc galvanized pressed steel not less than 14 USS gauge with appropriate blank covers, minimum size 4-11/16-in square by 2-1/8-in deep.

3. Boxes that are 100 cubic inches and larger shall be constructed of hop dip galvanized sheet steel without knockouts. Covers shall be secured with round head brass machine screws. All joints shall be welded and ground smooth.

4. Terminal cabinets shall be NEMA 12 sheet steel unless otherwise shown on the Drawings. Boxes shall be painted and have continuously welded seams. Welds shall be ground smooth and galvanized. Box bodies shall be flanged and shall not have holes or knockouts. Box bodies shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. Terminal boxes shall be furnished with latching hinged doors, terminal mounting straps and brackets. Terminal blocks shall be rated not less than 20A, 600V.

5. Acceptable Manufacturers:

a. Appleton

b. Raco

c. Steel City

d. Hoffman

e. Electromate Division of Robroy Ind.

f. Wiegmann

B. Wet and Corrosive Location Boxes and Fittings

1. NEMA 3R and 12 terminal boxes, junction boxes, pullboxes, etc. shall be painted steel, and those in NEMA 4X areas, shall be sheet Type 316 stainless steel unless otherwise shown on the Drawings. Boxes shall have continuously welded seams and mounting feet. Welds shall be ground smooth. Boxes shall be flanged and shall not have holes or knockouts. Box bodies shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. Covers shall be gasketed and fastened with stainless steel clamps. Terminal boxes shall be furnished with hinged doors, terminal mounting straps and brackets. Terminal blocks shall be NEMA type, not less than 20 Amps, 600 Volt.

2. Cast or malleable iron device boxes shall be Type FD. Boxes and fittings shall have cadmium-zinc finish with cast covers and stainless steel screws.

3. Acceptable Manufacturers:

a. Appleton

b. Crouse-Hinds

c. Steel City

d. Hoffman

e. Electromate - Division of Robroy Ind.

f. Or equal

4. NEMA 4X PVC coated outlet boxes shall be used with PVC coated conduit shall be furnished with a PVC coating bonded to the metal, the same thickness as used on the coated steel. Acceptable manufacturers:“OCAL” as manufactured by Thomas & Betts, "Plasti-Bond Red" as manufactured by Robroy Industries, Triangle PWC Inc, or equal

C. Hazardous (Classified) Location Boxes

1. Explosion-proof boxes shall be designed for Class 1, Group D, Division 1 hazardous locations, and shall also have O-ring seals to meet NEMA 4 requirements. Boxes and covers shall be aluminum, with stainless steel hinges and stainless steel bolts; Type EJB-N4 as manufactured by the Crouse-Hinds Co.; Appleton Electric Co.; Adalet-PLM or equal.

D. Hazardous Area Sealing

1. Conduit sealing fittings shall be approved for Class I, Division 1 and 2 areas, designed to minimize the passage of gas and vapor and to prevent the passage of flames. Crouse-Hinds,

Killark EYS, EY, EYD, or ENY, or equal, listed for use with the specified sealing compound.

2. Sealing compound shall be Crouse-Hinds , Killark SC Series, or equal, used with Crouse-Hinds or Killark Packing Fiber.

E. Miscellaneous Fittings

1. Flexible couplings shall be type ECGJH as manufactured by the Crouse-Hinds Co.; Appleton Electric Co.; Killark Electric Manufacturing Co. or equal.

2. Conduit hubs shall be as manufactured by Myers Electric Products, Inc. or equal.

3. Conduit wall seals for new concrete walls below grade shall be O.Z./Gedney Co., Type WSK;; Spring City Electrical Manufacturing Co., Type WDP or equal.

4. Conduit wall seals for cored holes shall be Type CSMC as manufactured by the O.Z./Gedney Co. or equal.

5. Conduit wall and floor seals for sleeved openings shall be Type CSMI as manufactured by the O.Z./Gedney Co. or equal.

6. Combination expansion-deflection fittings embedded in concrete shall be Type XD as manufactured by the Crouse-Hinds Co.; Type DX as manufactured by O.Z./Gedney Co.; Type DF as manufactured by Appleton Electric Co. or equal.

7. Combination expansion-deflection fittings installed exposed shall be Type XD as manufactured by Crouse-Hinds Co.; Type DX as manufactured by O.Z. Gedney Co.; Type DF as manufactured by Appleton Electric Co. or equal.

8 Explosion proof fittings shall be as manufactured by the Crouse-Hinds Co.; Appleton Electric Co.; O.Z./Gedney Co. or equal.

9 Conduit sealing bushings shall be O.Z./Gedney, Type CSB or equal.

10. Grounding bushings shall be malleable iron with integral insulated throat rated for 150 degrees C, with solderless lugs as manufactured by Crouse Hinds/Cooper, Series HGLL; Appleton, Series GIB; O.Z./Gedney, Type HBLG or equal.

2.03 HARDWARE

A. Conduit Mounting Equipment

1. In dry indoor areas, hangers, rods, backplates, beam clamps, channel, etc shall be galvanized iron or steel.

2. PVC coated steel channel or Fiberglass channel with stainless steel hardware shall be used in areas designated "WET" or "CORROSIVE" on the Drawings and in outdoor locations. Fiberglass channel shall be resistant to the chemicals present in the area in which it is used.

3. Furnish any and all necessary supports, brackets, conduit sleeves, racks and bracing as required. All boxes and hardware shall be galvanized zinc plated steel except that stainless steel shall be used in areas designated as designated NEMA 3R, 4, or 4X on the Drawings.

B. Conduit Identification Plates

1. Conduit identification plates shall be embossed stainless steel with stainless steel band, permanently secured to the conduit without screws.

2. Identification plates shall be as manufactured by the Panduit Corp. or equal.

C. Wall and Floor Slab Opening Seals

1. Wall and floor slab openings shall be sealed with a UL approved expending material which equals or exceeds the fire rating of the wall or floor construction as manufactured by the Thomas & Betts Corp.; Pro Set Systems; Neer Mfg. Co.; Specified Technologies, Inc. or equal.

D. Cold Galvanizing Compound

1. Cold galvanizing compound shall be as manufactured by ZRC Products Company, a Division of Norfolk Corp. or equal.

E. Conduit Supports

1. Trapezes

a. In dry indoor areas, beams, channels, struts, hangers, bracing, rods, beam clamps, accessories and components shall be galvanized steel.

b. PVC coated steel beams, channels, struts or fiberglass beams, channels, struts with stainless steel hangers, bracing, rods, beam clamps, accessories and components shall be used in areas designated NEMA 3R, 4, or 4X and in outdoor locations. Fiberglass channels shall be resistant to the chemicals resent in the area in which it is used.

2. Flush Mounted Supports

a. In dry indoor areas, channels, struts, accessories and components shall be galvanized steel.

b. PVC coated steel channels, struts or fiberglass channels, struts with stainless, accessories and components shall be used in areas designated NEMA 3R, 4, or 4X and in outdoor locations. Fiberglass channels, struts shall be resistant to the chemicals present in the area in which it is used.

3. Conduit Racks

a. In dry indoor areas, conduit racks, accessories and components shall be galvanized steel.

b. PVC coated steel conduit racks or fiberglass conduit racks with stainless, accessories and components shall be shall be used in areas designated NEMA 3R, 4, or 4X and in outdoor locations. Fiberglass channels shall be resistant to the chemicals present in the area in which it is used.

4. Conduit Hangers

a. In dry indoor areas, conduit clamps, rods, beam clamps, bracing, accessories and components shall be galvanized steel.

b. Stainless steel conduit clamps, rods, beam clamps, bracing, accessories and components shall be shall be used in areas designated NEMA 3R, 4, or 4X and in outdoor locations.

5. Adjustable steel and plastic band hangers, adjustable band hangers, adjustable swivel ring hangers and J-hangers shall not be allowed.

6. All hangers, bracing, rods, beam clamps, accessories and components shall be as manufactured by the Carpenter & Paterson Inc.; Grinnell Corporation; B-Line Systems Inc. or equal.

PART 3 EXECUTION

3.01 RACEWAY APPLICATIONS

A. Refer to Table 16110-1 for specific raceway application requirements.

B. All conduit of a given type shall be the product of one manufacturer.

C. Refer to Section 16600 for underground applications.

3.02 BOX APPLICATIONS

A. Unless otherwise specified or shown on the Drawings, all boxes shall be metal.

B. Exposed switch, receptacle and lighting outlet boxes and condulet fittings shall be cast or malleable iron, except that non-metallic PVC shall be used with PVC.

C. Concealed switch, receptacle and lighting outlet boxes shall be pressed steel.

D. Terminal boxes, junction boxes and pull boxes shall have NEMA ratings suitable for the location in which they are installed.

E. Boxes flush in block, brick or tile walls shall be located at a course line and provided with square tile covers. Flush boxes shall not project beyond the finished surfaces nor shall surfaces project more than 1/8-in beyond the box enclosure. Wiring devices located in close proximity to each other shall be installed in one solid gang box with single cover.

F. All conduit bodies and pulling outlets shall comply with NEC wire bending space requirements. Mogul type fittings shall be used for sizes 2-1/2-in and larger.

TABLE 16110-1 ***Raceway Application Guidelines***	
Location/Circuit Type	***Raceway Type***
All locations (except as modified by entries below)	▪ Exposed (General)- Galvanized rigid steel (GRS) conduit. ▪ Concealed - Do not embed within structure. If this is not possible, use Schedule 40 PVC conduit. ▪ Underground - PVC duct (as specified) in concrete reinforced duct bank. ▪ Avoid running through corrosive locations.
All locations	▪ Stub outs through concrete, asphalt, etc: PVC coated GRS
All locations Fiber Optic wiring systems	▪ Exposed - Galvanized rigid steel (GRS) conduit. ▪ Concealed - Schedule 40 PVC conduit.
Clean, dry finished areas - offices, administrative areas, lobbies, control room, lunch room, toilets, and laboratories, etc.	▪ Conceal raceways in walls and above hung ceilings in rooms and areas that have finished interiors. ▪ Surface raceway for multiple receptacle, voice, and data outlets in labs and control rooms or in offices where specified. ▪ Galvanized rigid steel (GRS)
Clean, dry non-finished areas - electrical rooms, generator rooms, mechanical rooms, shops, dry storage, etc.	▪ Exposed conduit for power wiring, lighting, switch, and receptacle circuits - Galvanized rigid steel (GRS). ▪ Concealed conduit for power wiring, lighting, switch, and receptacle circuits - Schedule 40 PVC conduit when embedded within concrete floor slabs. GRS when embedded within masonry block walls.
Process areas - non-corrosive, non-hazardous DAMP or WET locations	▪ Exposed conduit for power wiring, lighting, switch, and receptacle circuits - Galvanized rigid steel (GRS) ▪ Concealed conduit for power wiring, lighting, switch, and receptacle circuits - Schedule 40 PVC conduit when embedded within concrete floor slabs or below slab on grade. GRS when embedded within masonry block walls.
Corrosive areas - chemical storage and handling areas, underground vaults, within tanks or clearwells, filter pipe galleries and locations where designated corrosive on the Drawings.	▪ Exposed conduit for power wiring, lighting, switch, and receptacle circuits – PVC coated rigid steel. ▪ Concealed conduit for power wiring, lighting, switch, and receptacle circuits - Schedule 40 PVC conduit when embedded within concrete floor slabs or structures or below slab on grade.
Hazardous areas -- Class 1, Division 1 and 2.	▪ Exposed conduit for power wiring, lighting, switch, and receptacle circuits - PVC coated GRS ▪ Concealed conduit for power wiring, lighting, switch, and receptacle circuits - PVC coated GRS

TABLE 16110-1 ***Raceway Application Guidelines***	
Location/Circuit Type	***Raceway Type***
Outdoor areas - all locations.	▪ Exposed conduit for power wiring, lighting, switch, and receptacle circuits - Galvanized rigid steel (GRS). PVC conduit shall not be used exposed. ▪ Concealed conduit for power wiring, lighting, switch, and receptacle circuits - Schedule 40 PVC conduit when embedded within concrete structures or below slab on grade.

3.03 FITTINGS APPLICATIONS

A. Combination expansion-deflection fittings shall be used where exposed conduits cross structure expansion joints or in straight runs where expansion is anticipated. Combination expansion-deflection fittings shall be installed where embedded conduits cross structural expansion joints. Refer to Structural Drawings for expansion joint locations. Provide bonding jumpers around fittings.

B. All underground conduit penetrations at walls or other structures shall be sealed watertight. Conduit wall seals and sleeves shall be used in accordance with the manufacturer's installation instructions and the details shown on the Drawings.

C. Conduit sealing bushings shall be used to seal conduit ends exposed to the weather and at other locations shown on the Drawings.

D. Insulated throat grounding bushings shall be used where specified herein, in Section 16660, and where conduits stub up into electrical equipment such as MCC's, switchboards, etc.

3.04 INSTALLATION

A. No conduit smaller than 3/4-in electrical trade size shall be used, nor shall any have more than the equivalent of three 90 degree bends in any one run. Pull boxes shall be provided as required by the NEC after every 270 degrees of bends and for straight run not to exceed 200 feet or as directed.

B. No wire shall be pulled until the conduit system is complete in all details; in the case of concealed work, until all rough plastering or masonry has been completed; in the case of exposed work, until the conduit system has been completed in every detail.

C. All conduit which may under any circumstance contain liquids such as water, condensation, liquid chemicals, etc, shall be arranged to drain away from the equipment served. If conduit drainage is not possible, conduit seals shall be used to plug the conduits. The ends of all conduits shall be temporarily plugged to exclude dust, moisture and debris from entering during construction.

D. Conduit ends exposed to the weather shall be sealed with conduit sealing bushings.

E. Conduits noted as spare shall be capped or plugged at both ends with easily removable fittings.

F. Conduit terminating in NEMA 3R, 4, 4X and 12 enclosures shall be terminated with Myers type conduit hubs.

G. Conduit terminating in pressed steel boxes shall have double locknuts and insulated bushings.

H. Conduits containing equipment grounding conductors and terminating in sheet steel boxes shall have insulated throat grounding bushings.

I. Conduits, except for PVC, shall be installed using threaded fittings.

J. The use of running threads is prohibited. Where such threads are necessary, a 3-piece union shall be used.

K. All conduits entering or leaving a motor control center, switchboard or other multiple compartment enclosure shall be stubbed up into the bottom horizontal wireway or other manufacturer's designated area, directly below the vertical section in which the conductors are to be terminated. The 3-in extension of conduit above the floor slab or concrete equipment pad may be reduced to a dimension that suits the equipment manufacturer's installation requirements if the 3-in stub-up interferes with the equipment being provided.

L. Rigid galvanized steel conduits buried in earth shall be completely painted with bitumastic.

M. Rigid galvanized steel conduits which have been field cut and threaded shall be painted with cold galvanizing compounds.

N. PVC coated rigid galvanized steel conduit shall be used for elbows at risers at the utility pole for electrical and telephone service conduits. Rigid galvanized steel conduit shall be used at utility pole for electrical and telephone service and fire alarm conduits to a height of 10-ft above finished grade. Furnish and install weather heads at service pole riser if required by utility company.

O. PVC coated rigid galvanized steel conduit and elbows shall be used for pad-mounted transformer stub-ups.

P. In hazardous locations, conduits terminating at boxes enclosing circuit opening equipment shall be sealed at the entrance to the enclosure with approved compound filled sealing fittings to prevent passage of explosive or combustible gases through the conduits. All conduits leading from or entering hazardous locations shall be similarly sealed at points of exit or entrance. Exposed conduits passing through hazardous locations shall be sealed at both the entrance to and the exit from the hazardous locations. A sealing compound installation schedule shall be submitted for approval. Each installation shall be signed off by the CONTRACTOR and the ENGINEER and each fitting shall be legibly marked with red paint to indicate that the sealing compound has been installed.

Q. Conduit sealing and drain fittings shall be installed in all hazardous (classified) areas designated Class 1, Division 1, and Class 1, Division 2.

R. Liquid-tight flexible metal conduit shall be used for all motor terminations, the primary and secondary of transformers, generator terminations and other equipment where vibration is present or may require removal. The length of liquid-tight flexible metal conduit shall not exceed 36"

when used for vibration isolation, and shall not exceed 72" in length when attaching to luminaires. Non-metallic flexible conduit shall only be allowed for use with rigid PVC conduit systems.

S. Flexible couplings shall be used in hazardous locations for all motor terminations and other equipment where vibration is present.

T. PVC coated rigid steel conduit shall be used as a transition section where concrete embedded conduit stubs out of floor slabs or through below grade walls or where conduit installed under building slabs on grade stub out of floors. The PVC coated rigid steel conduit shall extend a minimum of 3-in into and out of the floor slab, concrete pad, or wall to allow for proper threading of the conduit.

U. PVC conduit to non-metallic box connections shall be made with PVC socket to male thread terminal adapters with neoprene O-ring and PVC round edge bushings.

V. PVC conduit shall be supported with non-metallic clamps, PVC coated steel or non-metallic racks and stainless steel hardware.

W. Expansion fittings shall be used on exposed runs of PVC conduit where required for thermal expansion. Installation and number of fittings shall be as recommended by manufacturer.

X. PVC boxes, conduit fittings, etc, with integral hubs shall be solvent welded directly to the PVC conduit system.

Y. Non-metallic boxes with field drilled or punched holes shall be connected to the PVC conduit system with threaded and gasketed PVC Terminal Adapters.

Z. Conduit supports, other than for underground raceways, shall be spaced at intervals not exceeding the distance required by the NEC to obtain rigid construction.

AA. Single conduits shall be supported by means of one-hole pipe clamps in combination with one-screw back plates, to raise conduits from the surface. Multiple runs of conduits shall be supported on fabricated channel trapeze type racks with steel horizontal members and threaded hanger rods. The rods shall be not less than 3/8-in diameter. Surface mounted panel boxes, junction boxes, conduit, etc, shall be supported by spacers to provide a minimum of 1/2-in clearance between wall and equipment.

AB. Conduit Supports (Other than Underground Raceways)

1. Trapezes

    a. Conduit support trapezes shall be vertically supported every 10-ft or less, as required to obtain rigid conduit construction.

    b. Lateral seismic restraints (Sway Bracing) shall be spaced 30-ft or less.

    c. Horizontal seismic restraints shall be spaced at 40-ft or less. There shall be at least one horizontal restraint per horizontal run.

d. Attachment to structural steel shall be by beam clamps or welded beam attachment. C-clamps will not be allowed for vertical hangers. Side beam clamps with beam hooks shall be used for seismic restraint only.

e. Attachment to concrete shall be cast-in-place inserts, cast-in place welded plates with welded studs or stainless steel adhesive anchors.

2. Flush Mounted Supports

a. Support shall be spaced 10-ft or less, as required to obtain rigid conduit construction.

b. Attachment to concrete shall be with cast-in-place inserts, cast-in place welded plates with welded studs or stainless adhesive anchors.

3. Conduit Racks

a. Support shall be spaced 10-ft or less, as required to obtain rigid conduit construction.

b. Horizontal seismic restraints shall be spaced at 30-ft or less.

c. Attachment to concrete shall be with cast-in-place inserts, cast-in place welded plate with welded studs or stainless adhesive anchors.

4. Conduit Hangers

a. Conduit hangers shall be vertical supported 10-ft or less, as required to obtain rigid conduit construction.

b. Lateral seismic restraints (Sway Bracing) shall be spaced 20-ft or less.

c. Horizontal seismic restraints shall be spaced at 30-ft or less. There shall be at least one horizontal restraint per horizontal run.

d. Attachment to structural steel shall be by beam clamps or welded beam attachment. C-clamps will not be allowed for vertical hangers. Side beam clamps with beam hooks shall be used for seismic restraint only.

e. Attachment to concrete shall be cast-in-place inserts, cast-in place welded plates with welded studs or stainless steel adhesive anchors.

5. All reinforcing bars shall be located by the Electrical Subcontractor with the use of a rebar locator prior to installing adhesive capsule type anchors. Mark the location of all reinforcing bars in an area bounded by a line drawn at least 18-in from the edge of the support bearing/weld plates on all four sides of the bearing/weld plates prior to fabricating and installing bearing/weld plates.

6. Where interference occurs, adjust anchor locations to clear reinforcing bars and alter support configuration at no additional cost to the OWNER.

AC. Miscellaneous steel for the support of fixtures, boxes, transformers, starters, contactors, panels and conduit shall be furnished and installed. Channel supports shall be ground smooth and fitted with plastic end caps.

AD. Steel channels, flat iron and channel iron shall be furnished and installed for the support of all electrical equipment and devices, where required, including all anchors, inserts, bolts, nuts, washers, etc, for a rigid installation. Channel supports shall be ground smooth and fitted with plastic end caps

AE. All conduits on exposed work, within partitions and above suspended ceilings, shall be run at right angles to and parallel with the surrounding wall and shall conform to the form of the ceiling. No diagonal runs will be allowed. Bends in parallel conduit runs shall be concentric. All conduits shall be run perfectly straight and true.

AF. Where conduits pass through openings in walls or floor slabs, the remaining openings shall be sealed against the passage of flame and smoke in accordance with UL requirements and the details shown on the Drawings. The sealing method shall have a UL fire rating, which equals or exceeds the fire rating of the wall or floor construction.

AG. Conduits shall not cross pipe shafts, access hatches or vent duct openings. They shall be routed to avoid such present or future openings in floor or ceiling construction.

AH. Conduits passing from heated to unheated spaces, exterior spaces, refrigerated spaces, cold air plenums, etc, shall be sealed with "Duxseal" as manufactured by Manville or seal fitting to prevent the accumulation of condensation.

AI. Conduits shall be located a minimum of 3-in from steam or hot water piping. Where crossings are unavoidable, the conduit shall be kept at least 1-in from the covering of the pipe crossed.

AJ. Mandrels shall be pulled through all existing conduits which will be reused and through all new conduits 2-in in diameter and larger prior to installing conductors.

AK. 3/16-in polypropylene pull lines shall be installed in all conduits noted as spares or designated for future equipment. Conduit noted as spare shall be capped or plugged at both ends with easily removable fittings

AL. Emergency (generator) source and normal (power company) source feeders shall not be run through the same pull box.

AM. Where no type or size is indicated for junction boxes, pull boxes or terminal cabinets, they shall be sized in accordance with the requirements of NEC Article 314. Enclosure type and material shall be as specified herein.

AN. Pull or junction boxes shall be furnished and installed where shown on the Drawings, in every 200 feet of straight conduit runs or in runs where more than the equivalent of four 90 degree bends occur or at any point necessary for wire pulling and splicing. Splices shall not be made in pulling elbows.

AO. A conduit identification plate shall be installed on all power, instrumentation, alarm and control conduits at each end of the run and at intermediate junction boxes, manholes, etc. Conduit plates

shall be installed before conductors are pulled into the conduits. Exact identification plate location shall be coordinated with the ENGINEER at the time of installation to provide uniformity of placement and ease of reading. When a master conduit numbering system is used, the conduit tag numbers shall be exactly as shown on the drawings, if a master conduit numbering system is not used the conduit identification tags shall provide detailed "to" and "from" information.

END OF SECTION

SECTION 16120

WIRES AND CABLES (600 VOLT MAXIMUM)

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish, install and test all wire, cable and appurtenances as shown on the Drawings and as specified herein.

B. Conduit and wire schedules are prepared as a guide to the CONTRACTOR; however, omissions in the Documents shall not relieve the CONTRACTOR of the responsibility of furnishing and installing conduit and wire as required to interconnect the equipment furnished by this Contract.

C. The conduit and wire schedules are based on the equipment characteristics as described in these Specifications. The exact size and wire fill shall be coordinated with the final equipment supplied by the CONTRACTOR. If changes are required to the size of the wires or conduits or to the number of wires due to CONTRACTOR initiated modifications, a scheme similar to that detailed shall be utilized. Such changes shall be provided at no cost to the OWNER. Only major conduit runs are shown. Miscellaneous small equipment control conduits, final flexible conduits connections, conduits on the skid-mounted systems, etc, are in general not detailed but shall be provided as required for a fully functional system

1.02 RELATED WORK

A. Conduit and wire schedules are included on the Drawings.

B. Medium Voltage Cable is included in Section 16121.

C. Fiber Optic Cable is included in Section 16801.

D. Copper PLC Network Cable is included in Section 13421.

1.03 SUBMITTALS

A. Submittals shall be in accordance with Sections 01300 and 16000.

B. Submit catalog data indicating manufacturer, insulation designation, and ratings for:

1. Power, control, and instrumentation wire.

2. Termination and splicing materials.

3. Circuit identification system.

C. Submit results of wire field testing.

D. Submit labeled samples of each type of wire and cable.

1.04 DELIVERY, STORAGE AND HANDLING

A. Carefully handle all conductors to avoid kinks and damage to insulation.

PART 2 PRODUCTS

2.01 GENERAL

A. Wires and cables shall be of annealed, 98 percent conductivity, soft drawn copper.

B. All conductors shall be stranded, except that lighting and receptacle wiring may be solid.

C. Except for control, signal and instrumentation circuits, wire smaller than No. 12 AWG shall not be used.

D. Wire shall have 600 Volt insulation except where indicated otherwise.

E. All wire of a given type shall be the product of a single manufacturer.

2.02 BUILDING WIRE

A. Single conductor power wiring for circuits 600 volts and below shall be NEC type XHHW as manufactured by General Cable.; American Insulated Wire Corp.; Southwire Co.;or equal.

B. Bare copper ground wire shall be stranded, annealed copper wire ASTM-B3.

C. Equipment grounding conductors shall be NEC Type THW green and sized in accordance with NEC Table 250-122. Ground grid conductors shall be insulated unless shown otherwise on the Drawings.

2.03 CONTROL, STATUS AND ALARM WIRE

A. Wire shall be No.14 AWG NEC type THHN/THWN, stranded as manufactured by The Okonite Co.; General Cable.; American Insulated Wire Corp.; Southwire Co.; or equal..

2.04 INSTRUMENTATION WIRE

A. Wire for process instrumentation signals (i.e. 1-5 VDC, 4-20 mADC), R.T.D., potentiometer and similar signals shall be:

1. Single pair cable:

a. Conductors: 2 No. 16 stranded and twisted on 2-in lay

b. Insulation: PVC with 300 Volt, 105 degrees C rating

c. Shield: 100% Aluminum/polyester foil with drain wire

d. Jacket: PVC with UL Subject 13, UL 1581 and manufacturers' identification

e. Max overall diameter: 0.262-in

f. Miscellaneous: UL Listed as Instrument Tray Cable/Power Limited Tray Cable (PLTC) for use in accordance with Article 727 and Article 725 of the NEC.

g. Manufacturers: Belden No. 1030A; Manhattan No. M39119; General Cable No. C0456; The Okanite Co.;or equal

2. Three conductor (triad) cable:

a. Conductors: 3 No. 16 stranded and twisted on 2-in lay

b. Insulation: [PVC] [XLP] with [300] [600] Volt, 105 degrees C rating

c. Shield: 100% Aluminum/polyester foil with drain wire

d. Jacket: PVC with UL Subject 13, UL 1581 and manufacturers' identification

e. Max overall diameter: 0.276-in

f. Miscellaneous: UL Listed as Instrument Tray Cable/Power Limited Tray Cable (PLTC) for use in accordance with Article 727 and Article 725 of the NEC.

g. Manufacturers: Belden No. 1031A; Manhattan No. M39120; General Cable No. C0457; The Okonite Co.; or equal

2.05 SPLICES (POWER CONDUCTORS)

A. Unless otherwise indicated on the Drawings, splices shall not be made in the cables without prior written approval of the ENGINEER. Where splicing is approved by the ENGINEER, splicing materials for all 600 Volt splices shall be made with long barrel, tin plated copper compression (hydraulically pressed) connectors and insulated with heavy wall heat shrinkable tubing. The conductivity of all completed connections shall be not less than that of the uncut conductor. The insulation resistance of all completed connections of insulated conductors shall be not less than that of the uncut conductor.

B. Wire lugs shall be tin plated copper, long barrel compression type (hydraulically pressed) for wire sizes No. 8 AWG and larger. Lugs for No. 10 AWG and smaller wire shall be locking spade type with insulated sleeve. Lugs shall be as manufactured by the Thomas and Betts Co.; Burndy; Amp; or equal.

C. Compression type connectors shall be insulated with a heat shrink boot or outer covering and epoxy filling. Splice kits shall be as manufactured by Raychem (Tyco); Ideal Industries; 3M Co. or equal.

D. Solderless pressure connectors shall be self-contained, waterproof and corrosion-proof units incorporating prefilled silicone grease to block out moisture and air. Connectors shall be sized according to manufacturer's recommendations. The connectors shall be UL listed and CSA approved, as manufactured by King Innovation; Ideal Industries, Inc., or equal.

2.06 MOTOR CONNECTIONS

A. Motor connections shall be ring type mechanical compression terminations installed on the branch circuit wires and the motor leads and secured with bolt, nut and springwasher. Connections shall be insulated with a Raychem Type RVC, roll-on stub insulator; Thomas & Betts, Shrink-Kon MSCV20; or equal. For wire sizes N0. 8 and larger, long barrel, tin plated copper compression (hydraulically pressed) type connections Burndy Co., or equal) shall be installed on the branch circuit wires and the motor leads. Connections shall be insulated with heavy duty heat shrinkable material. Raychem Corp. Type MCK roll-on stub insulator, 3M Co., or equal.

2.07 TERMINATION AND SPLICES (CONTROL, STATUS AND ALARM CONDUCTORS)

A. Termination connectors shall be of the locking fork-end (upturned leg ends) type as manufactured by Ideal Industries; 3M Co.; Panduit Corp. or equal.

B. In-line or butt type splices of control, status, and alarm conductors are not acceptable. Terminal blocks located in terminal boxes shall be utilized in lieu of splices. Cables shall be continuous between devices.

2.08 TERMINATIONS (INSTRUMENTATION CABLES)

A. Termination connectors shall be of the locking fork-end (upturned leg ends) type as manufactured by Ideal Industries; 3M Co.; Panduit Corp. or equal.

B, Splicing of signal/instrumentation and other data highway cables is not acceptable. Instrument cables shall be installed in a continuous run from source to destination. If a discontinuity is required, as approved by the ENGINEER, provide terminal blocks located in terminal boxes in lieu of splices.

2.09 WIRE AND CABLE MARKERS

A. Wire and cable markers shall be "Omni-Grip" as manufactured by the W.H. Brady Co.; Thomas & Betts Co., SMS; 3M Co., STD-TAG; or equal.

B. Wire and cables with diameters exceeding the capacity of the "Omni-Grip" shall be marked with pre-printed, self-adhesive vinyl tapes as manufactured by the W.H. Brady Co.; Panduit Corp.; 3M Co.; or equal.

2.10 WALL AND FLOOR SLAB OPENING SEALS

A. Wall and floor slab openings shall be sealed with UL approved expanding material which equals or exceeds the fire rating of the wall or floor construction such as "FLAME-SAFE" as manufactured by the Thomas & Betts Corp.; Pro Set Systems; Neer Mfg. Co.; Specified Technologies, Inc.; or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Uniquely identify all wires, cables and each conductor of multi-conductor cables (except lighting and receptacle wiring) at each end and in all manholes, hand holes and pull boxes with wire and cable markers.

B. Use lubrications to facilitate wire pulling. Lubricants shall be UL approved for use with the insulation specified.

C. The crimping tools used in securing the conductor in the compression type connectors or terminal lugs shall be those made for that purpose and for the conductor sizes involved. The crimping tool shall be the ratchet type which prevents the tool from opening until the crimp action is completed. Such tools shall be a product of the connector manufacturer.

D. Install an equipment grounding conductor in all raceways.

E. Seal openings in slabs and walls through which wires and cables pass.

F. Pull cables from the direction that requires the least tension. Use a feed-in tube and sheave designed for cable installation. Use sheaves with radii that exceed the cable manufacturer's recommended minimum bending radius. Use a dynamometer and constant velocity power puller. Velocity should not be less than 15-ft./min. or more than 50-ft./min. Do not exceed the cable manufacturer's maximum recommended tension.

G. If cable cannot be terminated immediately after installation, install heat shrinkable end caps.

H. Fireproof exposed cables in manholes, vaults, pullboxes, switchgear and other areas not protected by conduit where medium voltage cables are present. Use fire-proofing tape and glass tape in accordance with the manufacturer's instructions. Fire-proofing tape shall be installed with one half-lapped layer of Scotch Brand 77 Electric Arc and Fireproofing Tape (3M Corp., or equal). Tape shall be secured with a two-layer band of Scotch Brand 69 Glass Electrical Tape (3M Corp., or equal) over the last wrap.

3.02 WIRE COLOR CODE

A. All wire shall be color coded or coded using electrical tape in sizes where colored insulation is not available. Where tape is used as the identification system, it shall be applied in all junction boxes, manholes and other accessible intermediate locations as well as at each termination.

B. The following coding shall be used:

System	Wire	Color
240/120 Volts	Neutral	White
Single-Phase, 3 Wire	Line 1	Black
	Line 2	Red

208Y/120, Volts 3 Phase, 4 Wire	Neutral Phase A Phase B Phase C	White Black Red Blue
240/120 Volts 3 Phase, 4 Wire delta, center tap ground on phase coil A-C	Neutral Phase A Phase B (High) Phase C	White Black Orange Blue
480Y/277 Volts 3 Phase, 4 Wire	Neutral Phase A Phase B Phase C	White Brown Orange Yellow

C. Neutral or ground wires that terminate in a panelboard and require color tape shall have the color tape extend at least 6-in from the termination point.

3.03 TERMINATIONS AND SPLICES

A. Power conductors: Unless otherwise indicated on the Drawings, no splices may be made in the cables without prior written approval of the ENGINEER. Where splicing is approved, terminations shall be die type or set screw type pressure connectors as specified. Splices (where allowed) shall be die type compression connector and waterproof with heat shrink boot or epoxy filling for copper conductors # 4 AWG and larger. Splices shall be solderless pressure connectors with insulating covers for copper conductors # 6 AWG and smaller. Aluminum conductors (where specified) shall employ terminations and splices specifically designed for aluminum conductors.

B. Control Conductors: Termination on saddle-type terminals shall be wired directly with a maximum of two conductors. Termination on screw type terminals shall be made with a maximum of two spade connectors.

C. Instrumentation Signal Conductors (including graphic panel, alarm, low and high level signals): terminations same as for control conductors.

D. Except where permitted by the ENGINEER no splices will be allowed in manholes, handholes or other below grade located boxes.

E. Splices shall not be made in push button control stations, control devices (i.e., pressure switches, flow switches, etc.), conduit bodies, etc.

3.04 INSTRUMENTATION CABLES

A. All circuits shall be installed as twisted pairs or triads. In no case shall a circuit be made up using conductors from different pairs or triads. Triads shall be used wherever three wire circuits are required.

B. Terminal blocks shall be provided at all instrument cable junction and all circuits shall be identified at such junctions.

C. Shielded instrumentation wire, coaxial, data highway, I/O and fiber optic cables shall be run without splices between instruments, terminal boxes, or panels.

D. Ground shielding on instrumentation wires at one end only as recommended by the instrument manufacturer and isolated at all other locations. Terminal blocks shall be provided for interconnecting shield drain wires at all junction boxes. Where individual circuit shielding is required, each shield circuit shall be provided with its own block.

E. Install shielded instrumentation wire in conduit and pull boxes that contain only shielded instrumentation wire. Instrumentation cables shall be separated from all other (i.e. power, control, etc.) cables in manholes by enclosing them within raceways and boxes.

F. Shielded cable terminations at each end shall be provided with heat shrinkable tubing placed over the exposed shield and conductors. The tubing shall extend 1-in minimum over the jacket end and extend 0.5-in minimum from the jacket end over the exposed conductors.

3.05 FIELD TESTING

A. Insulation Resistance Tests: Perform insulation resistance tests on all circuits with 600-volt wire insulation. Make these tests after all the equipment has been connected, except that equipment which may be damaged by the test voltage shall not be connected. Test the insulation with a 500 Vdc insulation resistance meter with scale reading not less than 100 megaohms. The insulation resistance shall be 20 megaohms or more. Tests shall be in accordance with the NETA Standards 7.3.1.2 and 7.3.1.3 as detailed in Section 16950. Representative testing of cables is not acceptable.

B. Phase Rotation: The phase rotation of all circuits shall be counter clockwise in sequence. The CONTRACTOR shall verify that each three-phase service, feeder and branch circuit meets this requirement.

C. Perform continuity tests of all wiring to confirm no grounding exists from conductor to conductor or conductor to ground.

D. Tests shall be performed in the presence of the CONTRACTOR's quality control representative.

E. Written test reports shall be prepared in accordance with NETA guidelines for all 480V feeder cable runs as a minimum.

F. Written test reports for the identified cable runs shall be submitted to the ENGINEER for approval before energization of the cable. If any remedial action is required to achieve a passing grade, describe the corrections performed.

G. Any installation that does not pass the tests above shall be corrected and retested.

H. All data highway and special systems cabling shall be tested as required by the system manufacturer requirements.

END OF SECTION

SECTION 16121

MEDIUM VOLTAGE CABLE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish, install, and test the medium voltage cables and accessories as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Section 16000 – Electrical and Instrumentation – General Provisions.

B. Section 16800 – Fiber Optic and Power Conduits Along Pipelines.

C. Section 16950 – Electrical System Testing and Settings.

1.03 SUBMITTALS

A. Shop drawings and product data in accordance with Section 01300, showing materials of construction and details of installation:

B. Submit, in accordance with Section 01300, the following:

1. Product data sheets

2. Factory and field test reports

3. Cable samples

4. Pulling tension and sidewall pressure calculation.

C. Statement of Qualifications:

1. Cable Accessories: The manufacturer shall be able to document a minimum of five years successful field experience as well as demonstrating technical life assessment as requested. The manufacturer shall establish and document a Quality Assurance Program implementing suitable procedures and controls for all activities affecting quality. The program shall provide documentation that verifies the quality of production joint kits and traceability back to inspection records, raw material and the original designs and design proof tested joints.

D. Warranties:

1. Cable: The manufacturer shall warrant the cable against failures for a period of 20 years from date of installation and shall remove and replace failed cables at his own expense during this warranty period.

1.04 REFERENCE STANDARDS

A. Medium voltage cables shall meet or exceed the specifications and requirements of the latest Insulated Cable Engineers Association (ICEA) and the Association of Edison Illuminating Companies (AEIC) publications, except as modified by this Section.

B. Ethylene-propylene rubber (EPR) insulated shielded cable shall meet or exceed ICEA S-93-639, NEMA WC-74, CSA 68.3 and AEIC CS-8.

C. Ethylene-propylene rubber (EPR) insulated non-shielded cable shall meet or exceed ICEA S-96-659 and NEMA WC-71.

D. Cables shall comply with Underwriters Laboratories (UL) Standard 1072.

E. Cables shall comply with IEEE 383 and IEEE 1202 Flame Tests where installed within buildings.

F. Field testing and commissioning shall be done in accordance with Section 16950.

G. National Electrical Code (NEC) NFPA 70.

H. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. Qualifications:

1. Cable: The general construction of the cable and the insulation material used shall be similar to that used for cable of the same size and rating in continuous production for at least 20 years and successfully operating in the field in substantial quantities.

2. Cable: Upon request, the manufacturer shall submit a copy of his Quality Assurance Manual detailing the quality control and quality assurance measures in place at his facility.

3. Cable: The manufacturer shall have available for audit detailed descriptions of the method by which his various manufacturing processes and production test are recorded, thus enabling the "traceability" of the completed cable. All steps in the manufacturing process, from receipt of raw material to the final tests, are to be included. Where multiple records are used, the method for cross-referencing shall be noted.

4. Cable shall be UL listed as Type MV-105.

1.06 SYSTEM DESCRIPTION N/A

1.07 DELIVERY, STORAGE, AND HANDLING

A. Acceptance at Site:

1. Check for reels not completely restrained, reels with interlocking flanges or broken flanges, damaged reel covering or any other indication of damage.

B. Storage and Protection:

1. Unload reels using a sling and spreader bar or by two lifting forks perpendicular to the reel ends. The lift shall not contact the cable.

2. Roll reels in the direction of the arrows shown on the reel and on surfaces free of obstructions that could damage the cable.

3. Do not drop reels from any height.

4. Store cable on a solid, well drained location. Unjacketed armored cable shall be stored indoors. Cover cable reels with plastic sheeting or tarpaulin. Do not lay reels flat.

5. Seal cable ends with heat shrinkable end caps. Do not remove end caps until cables are ready to be terminated.

PART 2 PRODUCTS

2.01 GENERAL

A. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

B. The manufacturer's name, the voltage class, type of insulation, thickness of insulation, conductor size, UL listing and date of manufacture shall be printed on the jacket.

C. Cables shall be suitable for use in partially submerged salt water locations, in non-metallic or metallic conduits, underground duct systems and direct buried installation.

D. Cables shall be able to operate continuously at 105 degrees C conductor temperature, with an emergency rating of 140 degrees C and a short circuit rating of 250 degrees C. Emergency overloads shall be possible for periods of up to 500 accumulative hours during the life time of the cable.

E. Medium voltage cable shall be shielded unless specifically shown otherwise on the Drawings.

F. Medium voltage cables shall have the following physical characteristics in accordance with ICEA, AEIC and UL standards:

1. Conductors: Annealed, uncoated Class B copper, compressed concentric lay, stranded per ASTM B-8 or compact concentric stranded per ASTM B-496.

2. Insulation: Thermosetting dielectric based ethylene propylene rubber (EPR) compound over an extruded, non-conducting high dielectric stress control strand screen layer, with a semi-conducting screen layer applied directly over the primary insulation.

G. Acceptable manufacturers:

1. Okonite Company, Inc.

2. General Cable Co.

3. The Southwire Company

4. approved equal

2.02 CABLE SHOP TESTING

A. Perform manufacturers standard production testing and inspection in accordance with Section 6 of the referenced ICEA standards. If requested by the ENGINEER, the manufacturer shall submit certified proof of compliance with ICEA design and test standards.

B. Provide certified test reports indicating that the cable has passed the vertical tray flame test in accordance with IEEE 1202 where applicable to the size cable.

2.03 CABLE RATINGS AND TYPE

A. 15 kV Cable

1. Cable type: Single conductor.

2. Insulation level as required as required by UL 1072: 220 mils/133 percent.

3. Operating voltage; 12,470 Volts, 3 Phase, 60 Hz, grounded distribution system.

2.04 CABLE SHIELDING SYSTEM

A. Insulation Shield

1. The insulation shield shall consist of a layer of semi-conducting material extruded directly over the insulation.

B. Metallic Shield

1. 5 mil copper tape helically applied with a nominal 12.5 percent overlap.

C. Cable Jacket

1. Provide an overall, moisture, heat, abrasion, UV and ozone resistant jacket over the metallic shield. Jacket material shall be polyvinyl chloride (PVC).

2.05 CABLE ACCESSORIES

A. General

1. Cable termination and splicing material shall be as manufactured by Raychem; 3M Corp.; Elastimold or equal. All material used in terminating and splicing medium voltage cables shall be as recommended by the cable manufacturer. Cables shall be terminated and spliced in accordance with the kit supplier's Drawings.

2. Cable terminations shall meet or exceed IEEE Standard 48, Class I requirements.

3. EP insulated cable splices shall be hand wrapped and shall meet or exceed the requirements of ANSI C119.1 and IEEE 404.

4. Cable accessories shall be by one manufacturer to assure adequate installer training and application assistance.

B. Indoor Cable Termination

1. Single conductor shielded cable terminations for indoor applications shall be one piece, track resistant EPDM rubber with top seal and ground strap assemblies.

2. Termination shall have a current rating equal to, or greater than the cable ampacity.

3. Termination shall accommodate any form of cable shielding or construction without the need for special adapters.

4. Acceptable products:

   a. 3M Corp. Cold Shrink Quick Term QT III, 7620-T Series.

   b. Raychem Corp., HVT Series.

   c. Elastimold, Separable Connectors

C. Outdoor Cable Terminations

1. Single conductor shielded cable terminations for outdoor protected or exposed locations shall be one piece, track resistant silicone rubber with top seal, rain skirt and ground strap assemblies. Cable compartments of outdoor metal clad switchgear shall be considered as outdoor locations.

2. Termination shall have a current rating equal to, or greater than the cable ampacity.

3. Termination shall accommodate any form of cable shielding or construction without the need for special adapters.

4. Acceptable products:

   a. 3M Corp. Cold Shrink Quick Term QT III, 7620-S Series.

   b. Raychem Corp., HVT Series.

   c. Elastimold, PCT-1/35.

D. Tape Shielded Inline and Tee and Multi-point Cable Splice

1. Splice all shielded cables rated 15,000 Volts or less with conductor sizes ranging from No. 4 to 1,000 Kcmil in accordance with the instructions provided with inline cold shrink splice kits, 3M Corp. QS-III, 3M Scotch Brand Tape Splicing Kits 5717, 5718, 5719 and 5720, Raychem Corp., CAS Series or ENGINEER Approved equal.

2. Shielded cable splices shall be capable of normal continuous operations at the rated voltage and current on the cable it is to be used on (15 kV maximum). The splice kit shall contain all of the necessary materials required to make three splices including cable preparation materials, such as solvents, rags and abrasive materials. The primary insulating tape shall be an all-voltage linerless tape. A comprehensive step-by-step instruction sheet shall be included with each kit.

3. Separable connector system 15kV Class 200 AMP Deadbreak, rack installation in accordance with the instructions provided with the connector system by 3M Corp. 5810/5811 Loadbreak Series; 5815 Modular Technology Series, or equal by Raychem, Elastimold, or ENGINEER approved equal.

E. Heat Shrinkable Bus Connection Kits

1. Bus kits shall be capable of insulating bus bars 2-in to 6-in wide and for connection of one to four cables. Kits shall electrically insulate and environmentally seal the connection and be easily re-enterable.

2. Cable-to-bus bar connection kits shall be rated up to 15 kV class and tested in accordance with ANSI C37.20c, Section 5.2.1.4 Test for Bus Bar Insulation and Section 5.2.9 Flame-Retardant Test for Applied Insulation. Kits shall be Raychem Corp., Type HVBC, or equal by 3M Corp., Elastimold, or ENGINEER approved equal.

F. Cable end caps shall be heat shrinkable polyelofin, 3M Corp., Type SKE or equal.

G. Lugs and Connectors

1. Copper lugs and connectors shall be crimped with standard industry tooling. All connections of copper stranded wire in sized No. 6 AWG through 1000 kcmil shall be made electrically and mechanically secured. The lugs and connectors shall have a current carrying capacity equal to the conductors for which they are rated and meet UL 486 requirements. Lugs larger than 4/0 AWG shall be two-hole lugs with NEMA spacing. The lugs and connectors shall be rated for

operation through 35 kV. The lugs shall be of closed end construction to exclude moisture migration into the cable conductor.

H. Electrical Grounding Braid

1. Conducting metal braid shall be woven from 240 strands of 30 AWG tinned copper wires and be capable of carrying fault current comparable to that of 6 AWG copper wire, 3M Corp., Scotchbrand 25 or equal.

I. Cable Marking Systems

1. A 7-mil, flame retardant, cold and weather-resistant vinyl plastic electrical tape shall be used for phase identification, 3M Corp.; Scotch 35 Tape or equal.

2. Cable tags shall be heat stamped nylon secured by polypropylene cable ties, Thomas & Betts No. TC228-9, or equal.

2.06 PULLING COMPOUNDS

A. Pulling compound shall be nontoxic, nonflammable, noncombustible and noncorrosive. The material shall be UL listed and compatible with the cable insulation and jacket.

B. Acceptable manufacturers are Ideal Company; Polywater, Inc.; Cable Grip Co., 3M Corp. WL Series or equal.

PART 3 EXECUTION

3.01 GENERAL

A. Determine the cutting lengths, reel arrangements and total lengths of cable required and shall furnish this data to the cable manufacturer as soon as possible to assure on-time delivery of cable.

B. Make use of the field engineering services available from the cable manufacturer.

3.02 INSTALLATION

A. Install cable and cable accessories as required or shown on the Drawings and in accordance with manufacturer's instructions and approved shop drawings.

B. Cable Installation

1. When temperature is below 50 degrees F, cable reels shall be stored at 70 degrees F for at least 24 hours before installation.

2. Do not exceed manufacturer's recommendations for maximum pulling tensions and minimum bending radii.

3. Use loose pulling eyes unless factory pulling eyes have been installed.

4. Pull cables from direction that requires the least tension.

5. Feed cables into raceway with zero tension and without cable crossover at raceway entrance.

6. Provide continuous monitoring of cable tension during the cable pull. ENGINEER shall witness the cable installation and tension. Submit certified field testing reports indicating cable tensions during the pull to the ENGINEER within five days of the completion of the installation.

C. Splicing and Terminating

1. Cables shall be installed with a minimum of splices. Proposed splice locations shall be submitted to the ENGINEER for approval.

2. Splices and terminations shall be made with either manufactured splice and termination kits or premolded cable accessory components.

3. Separable connector junctions and accessories shall be mounted on a metal rack system.

4. The work area shall be kept warm, dry and ventilated during splicing and terminating of the cables.

5. Splicing and terminating shall be performed by electricians having at least 80 hours of formal training and a minimum of five years field experience in this type of work.

6. Prepare cables in accordance with splice or termination kit manufacturers installation details.

7. Clean cables for splicing or terminating with cleaning kits included with the splice or terminating kit. If a cleaning kit is not provided with the kit use a 3M Corp. CC-2 preparation kit or equal.

8. Maintain shield continuity around splices. Bond cable shields at each terminal or splice location.

9. Install a neoprene tape wrap around each splice and bonding jumper to provide a watertight environmental seal.

10. Insulate and seal each cable-to-bus termination with heat shrinkable bus connector kits.

D. Marking and Identification

1. Plastic nameplates shall be installed in each manhole, pull box and at splice and terminating points. These nameplates shall show the phase and feeder designations and the date when the cable was installed or splice or termination was made. The feeder designation shall be as indicated on the Drawings. Nameplates shall be tied to each cable with self-locking nylon ties.

3.03 FIELD TESTING

A. Field testing shall be performed by the independent testing firm specified in Section 16950. The testing firm shall provide all material, labor, equipment and technical supervision to perform the tests and inspection.

B. Equipment testing and inspection shall be performed in accordance with NETA Standard ATS and shall include the following:

1. Visual and mechanical inspection.

2. Shield continuity test.

3. Insulation resistance test.

4. DC Hipot test per IEEE Standard 400.

C. Submit certified copies of the test results and leakage plots within five days of completion of the tests.

D. Immediately notify the ENGINEER and do not energize the cables if any of the following conditions occur:

1. Cable damage.

2. Improper installation or grounding.

3. Shield discontinuity or high resistance.

4. Dielectric absorption ratio and polarization index below 1.5.

5. Abnormal plot of leakage current versus voltage.

E. Defective or Damaged Cables

1. The ENGINEER shall make sole determination of the acceptability of the cables based on the submitted test reports. Do not energize cables until the test reports have been reviewed and approved by the ENGINEER.

2. If, in the opinion of the ENGINEER, the cables, terminations or splices are determined to be damaged or defective, provide the following remedial actions at no additional cost to the OWNER:

a. Remove splices and terminations and completely re-test the cables to determine whether the cables are damaged or defective.

b. Remove and replace damaged or defective cables as directed by the ENGINEER.

c. Remake terminations and splices with new kits.

d. Completely re-test cable, splices and terminations in accordance with Paragraph 3.03B above.

END OF SECTION

SECTION 16141

WIRING DEVICES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and install wiring devices as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Outlet boxes are included in Section 16110.

1.03 SUBMITTALS

A. Submittals shall be in accordance with Section 16000.

1.04 REFERENCE STANDARDS

A. Wiring devices shall comply with the requirements of the National Electric Code (NEC) and shall be Underwriters Laboratories (UL) labeled.

PART 2 PRODUCTS

2.01 MATERIALS

A. Wall switches shall be heavy duty, specification grade, toggle action, flush mounting quiet type. All switches shall conform to the latest revision of Federal Specification WS 896. Wall switches shall be suitable for the area classification indicated and shall be of the following types and manufacturer:

1. Single pole, 20 Amp, 120/277 Volt - Cooper Wiring Devices; Hubbell Wiring Devices-Kellems; Pass & Seymour, Inc. or equal.

2. Double pole, 20 Amp, 120/277 Volt - Cooper Wiring Devices; Hubbell Wiring Devices-Kellems; Pass & Seymour, Inc. or equal.

3. Three way, 20 Amp, 120/277 Volt - Cooper Wiring Devices, Hubbell Wiring Devices-Kellems; Pass & Seymour, Inc. or equal.

4. Four way, 20 Amp, 120/277 Volt - Cooper Wiring Devices; Hubbell Wiring Devices-Kellems; Pass & Seymour, Inc. or equal.

5. Single pole, 20 Amp, 120/277 Volt - key operated, Cooper Wiring Devices; Hubbell Wiring Devices-Kellems; Pass & Seymour, Inc. or equal.

6. Single pole, 20 Amp, 120 Volt - red pilot-lighted handle, Cooper Wiring Devices; Hubbell Wiring Devices-Kellems; Pass & Seymour, Inc. or equal.

7. Single pole, 20 Amp, 120 Volt, clear lighted handle, Cooper Wiring Devices; Hubbell Wiring Devices-Kellems; Pass & Seymour, Inc. or equal.

8. Momentary contact, three position, 2 circuit, center off - Cooper Wiring Devices; Hubbell Wiring Devices-Kellems; Pass & Seymour, Inc. or equal.

B. Receptacles shall be heavy duty, specification grade of the following types and manufacturer or equal. Receptacles shall conform to Fed Spec WC596-F.

1. Duplex, 20 Amp, 125 Volt, 2 Pole, 3 Wire; Cooper Wiring Devices; Hubbell Wiring Devices-Kellems; Pass & Seymour, Inc. or equal.

2. Weatherproof/corrosion resistant single, 20 Amp, 125 Volt, 2 Pole, 3 Wire, with cover; Crouse-Hinds Co., Catalog No. WLRS-5-20; Appleton Electric FSKJ520; Pass & Seymour or equal.

3. Weatherproof/corrosion resistant duplex, 20 Amp, 125 Volt, 2 Pole, 3 Wire, with cover; Crouse-Hinds Co., Catalog No. WLRD-5-20; Appleton Electric FSKD520; Pass & Seymour or equal.

4. Ground fault circuit interrupter, duplex, 20 Amp, 125 Volt, 2 Pole, 3 Wire, GFCI feed thru type with "test" and "reset" buttons. Cooper Wiring Devices; Hubbell Wiring Devices-Kellems; Pass & Seymour, Inc. or equal.

C. Device Plates

1. Plates for indoor flush mounted devices shall be of the required number of gangs for the application involved and shall be as follows:

a. Administration type buildings: Smooth, high impact nylon of the same manufacturer and color as the device. Final color shall be as selected by the Architect.

b. Where permitted in other areas of the Project, flush mounted devices in cement block construction shall be Type 302 high nickel (18-8) stainless steel of the same manufacturer as the devices.

2. Plates for indoor surface mounted device boxes shall be cast metal of the same material as the box, Crouse-Hinds No. DS23G and DS32G; Appleton FSK1DRC, FSK1TSEC; Pass & Seymour or equal.

3. Oversized plates shall be installed where standard plates do not fully cover the wall opening.

4. Device plates for switches mounted outdoors or indicated as weatherproof shall be gasketed, cast aluminum with provisions for padlocking switches "On" and "Off", Crouse Hinds No. DS185; Appleton FSK1VS; Pass & Seymour or equal.

5. Multiple surface mounted devices shall be ganged in a single, common box and provided with an adapter, if necessary, to allow mounting of single gang device plates on multigang cast boxes.

6. Engraved device plates shall be provided where required.

7. Provide weatherproof-while-in-use, gasketed cover for receptacles mounted in a FS/FD box outdoors or in wet indoor areas. Covers shall be Cooper Crouse-Hinds; RACO (Hubbell); Pass & Seymour, Inc. or equal.

D. Three Phase Power Receptacles

1. Three phase power receptacles and plugs shall be rated for the voltage and current ratings of the connected load unless otherwise shown on the Drawings.

2. Receptacles and plug housings shall be constructed of hi-impact, corrosion resistant non-metallic materials, stainless steel or copper free aluminum listed to UL Standard 498 for watertight construction. Hardware shall be stainless steel.

3. Performance

   a. Maximum working voltage: 600 Volts RMS.

   b. Dielectric withstand voltage: 3000 Volts.

   c. Full load break capability at rated current.

   d. 5000 connect/disconnect cycles at rated voltage and current.

4. Furnish and install one mating plug with each receptacle.

5. Provide the following features:

   a. Color coded by voltage.

   b. One piece housing/angled backbox

   c. Shrouded pins

   d. Self closing gasketed cover.

   e. Watertight cable entrances/stress relief grips.

   f. Mating keys.

6. Acceptable manufacturers:

   a. Hubbell

   b. Appleton

   c. Cooper Crouse-Hinds

PART 3 EXECUTION

3.01 INSTALLATION

A. Switch and receptacles outlets shall be installed flush with the finished wall surfaces in areas with stud frame and gypsum board construction, in dry areas with cement block construction or when raceways are shown as concealed on the Drawings.

B. Do not install flush mounted devices in areas designated NEMA 12, 3R, or 4X on the Drawings. Provide surface mounted devices in these areas.

C. Provide weatherproof devices covers in areas designated NEMA 3R, or 4X on the Drawings.

D. Convenience outlets shall be 18-in above the floor unless otherwise required or shown on the Drawings.

E. Convenience outlets installed outdoors and in rooms where equipment may be hosed down shall be 48-in above floor or grade or as shown on the Drawings.

F. Switches and dimmer controls for lighting shall be mounted 48-in above the finished floor unless otherwise noted or required.

G. The location of all devices is shown, in general, on the Drawings and may be varied within reasonable limits so as to avoid any piping or other obstruction without extra cost, subject to the approval of the ENGINEER. Coordinate the installation of the devices for piping and equipment clearance.

END OF SECTION

SECTION 16191

MISCELLANEOUS EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install all miscellaneous equipment as shown on the Drawings and as specified herein.

B. This Section provides the requirements for miscellaneous equipment typically employed in a facility, however, not all components specified in this Section are necessarily utilized on this project.

C. The following equipment is included under this Section:

1. Disconnect switches.

2. Fused disconnect switches.

3. Manual motor starters.

4. Horsepower Rated, Toggle Switch Type Disconnect Switch

5. Combination magnetic motor starters.

6. Control stations.

7. General purpose dry transformers.

8. Transformer-Panel Assemblies (Mini Power Centers).

9. Control relays.

10. Terminal Blocks.

11. Intrinsically Safe Relays.

12. Timing relays (solid state).

13. Corrosion inhibitors.

14. Equipment identification nameplates.

15. Equipment mounting stands.

16. Warning Signs.

17. Heat Detectors.

1.02 SUBMITTALS

A. Submittals shall be in accordance with Section 01300. Submittals shall contain detailed catalog information or drawings describing electrical and physical characteristics of all equipment specified in sufficient detail to show compliance with the Drawings and Specifications.

1.03 REFERENCE STANDARDS

A. Equipment enclosures shall have NEMA ratings suitable for the location in which they are installed, as specified in Section 16000.

PART 2 PRODUCTS

2.01 MATERIALS

A. Disconnect Switches

1. Disconnect switches shall be heavy-duty, quick-make, quick-break, visible blades, 600 Volt, 3 Pole with full cover interlock, interlock defeat and flange mounted operating handle. All current carrying parts shall be copper.

2. NEMA 3R enclosures shall be rain tight, galvanized or painted steel.

3. NEMA 4X enclosures shall be stainless steel.

4. NEMA 7 enclosures shall be cast aluminum.

5. Switches shall be as manufactured by the Square D Co.; General Electric; Eaton Electrical, or equal.

B. Fused Disconnect Switches

1. Fused disconnect switches shall be heavy-duty, quick-make, quick-break, visible blades, 600 Volt, 3 Pole with full cover interlock, interlock defeat and flange mounted operating handle. All current carrying parts shall be copper.

2. Fuses shall be rejection type, 600 Volts, 200,000 A.I.C., dual element, time delay, Bussman Fusetron, Class RK-5, or equal.

3. NEMA 3R enclosures shall be rain tight, galvanized or painted steel

4. NEMA 4X enclosures shall be stainless steel.

5. NEMA 7 enclosures shall be cast aluminum.

6. Switches shall be as manufactured by the Square D Co.; General Electric; Eaton Electrical, or equal.

C. Horsepower Rated, Toggle Switch Type Disconnect Switch

1. Toggle type disconnect switches shall be manufactured of thermoplastic materials with screw-type terminals. The switches shall be rated 600 VAC and 20A at 600 VAC.

2. Toggle type disconnect switches shall be similar to a manual non-reversing starter without overloads and shall be 3 Pole, capable of "on-off" control of a 10 horsepower motor at 460 VAC.

3. Enclosure shall be provided with lock off provisions.

4. NEMA 3R enclosures shall be die-cast zinc.

5. NEMA 7 enclosures shall be cast aluminum.

6. Switches shall be as manufactured by the Square D Co.; Siemens Electrical Products; Eaton Electrical or equal.

D. Manual Motor Starters

1. Manual starters shall be suitable for the voltage and number of phase shown on the Drawings and shall be non-reversing, reversing or two speed type as shown on the Drawings. NEMA sizes shall be as required for the horsepowers shown on the Drawings. Manual starters shall have motor overload protection in each phase. Built-in control stations shall be furnished as required or as shown on the Drawings. Starter shall be furnished with lock off provisions.

2. Enclosures for use in NEMA 3R areas shall be rated NEMA 4, painted steel.

3. NEMA 4X enclosures shall be stainless steel.

4. NEMA 7 enclosures shall be cast aluminum.

5. Manual motor starters shall be as manufactured by the Square D Co.; General Electric; Eaton Electrical, or equal.

E. Combination Magnetic Motor Starters

1. Motor starters shall be a combination motor circuit protector and contactor, 2 or 3 Pole, single or 3 Phase as required, 60 Hz, 600 Volt, magnetically operated, full voltage non-reversing unless otherwise shown on the Drawings. NEMA sizes shall be as required for the horsepowers shown on the Drawings. Minimum size shall be NEMA size 1. Combination motor starters shall be fully rated for 22,000 Amps RMS symmetrical.

2. Motor circuit protectors shall be molded case with adjustable magnetic trip only. They shall be specifically designed for use with magnetic motor starters.

3. Multi-speed and reversing starters shall include two motor rated contactors mechanically and electrically interlocked so that only one device may be energized at any time.

4. Each motor starter shall have a 120 Volt operating coil and control power transformer. Transformer primaries and secondaries shall be equipped with time-delay fuses. Three phase starters shall have three overload relays. One normally open and one normally closed auxiliary contact shall be provided as spares in addition to contacts shown on the Drawings.

5. Overload relays shall be adjustable, ambient compensated and manually reset.

6. Furnish built-in control stations and indicating lights where shown on the Drawings.

7. NEMA 3R enclosures shall be painted steel.

8. NEMA 4X enclosures shall be stainless steel

9. NEMA 7 enclosures shall be cast aluminum.

10. Combination magnetic motor starters shall be as manufactured by the Square D Co.; General Electric; Eaton Electrical, or equal.

F. Control Stations

1. Control stations shall be heavy-duty type, with full size (30mm) operators.

2. Control station operators noted as emergency stop or LOS on the Drawings shall be maintained contact, push to stop/pull to release type

2. Enclosures for use in NEMA 3R areas shall be rated NEMA 4, painted steel.

3. NEMA 4X enclosures shall be fiberglass reinforced polyester.

4. NEMA 7 enclosures shall be cast aluminum.

5. Control stations shall be Square D Class 9001, similar by Eaton Electrical; General Electric Co., or equal.

G. General Purpose Dry Type Transformers

1. Transformers shall be dry type, two-winding with kVA and voltage ratings as shown on the Drawings. Transformer shall incorporate a 220 degree C insulation system and be designed not to exceed 115 degrees C temperature rise above a 40 degree C ambient full load.

2. Four full capacity taps shall be furnished, two 2-1/2 percent above and two 2-1/2 percent below rated primary voltage.

3. Windings shall be copper.

4. Transformers shall be built in accordance with ANSI C89.2, and shall be UL listed.

5. Transformers shall be energy efficient type, meeting the efficiency levels specified in NEMA Standard TP1-2002. Efficiency shall be tested in accordance with TP1-2002.

6. Transformers shall be furnished in NEMA 1 enclosures unless otherwise noted on the Drawings or as required by Section 16000. Areas where a NEMA 4X and/or stainless steel enclosure is required, the transformer shall be of the TENV type.

7. Transformers shall be furnished with hot-dipped galvanized mounting hardware. In NEMA 4X areas or where stainless steel enclosures are required, hardware shall be Type 316 stainless steel.

8. Transformers shall have common core construction with low hysteresis and eddy current losses. The core flux density shall be below the saturation point to prevent overheating caused by harmonic distortion.

9. Transformer impedance shall be a minimum of 3 percent and a maximum of 5 percent.

10. Provide vibration isolators for transformers rated 112.5 kVA and higher.

11. Provide ground lug on frame and strap ground core assembly to frame of enclosure.

12. Transformers shall be manufactured by Square D Co.; General Electric Co.; Eaton Electrical, or equal.

H. Transformer-Panel Assembly (Mini Power Center)

1. Manufacturers

   a. Eaton Electrical, Mini-Power Center

   b. Square D, Mini-Power Zone

   c. General Electric, Servicenter

   d. or equal

2. Ratings

   a. kVA and voltage ratings shall be as shown on the Drawings.

   b. Units shall be designed for continuous operation at rated kVA, for 24 hours a day, 365 days a year operation, with normal life expectancy as defined in ANSI C57.96.

   c. Transformer sound levels shall not exceed the following ANSI and NEMA levels for self-cooled ratings.

   d. Transformer windings shall be copper.

3. Construction

   a. Each assembly shall include a main primary breaker, an encapsulated dry-type transformer, and a secondary panelboard with main breaker.

   b. Main primary, secondary, and feeder breakers shall be enclosed with a padlockable hinged door.

4. Bus

    a. Panelboard bus shall be copper sized to NEMA 65 degrees C rise.

5. Wiring/Terminations

    a. All interconnecting wiring between the primary breaker and transformer, secondary main breaker and transformer, and distribution section shall be factory installed.

    b. All transformers shall be equipped with a wiring compartment suitable for conduit entry and large enough to allow convenient wiring.

6. Main Devices

    a. Each assembly shall include a main primary breaker with an interrupting rating of 22 kA at 480 Volts; and a secondary panelboard with main breaker rated 10 kA interrupting rating at 240 Volts.

7. Feeder Devices

    a. The secondary distribution section shall accommodate one inch, bolt-on breakers with 10 kA interrupting capacity.

8. Enclosure

    a. The enclosure shall be made of heavy-gauge steel and the maximum temperature of the enclosure shall not exceed 90 degrees C.

    b. The enclosure shall be totally enclosed, non-ventilated, NEMA Type 3R, with lifting eyes.

I. Control Relays

1. Control relays shall be heavy duty machine tool type, with 10 Amp, 300 Volt convertible contacts. Number of contacts and coil voltage shall be as shown on the Drawings. General use relays shall be General Electric Co., Catalog No. CR120B; similar by Square D Co.; Allen-Bradley Co., or equal. Latching relays shall be General Electric Co., Catalog No. CR120BL; similar by Square D Co.; Allen-Bradley Co. or equal.

2. Time delay relays shall be pneumatic, 600 Volt, 20 Amp contacts, with calibrated knob operated adjustment. On delay and off delay types and timing ranges shall be as shown on the Drawings. Relays shall be Agastat Model 7012 or 7022; similar by Square D Co.; Eaton Electrical, or equal.

J. Terminal Blocks

1. Terminal blocks shall be NEMA type rated at 20 amperes minimum, 600 Volt, channel mounted, with tubular screw and pressure plate.

2. Terminal blocks shall be Bulletin 1492 as manufactured by the Allen-Bradley Co.; ABB; Kukla, or equal.

K. Intrinsically Safe Relays

1. Intrinsically safe relays shall be solid state type with 5 Amp output contacts, suitable for use on a 120 Volt, 60 Hz power supply and shall be FM approved for pilot devices in Class I, Division 1, Group D hazardous atmospheres.

2. Intrinsically safe relays shall be Gems Solid State Safe-Pak as manufactured by Gems Sensors, Division of Transamerica Delaval, Inc.; R. Stahl, Inc; MTL Inc., or equal

L. On-Delay, Off-Delay Timers (Solid State)

1. On and off delay timers shall be microprocessor based, solid state type.

2. Timers shall have the following features:

a. Adjustable timing ranges from 0.1 seconds to 99 hours, 59 minutes minimum.

b. Setpoints entered by pressing membrane covered keyboard on unit.

c. LCD readout of timing progress and setpoint.

d. Adjustable for on-delay or off-delay modes.

e. Standard sized plug-in case.

f. Totally sealed face plate.

g. Sealed battery backup power to retain memory for up to 30 days.

h. Accuracy plus or minus 0.01 second.

i. DPDT isolated instantaneous and timed output contacts rated 6 Amps minimum at 120 Volt.

2. Timers shall be Bulletin 651 Multirange, solid state as manufactured by Tenor Co., Inc.; Eagle Signal, CS-300 Series or equal.

M. Corrosion Inhibitors

1. All equipment enclosures, terminal boxes, etc., located in a corrosive rated area (where shown on the Drawings) that contains electrical or electronic equipment or terminal strips shall be furnished with an internally mounted, chemically treated corrosion inhibitor pad.

2. The corrosion inhibitor pads shall be as manufactured by Hoffman Engineering Co.; 3M; AGM Container Controls, or equal.

N. Equipment Identification Nameplates

1. All field mounted electrical equipment such as disconnects, push button stations, etc, shall be provided with a weather resistant engraved laminoid equipment identification nameplate screwed or bolted adjacent to the device. Nameplate shall identify the mechanical equipment controlled exactly as shown on the electrical singleline drawings (i.e., P-95 Cooling Water Pump No. 1).

O. Equipment Mounting Stands

1. Equipment mounting stands shall be custom fabricated from 1/4-in steel plate and 4-in steel channel, as shown on the Drawings. For NEMA 4X areas or where stainless steel enclosures are required mounting stands and channels shall be Type 316 stainless steel.

2. Hot dip galvanizing shall conform to the requirements of Division 5.

P. Arc Flash Protection Warning Signs

1. Provide field-affixed arc flash warning labels on all switchboards, panelboards, industrial control panels, and motor control centers in accordance with National Electrical Code Article 110.16.

2. As a minimum, warning signs shall state “WARNING: Arc Flash and Shock Hazard, Appropriate PPE required”, and shall be designed in accordance with ANSI Z535.4-1998 and the final Arc Flash Study report (Specification Section 16015).

Q. Electric Warning Sign

1. Provide and install using stainless steel fasteners restrictive signs that conform with OSHA regulations for accident prevention. Size of sign: 10-in high by 14-in wide. Sign shall state “DANGER HIGH VOLTAGE” and any other applicable OSHA required terminology. Sign shall be constructed of High Performance Plastic (HPP) by the Seton Name Plate Corp.; Global Equipment Co.; World-wide Sign Co., or equal.

R. Heat Detector

1. Heat detection device shall be combination fixed temperature and rate of rise. The detectors shall alarm at a fixed temperature of 135°F (57.2°C) and have a rate-of-rise element rated at 15°F (8.3°C) per minute . An output contact shall be provided for remote indication of alarm.

2. Device shall Meet Agency Standards: ANSI/UL 521- Heat Detectors for Fire Protective Signaling Systems , FM 3210- Heat Detectors for Automatic Fire Alarm Signaling, and CSFM 7270 – Heat Detector.

3. The detectors shall be low profile ceiling-mount/wall-mount and shall be plug-in mounted into a twist-lock base. The detectors shall be constructed of UV resistant polymer and shall be detachable from the mounting base to simplify installation, service and maintenance. Mounting base wiring connections shall be made by means of screws. The detector shall

allow pre-wiring of the base, and the head shall be a plug-in type. Mounting base shall be mounted on junction box.

4. Power input shall be 120 volt.

5. Detectors shall be as manufactured by System Sensor, Simplex/Grinnell, Siemens or ADT.

PART 3 EXECUTION

3.01 INSTALLATION

A. Mounting Stands

1. Field mounted disconnects, pushbutton control stations, alarm panels, enclosed starters and circuit breakers, transformers, automatic transfer switches, wireways, contactors, terminal boxes, junction and pull boxes shall be mounted on galvanized or stainless steel stands as specified. Where clearance requirements for stands may not be maintained, the ENGINEER may direct electric control equipment to be wall-mounted adjacent to the driven equipment, but in no case shall the distance from the drive motor to the control station exceed 3-ft, all at no additional cost to the OWNER.

2. Channel supports shall be ground smooth and fitted with plastic end caps.

END OF SECTION

SECTION 16230

DIESEL ENGINE DRIVEN GENERATORS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section describes materials, installation, and testing of standby diesel driven electrical generators that are to be installed as a part of this project.

1. A single Engine Generator System Supplier (EGSS) shall furnish all materials and equipment defined in this Specification Section.

2. The EGSS shall also furnish the natural gas driven generators specified in Section 16231.

3. The EGSS shall furnish materials, equipment, and test the skid mounted standby engine driven generator systems and required supporting systems as shown in Table 16230-A and specified herein.

4. Each engine generator system will be used to provide standby power to a Pump Station. Multiple pump stations and associated generator systems are included in this contract.

5. The EGSS shall provide storage until engine generator unit is shipped to the installation site.

6. The EGSS shall review and certify installation of the installed equipment.

7. The EGSS shall provide to the OWNER all documentation required to allow the OWNER to complete, submit and obtain air quality permits and fire code permits for the engine generator systems furnished.

1.02 RELATED WORK

A. Automatic Transfer Switch: Section 16492.

B. Generator site-specific requirements are shown in Tables 16230-A and 16230-B.

C. Natural gas driven generators: Section 16231.

D. Miscellaneous Electrical Equipment: Section 16191.

E. Seismic Design Criteria: Section 01615.

F. Section 16950 – Electrical System Testing and Settings.

G. Mechanical installation details for the engine generator set including the exhaust silencer, combustion and cooling air inlet and outlet louvers, sound attenuators, etc., are shown on the Mechanical Drawings.

1.03 REFERENCES

A. Design, manufacturing and assembly of elements of the equipment herein specified shall be in accordance with but not limited to published standards of the following, as applicable:

1. American Gear Manufacturers Association (AGMA)
2. American Institute of Steel Construction (AISC)
3. American Iron and Steel Institute (AISI)
4. American Society of Mechanical Contract Administrators (ASME)
5. American National Standards Institute (ANSI)
6. American Society for Testing and Materials (ASTM)
7. American Welding Society (AWS)
8. Anti-Friction Bearing Manufacturers Association (AFBMA)
9. Institute of Electric and Electronic Engineers (IEEE)
10. National Electric Code (NEC)
11. National Electrical Manufacturers Association (NEMA)
12. Occupational Safety and Health Administration (OSHA)
13. Society for Protective Coatings (SSPC)
14. Underwriters Laboratory, Inc. (UL)
15. National Fire Protection Association (NFPA)
16. Society of Automotive Engineers (SAE)
17. American Petroleum Institute (API)
18. International Society of Automation (ISA)
19. Factory Mutual Engineering and Research Corp. (FM)

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.04 SYSTEM DESCRIPTION

A. The standby engine generator shall have continuous standby power rating (site rated) of the larger of the value shown on the Table 16230-A or the EGSS calculated rating for the specific equipment to be powered. The generator shall be rated at 80 percent lagging power factor, 480Y/277 volt, 3-phase, 4-wire, 60 Hertz.

B. The standby engine generator shall be arranged for automatic starting and stopping and load transfer upon failure of the normal source of power as sensed and signaled from the remote automatic transfer switch.

C. The standby engine generator package shall be complete in all respects and shall include all equipment and controls necessary for a fully operational system. Skid mounted equipment shall be completely factory assembled and shipped to the project site.

D. The equipment to be furnished under this Section includes, but shall not be limited to the following:

1. Skid mounted diesel engine and generator set.

2. Exhaust system.

3. Skid mounted fuel system, including transfer piping, base-mounted fuel supply tank, fill system, valves, and appurtenances.

4. Skid mounted piping, wiring and valves.

5. Flexible connectors and/or expansion joints for connection of field piping to the engine generator unit.

6. Engine mounted electric starter with skid mounted batteries.

7. Spring vibration isolators for the support of the generator skid frame.

8. Skid mounted engine generator control panel and appurtenances.

9. Spare parts and special tools.

10. Factory test

11. Field services, testing and training.

E. Performance Requirements

1. The voltage regulation shall be within plus or minus one percent from zero load to full-rated load. Upon application or removal of full- rated load in one step, the transient voltage and recovery to steady state operation shall be within three seconds.

2. Frequency regulation shall be isochronous from steady state no load to steady state full load. Random frequency variation shall not exceed plus or minus 0.25 percent (0.15 Hertz).

3. The engine-generator set shall be capable of single step load pick up of 100% nameplate kW and power factor, at site conditions, with the engine generator at the standby temperature as maintained by the engine water jacket heaters.

4. The engine generator shall be capable of sustaining a minimum of 90% of rated no load voltage with the specified kW load at near zero power factor applied to the generator set.

5. The engine generator shall be capable of starting the loads with a maximum of 25% starting voltage dip.

6. The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic, and no 3rd order harmonics or their multiples. Telephone influence factor shall be less than 40.

7. Noise levels at the property line with the unit operating at full rated load shall be no more than 45 dB(A).

8. Refer to Table 16230-A and 16230-B for additional performance and size criteria.

Table 16230-A
Diesel Generators

Station Name	Rated kW	Min. Starting KVA (@ 25% Max. Transient Voltage Dip)	Min. usable fuel supply	Maximum Sound Level	Maximum Physical Size (including Fuel Tank and Exclusive of Exhaust Silencer)
West Paso / Baywood	300	750 SKVA	24 hour full load operation	Refer to Table 16230-B	136”L x 58”W x 105”H
Mid-Town	175	450 SKVA	24 hour full load operation	Refer to Table 16230-B	117”L x 50”W x 82”H

Table 16230-B
Maximum Generator Sound Power Levels (dBA)

Noise Source	Octave Band								Total Sound Power
	63	125	250	500	1,000	2,000	4,000	8,000	
Generator	84	100	105	110	113	112	110	103	118
Exhaust	102	112	117	122	118	119	120	113	127

F. Equipment Anchorage Requirements

1. The requirements of this Work for anchorage are more stringent than the California Building Code, Uniform Building Code, or other model building code's standard recommendations because of the importance of this facility and the seismicity of the region. Anchorage of the equipment and engineering calculations furnished under this specification section shall be in accordance with 01615.

2. EGSS shall provide the installing contractor with details of anchor type, size, layout and embedment depth, and connections to engine-generator skid. The anchor bolts shall be 304 stainless steel and designed specifically for equipment furnished. Anchors shall be post-installed adhesive anchors.

3. The installing CONTRACTOR will be responsible for providing anchorage system and for installing the complete engine generator, silencer, and all appurtenances. Equipment shall be installed in accordance with final submittals and contract documents. Installation shall comply with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.

1.05 SUBMITTALS

A. Submit shop drawings in accordance with Sections 01300 and 16000.

B. Equipment submittals shall include the following:

1. Shop drawings, catalog cuts, internal wiring schematics and other materials required to completely describe the systems and equipment being furnished.

2. Identification, description and dimensions for each separately installed sub-assembly or piece of equipment and associated piping and electrical connection schematics.

3. Seismic anchoring information as described above.

4. Performance specifications of all items of equipment.

5. Control panel layout drawings and component bill of materials for all control devices.

6. Complete electrical, instrumentation, control and wiring diagrams of instrumentation and controls and electrical components. Specifically, the following is required:

a. One line diagrams and wiring diagrams for assembly and components.

b. Complete electrical circuit schematics, including generator control, alarms and power to all motors, accessories, and instruments furnished with the unit. Schematics shall include all termination points in each control panel. Wiring shall be identified by numbers and every termination point shall be

assigned a number. Termination point number (including wire number) shall appear on the schematics for each wiring termination shown. Submit written description of the operational control theory with the schematics.

c. Complete external electrical interconnection diagrams detailing exact terminals of connection, conduit sizes, and recommended wire sizes.

d. Complete Operations and Maintenance Manuals. Provide separate manual for each installation. The manuals shall be prepared specifically for the individual installation and shall include all required cuts, drawings, equipment lists, descriptions, etc., that are required to instruct operation and maintenance personnel unfamiliar with such equipment.

7. Specific submittal information for the following components shall be included:

a. Engine Data

(1) Manufacturer

(2) Model

(3) Number and arrangement of cylinders

(4) RPM

(5) Maximum power at rated RPM and site temperature and altitude conditions

(6) Make, model, and characteristics of governor

(7) EPA Tier 3 certification

(8) Certification of Emissions for the engines, including data on particulate matter, precursor organic compounds (POC), non-precursor organic compounds (NPOC), nitrogen oxides (NOx), and carbon monoxide (CO)

b. Generator Data

(1) Manufacturer

(2) Model

(3) Rated KVA

(4) Rated KW

(5) Voltage

(6) Insulation rating and temperature rise data

(7) Frequency

c. Generator efficiency, including excitation losses, at 80 percent PF

(1) Full load

(2) Three quarters load

(3) Half load

d. Guaranteed fuel consumption rate (at 138,000 BTU/gallons)

(1) Full load, gal/hr

(2) Three quarters load, gal/hr

(3) Half load, gal/hr

e. Generator unit and accessories

(1) Weight of skid mounted unit, including fuel tank and fuel

(2) Overall length

(3) Overall width

(4) Overall height

(5) Fuel tank details including construction, capacity, and physical size

(6) Exhaust pipe size, silencer manufacturer and silencer attenuation curve

(7) Size and locations of conduit stub-up areas

(8) Details of the power and control cables and connectors

f. Details of battery system including calculations for sizing batteries that indicates compliance with battery load and environmental starting requirements listed herein

8. The size, attenuation curve, and design back pressure for the silencing equipment as offered to accomplish the specified silencing for this installation.

9. Exhaust gas emissions data, maximum values at loads varying from full to 1/4 load:

a. Temperature (degrees F)

b. Flow (ACFM)

10. CFM of air required for combustion based upon inlet air temperature of 40 degrees C: (CFM)

11. Heat radiated to room by engine and alternator: (BTU/min)

12. Heat rejected to jacket water including lubricating oil: (BTU/min)

13. Heat rejected to aftercooler: (BTU/min)

14. Details of engine starting batteries including nominal ampere hour and cold cranking ampere ratings

15. Draft copy of the written service contract specified herein.

16. Operational Certification: Submit certification that is guaranteed to be adequate for load served. Include site-specific information on the loads to be served by the generator.

17. Test Reports: Furnish copies of the certified factory test and field test records of the complete engine driven generator unit.

18. Manufacturer"s recommendations for long-term storage, including specific types and grades of fluids, lubricants, etc.

19. Air and Fire Certifications

    a. Submit certification that the engine generator system complies with the particulate and combustion gas emission limits of the San Luis Obispo County Air Pollution Control District (APCD) and is permittable under the regulations in effect at the time of bidding. The unit shall be capable of meeting these emission limits without diminishing the 200 hour per year testing and maintenance time allowed by APCD for standby diesel generator units. Units unable to meet these limitations will not be accepted.

    b. The EGSS shall provide all required backup documentation regarding the engine and its components that is required by APCD for the air emission installation and operational permits.

    c. The EGSS shall provide all required backup documentation for the engine and its components that is required by the San Luis Obispo County Fire Department Fire Code Compliance Permit.

1.06 QUALITY ASSURANCE

A. The engine generator systems shall be the standard product, as modified by these Specifications, of a manufacturer regularly engaged in the production of this type of equipment.

B. The engine generator systems and all specified and required accessories shall be furnished by a single Engine Generator System Supplier (EGSS). The EGSS shall have sole responsibility for furnishing all items required for a complete and operable system and shall perform all work necessary to select, furnish, customize, and debug hardware specified within this Specification Section.

C. The EGSS shall be regularly engaged in the design and the installation of engine generator systems and their associated subsystems. For the purposes of this Specification, the EGSS shall be an organization that complies with all of the following criteria:

1. Maintains a permanent service organization and supply of spare parts in place at the time of the bid within 3 hours travel time of each of the project sites.

2. Supplies service and warrantee work for the engine generator system with their own employees.

3. Employs design, fabrication, testing and field service personnel on this project who have successfully completed a manufacturer‟s training course on the specific engine generator set proposed for this project.

4. Is an authorized distributor for the specified manufacturer of the engine and generator.

5. Furnishes a unit assembled from components with proven compatibility, reliability and are coordinated to operate as a unit.

6. Owns and operates service trucks dedicated to the purpose of providing field service on the engine generator and associated components.

7. Has performed work of similar or greater complexity on at least five previous projects.

8. The Engine Generator System Supplier (EGSS) shall be:

a. Energy Systems Power Systems; Stockton, CA

b. Cummins-West; Bakersfield or San Leandro, CA

c. Peterson Power; San Leandro, CA

d. Or equal

D. The engine generator systems and major components shall be manufactured and furnished to the EGSS by one of the following:

1. Generac

2. Onan-Cummins

3. Caterpillar

4. Or Equal

1.07 MAINTENANCE CONTRACT

A. Provide to the OWNER at no additional cost a separate written two year manufacturer's standard routine and preventative Maintenance Contract for each engine generator system, commencing on the Substantial Completion date established for the associated system. Maintenance contract shall include all parts, labor, and travel.

1.08 DELIVERY, STORAGE, AND HANDLING

A. After successful factory tests and other required milestones required for Ready-to-Deliver status the systems shall be stored at the EGSS"s expense until the installation site is ready to accept shipment. The units shall be stored at a storage facility acceptable to the OWNER in accordance with all manufacturer"s requirements for long-term storage. OWNER shall have access to the unit during storage.

B. Ship equipment, material and spare parts to the site complete except where partial disassembly is required by transportation regulations or for protection of components.

C. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which intended.

D. Mechanical and electrical equipment shall be coated, wrapped and otherwise protected from snow, rain, drippings of any sort, dust, dirt, mud, flood and condensed water vapor during shipment and while stored before construction.

1.09 PROJECT/SITE REQUIREMENTS

A. The engine generator and associated equipment shall be suitable for continuous operation at the intended site conditions. The engine generator system shall be installed indoors.

1.10 WARRANTY

A. The manufacturer shall warrant the material and workmanship of the generator system for a minimum of two (2) years from registered commissioning and start-up date.

B. The manufacturer shall offer an extended ten (10) years coverage.

C. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc. shall be allowed during the minimum noted warranty period described in paragraph A above.

1.11 OPERATION AND MAINTENANCE MANUALS

A. Provide Operations and Maintenance information per Section 01730. Separate operation and maintenance manuals are required for each engine generator system supplied.

B. Initial Operation and Maintenance Manual submittal: Operation and maintenance manuals are required for the engine generator system after successful completion of the Shop Tests. The Initial Operation and Maintenance Manuals shall include Shop Test results which have been given status „No Exceptions Noted" or „Make Corrections Noted". Initial Operation and Maintenance Manuals shall be submitted in accordance with Section 01300. Favorable review status is „No Exceptions Noted" or „Make Corrections Noted". Initial Operation and Maintenance Manuals shall include all information required to install the systems properly and for training of OWNER personnel required by under "Manufacturer's Services" below.

C. Final Operation and Maintenance Manuals: Final Operation and Maintenance Manuals shall be submitted for the engine generator system. Final Operation and Maintenance Manuals shall include successfully completed Field Test results. The Final Operation and Maintenance Manuals shall be favorably reviewed as a requirement for final acceptance of the system. Favorable review status is „No Exceptions Noted" or „Make Corrections Noted".

1.12 MAINTENANCE

A. Spare Parts

1. Provide the following spare parts for each generator set furnished:

a. One air filter element.

b. One lube oil filter element.

c. One fuel oil filter element.

d. One set of hoses and belts including one of each different size and type.

e. Three complete replacement sets of fuses of each different size and type.

f. One complete change of lube oil plus one gallon of make-up lube oil supplied in unopened containers.

g. Six pilot lamps of each type and voltage.

h. One quart of touch-up paint in each color used on the main assembly and housing.

i. One complete change of ethylene glycol anti-freeze solution to provide a 50 percent solution in the engine cooling system supplied in unopened containers

2. The spare parts and maintenance tools shall be packed in containers, permanently labeled by word and part number for easy identification of the items and properly packed for an extended period of storage before use.

1.13 MANUFACTURER"S SERVICES

A. Provide equipment manufacturer"s services for each generator set furnished for the minimum labor days listed below, travel time excluded:

1. Four hours to check the installation and advise OWNER during start-up, testing, and adjustment of the equipment.

2. Four hours to instruct the OWNER"s personnel in the operation and maintenance of the equipment. The OWNER reserves the right to videotape any training sessions.

PART 2 MATERIALS

2.01 GENERAL

A. Equipment and controls specified in this Section shall be new and be considered part of the engine generator system; the EGSS shall be responsible for integrating and furnishing the system in its entirety as specified herein.

B. The engine generator and related equipment shall be designed and constructed in conformance with the requirements of UL 2200 Standby Engine Generator Assemblies and NFPA110.

C. The generator set shall operate at 1800 rpm and at a voltage of 480Y/277 Volts AC, three phase, 4 wire, 60 hertz.

D. The complete generator set shall be rated per ISO8528 at no less than the kW ratings shown in table 16230-A, standby rating, with a 0.8 Power Factor. In addition, the rating of the complete generator set shall be sufficient for starting and running the site equipment as specified.

E. Mechanical equipment shall be designed and built for 24 hour continuous service at any and all points within the specified range of operation without overheating or excessive vibration or strain, and require only that degree of maintenance generally accepted as peculiar to the specific type of equipment required. Parts and components of all units shall be designed and built for interchangeability so that replacement parts may be installed without any additional fitting or machining.

F. The engine generator systems shall allow easy access to the various parts for maintenance purposes. All parts shall be properly enclosed to prevent the throwing or dripping of oil.

G. The engine generator systems shall be pre-piped and pre-wired insofar as possible.

H. Provide terminals for connection of all remote alarm, control and indications to and from the generator control panel. Generator power output cables shall be connected directly to the generator output breaker terminals.

2.02 ENGINE AND GOVERNOR

A. The engine generator set shall be a factory assembled unit, specifically designed and equipped for operation on No.2 diesel fuel oil. The engine and generator shall be directly connected with a semi-flexible steel coupling, shall be free from injurious torsional or other vibration and shall be vibro-mounted to a heavy steel sub-base. The diesel engine shall be four stroke cycle, radiator and fan cooled, turbocharged with intercooler using engine jacket water, full diesel, mechanical injection, arranged for direct connection to an alternating current generator. The unit shall operate at a rotative speed of not more than 1800 rpm. Units offered at ratings in excess of their published ratings are not acceptable and will not be approved. Two cycle engines are not acceptable.

B. Governor shall be Woodward, or approved equal, all electric, powered from the engine starting batteries and capable of maintaining isochronous regulation from no load to full rated load within 0.25 percent of rate frequency. It shall have the capacity for manual adjustment of speed setting and speed droop. Speed droop shall be adjustable from 0 to 5 percent from no load to full load. It shall be designed and installed to eliminate all electromagnetic interference.

C. Furnish a separate over-speed shutdown device which shall, in case of predetermined over-speed or the operation of various protective devices as later specified, instantly stop the engine without the fuel injection system losing its prime.

D. Skid-mounted radiator and cooling system shall be rated for full load operation in 40 degrees C ambient as measured at the generator air inlet, based on 0.5 in H_2O external static head. Radiator shall be sized based on a core temperature which is 10C higher than the rated operation temperature, or prototype tested to verify cooling performance of the engine/radiator/fan operation in a controlled environment. Radiator shall be provided with a duct adapter flange. The cooling system shall be filled with a 50/50-ethylene glycol/water mixture by the equipment manufacturer. Rotating parts shall be guarded against accidental contact.

E. Electric starters capable of three complete cranking cycles without overheating.

2.03 SUPPORTING STRUCTURE

A. The diesel engine generator shall be directly bolted, doweled, and aligned on a rigid, fabricated steel base, suitably sized to maintain the correct alignment, supported by heavy duty spring type vibro isolators. Isolators shall be suitable for anchoring to the level surface of a concrete pad.

B. All exposed surfaces on the structural steel members of the fabricated base frame and isolator spring restraints shall be shop primed and finished in accordance with Section 09901.

2.04 FUEL OIL SYSTEM (DIESEL FUEL)

A. Each engine fuel injection system shall include replaceable element type fuel oil filters, integral fuel supply pump, and flexible connectors for both fuel supply and return piping.

B. The diesel fuel system shall include a base-mounted diesel storage tank with leak detection monitor, fuel piping and fittings and isolating ball valves as specified herein.

1. Diesel tank shall have a minimum usable capacity of fuel as required to provide for 24-hour operation at full rated load as a minimum. The tank shall have dual steel shells (primary and secondary) with continuous welds and an annular space for monitoring leaks. The outer steel shell shall be completely enclose the inner steel tank and have a volume of 110 percent of the inner tank. The tank piping and fittings shall meet the requirements of Uniform Fire Code 37, 79-7, 110, and UL142.

2. The tank shall be equipped with the following:

a. Tank low level alarm switch; tank low-low level alarm and shutdown switch.

b. Fill assembly with 4-inch fill, cap, 7-gallon UL-listed overfill/spill containment. There shall be a manual drain back to the main tank.

c. Vent pipe and appurtenances. Vent package shall meet NFPA 30.

d. Mechanical fuel level gauge.

e. Electronic fuel level transmitter with readout and capacity for signal transmission.

f. Leak detection system with monitoring panel. Leak detector shall monitor the annular space between the walls of the fuel tank and shall include an auxiliary contact for remote alarm at the generator control panel.

3. The tank shall pass a 3 psi for 24 hour factory test.

4. Fuel piping, fittings, and valve shall be Schedule 40 black steel or stainless steel tubing.

5. Isolating valves for the fuel lines at engine shall be ball type with lever handles. The valve shall be bronze and stainless steel construction suitable for diesel fuel service.

6. Pressure relief valve designed to limit pressure to a maximum of 2.5 psi. It shall vent outside the enclosure.

7. The tank shall be labeled "Diesel Fuel Only" and have the NFPA placard. An NFPA placard shall be placed on the enclosure door. H=0, F=2, R=0.

C. The engine driven fuel supply pump shall discharge through a series filtration system, consisting of a 10 micron particle removal cartridge, followed by a water separation cartridge. A pressure relief valve shall be furnished and installed upstream of the filters and

arranged to discharge into the fuel tank. The excess fuel supplied to the engine shall be returned to the tank.

2.05 ELECTRIC (BATTERY) STARTING SYSTEM

A. Starting shall be accomplished by an engine mounted, solenoid shift electric starter, capable of withstanding four consecutive continuous cranking periods of 15 seconds duration each separated by 15 seconds rest periods before shutting down completely and provide an alarm to the control system.

B. The starting battery(ies) shall be low maintenance, long life, lead calcium type, especially designed for diesel engine cranking service and of a capacity as recommended by the battery manufacturer for cranking the engine being furnished, for the necessary break-away current as required and the spinning current for four consecutive starts of 15 seconds of cranking on each start, without being recharged, with the system at the site conditions. An insulated protective covering, skid mounted battery rack and suitable cables and connectors shall be provided. The rack shall be finished with an acid and fire resistant epoxy coating.

C. Cell containers shall be sealed, shock absorbing, heat resistant plastic with spray proof, flame arresting type vents. Battery shall be furnished with all connectors and hardware, lifting device, cables, and grease.

D. Battery charger shall be a UL listed, fully automatic, filtered, float-type, charger designed for heavy-duty industrial service, primarily to quickly recharge and maintain batteries that start internal combustion engines and suitable for mounting on the generator skid base. The D.C. output shall be regulated to within one percent with plus or minus 10 percent fluctuations of the input voltage and shall be current limited at 120 percent of rated output. have a continuous power rating sufficient to power all generator control devices in both the standby mode and the running mode, while maintaining correct charge voltage on the batteries. Accessories shall include D.C. ammeter and voltmeter, adjustable float and equalize controls, A.C. and D.C. circuit breakers, A.C. power failure alarm relay and low D.C. voltage alarm relay. A common battery charger malfunction alarm shall be indicated on the engine control panel. The charger shall be Chloride, LaMarche, or equal.

2.06 AIR INTAKE SYSTEM

A. The engine shall be equipped with suitably sized dry type air intake filter(s) to protect working parts of the engine from dirt and grit with replaceable type filter element. A crankcase breather and service indicators shall be included.

2.07 LUBRICATION SYSTEM

A. The engine shall be provided with a full pressure positive displacement, mechanical lubricating oil pump which shall have ample capacity to circulate the amount of lubricating oil and cooling oil required by the engine and turbocharger. The system shall be arranged to cool the pistons and to distribute oil to all moving parts of the engine including the turbocharger bearings and including full flow filter with replaceable spin-on canister elements and dipstick oil level indicator and a suitably sized shell and tube type oil cooler and an automatic temperature regulator if required. The engine shall be provided with a

sump type crankcase arrangement of sufficient capacity to suit the requirements of the engine.

2.08 ENGINE COOLING SYSTEM

A. The unit shall be equipped with a dual core radiator cooling system for the jacket water, lubricating oil and after cooler systems provided.

B. Provide suitable jacket water treatment for the prevention of both scale formation and corrosion in the engine water jackets and cooling system components which are in contact with the engine jacket water. This treatment shall be added to the cooling system prior to running the field acceptance test. Before adding the recommended treatment, the engine jacket water system shall be thoroughly cleaned and conditioned, in accordance with the manufacturer's instructions.

C. Provide manufacturer‟s recommended anti-freeze to prevent freezing of coolant to 25° F in sufficient quantity to fill all radiators.

D. Provide valved drains in the low point of the engine cooling system to allow easy drainage of coolant.

2.09 EXHAUST SYSTEM

A. Exhaust silencer(s), GT Exhaust, Maxim, Donaldson, or equal, for hospital grade type silencing, shall be installed. The exhaust pipe shall be ASTM A106 with wall thickness of 0.250-in, black steel with flanged fittings and of the size recommended by the engine manufacturer. Suitable expansion joints shall be provided and installed where required to provide for expansion of the pipe caused by a 1000 degree F temperature change. The exhaust line shall be connected to the engine by a suitable section of flexible stainless steel metal exhaust corrugated tubing suitable for the maximum temperature condition which may be encountered. Exhaust line elbows shall be long radius. Refer to Table 16230-B for maximum allowable exhaust dBA. Two exhaust silencers (mounted in series) shall be provided as required to meet the project site noise limits.

B. Furnish and install suitable equipment for the engine exhaust to attenuate the sound as specified.

C. The exhaust silencer shall be furnished loose for field mounting as indicated on the Drawings. The exhaust pipe shall terminate in a device to prevent the entrance of rain.

D. A suitable drain with valve shall be installed at the low point of the exhaust line.

E. Furnish and install all exhaust pipe spool pieces, elbows, pipe hangers, silencer supports, and appurtenance to allow installation of the system as shown on the Drawings, Exhaust pipe shall be Schedule 20 steel or approved equal.

F. Furnish and install insulation on all exhaust piping and silencer(s) located inside the building. Insulation shall be minimum 4” thick Fibrex FBX-1200 Series, or equal, with outer aluminum jacket and stainless steel band.

G. A stainless steel bellows type expansion joint as recommended by the engine manufacturer and suitable for the maximum engine exhaust operating temperature shall be used to connect the exhaust pipe to the engine.

H. Furnish and install all required steel support framing and hangers in accordance with the provisions of Section 15140 for mounting and supporting of the exhaust piping and silencer. Furnish Type 304L stainless steel support cradles and hold-down clamps to support the silencer from the concrete pads provided on the mezzanine.

2.10 JACKET WATER HEATERS

A. Automatic thermostatically controlled heater(s) shall be sized as recommended by the engine manufacturer to warm the engine to a minimum of 40C in a 15C ambient, in compliance with NFPA110 requirements, as a minimum, or the temperature required for starting and load pickup requirements of this specification.

B. The coolant heater shall be installed on the engine with SAEJ20 compliant materials. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run exceeds 12 inches. The coolant heater installation shall be specifically designed to provide proper venting of the system. The coolant heaters shall be installed using isolation valves to isolate the heater for replacement of the heater element. The design shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.

C. A separate manual power disconnect switch shall be provided for each heater.

D. Heaters shall be automatically deactivated when the engine generator unit is in operation.

2.11 ENGINE MOUNTED GAUGE PANEL

A. The engine generator system shall include an integrally mounted, vibration isolated engine gauge panel. This NEMA-12 enclosure shall include, but not be limited to, the following:

1. Lubricating oil pressure gauge.

2. Jacket water temperature gauge.

3. Combustion air filter manometer.

4. Elapsed time meter calibrated in hours and tenths of hours.

5. Fuel level gauge.

B. The gauges shall have a sealed case pulsation dampener and shall be a minimum of 2-in in diameter; time meter shall have 3-1/2 inch face. Digital readout gauges and meters are acceptable as an alternative. The scale range shall be as required for the particular application.

2.12 ENGINE GENERATOR CONTROLS

A. General

1. The engine generator shall include an integrally mounted engine generator control system. The components of this section shall be shop mounted on the skid. The controls shall include, but not be limited to, the following:

    a. Generator output circuit breaker.

    b. Generator voltage regulator control.

    c. Battery charger.

    d. Alarm and status annunciator system.

    e. Engine start and stop controls.

    f. Emergency stop switch

2. The control system including all covers, barriers, and supports shall be listed and labeled under the requirements of UL 891.

3. The generator set shall be provided with an electronic microprocessor-based control system designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall be designed to allow local monitoring and control of the generator set, with digital displays visible in any lighting condition.. The control system shall also allow remote monitoring of the generator set, as shown on Drawings, using dry relay contacts. Provide nameplates adjacent to each device to identify the device's function

4. The control panel shall be shock mounted at the alternator end of the unit, and oriented to be easily viewed, and shall be housed in a NEMA 12 enclosure. The controls shall be UL508 labeled.

5. Control system equipment shall be factory mounted and wired on or within the engine generator enclosure. Wiring shall be numbered in accordance with the numbering system used on the wiring/connection diagrams.

6. Panel wiring shall be stranded copper conductor, 600 volt, insulation type SIS, or equal. Minimum size shall be No. 14 AWG for A.C. power wiring and No. 16 AWG for D.C. control wiring. Wire for voltage regulator power and field circuits shall be shielded.

7. All DC control power for the engine generator system shall be derived from the engine generator set starting batteries.

B. Control Functions and Components

1. At a minimum, the control system shall contain the following components and functions.

a. Generator output frequency meter, ammeter, voltmeter, with phase selector switches.

b. Running time meter and start counter.

c. Engine generator mode selector switch: The controls shall include a three-position RUN-OFF-AUTO switch. In RUN, the engine shall start and run without load transfer; in OFF, the engine shall stop and will not start; in AUTO, the engine shall start and run and stop from the remote engine start contact provided by hardwired contact from the automatic transfer switch.

d. Reset pushbutton with indicator. Indicator shall flash to indicate that generator set is locked out due to a fault condition.

e. Lamp test pushbutton. Operation of this pushbutton shall cause all lamps on the panel to be simultaneously tested. As an alternative, provide push-to-test type pilot lights or digital indicators.

f. Emergency Stop push-button. The emergency stop push-button shall be a red, mushroom head push-button which maintains its position until manually reset.

g. Precision voltage and frequency adjust raise/lower switches or potentiometers. Switches (or potentiometers) shall allow the generator set frequency and voltage to be adjusted plus or minus 5%. Voltage and frequency adjustment switches shall be located inside of the control panel or shall be sealed in a manner to prevent unauthorized adjustment.

h. Alarm and status indicating panel to indicate the following conditions ("*" indicates required points; "-" indicates not required);

Function	Alarm (Amber)	Shutdown (Red)	Status (Green)
Low DC Voltage	*	-	-
High DC Voltage	*	-	-
Battery Charger Malfunction	*	-	-
Low Oil Pressure	*	*	-
High Oil Temperature	*	*	-
Fuel Tank – Low Level	*	-	-
Fuel Tank - Low-Low Level	*	*	-
Fuel Tank – Leak	*	-	-

Function	Alarm (Amber)	Shutdown (Red)	Status (Green)
Not in Auto	*	-	-
Low Water Jacket Temp	*	-	-
High Water Jacket Temp	*	*	-
Low Coolant Level	*	-	-
Gen Breaker Tripped	*	*	-
Overcrank	*	*	-
Overspeed	*	*	-
Under Frequency	*	-	-
Under Voltage	*	*	-
Over Voltage	*	*	-
In Automatic	-	-	*
Generator Running	-	-	*

i. Visual alarms shall be resettable only after the fault condition has been corrected. The audible alarm shall include a silencing circuit which after manual silencing of the current alarms will permit audible annunciation of subsequent failures.

j. The alarms shall have a type AM alarm sequence (manual reset of lamp required after the field contact returns to normal) as detailed below.

Condition	Contact	Lights	Horn
Normal	Normal	Off	Off
Alarm (Timed Off) (Timed to Steady-On)	Abnormal	Flashing	On
Silence	Abnormal	Steady-On	Off
Reset Normal	Off	Off	
Return to Normal	Normal	Off	Off
Test	---	Flashing	On

k. The control system shall also incorporate a data logging and display provision to allow logging of a minimum of the last 20 warning or shutdown indications on the generator set, the time of the last fault of each type, and the number of faults of each type, and total time of operation at various loads as a percent of the standby rating of the generator set.

l. The audible alarm horn shall be an adjustable volume (approximately 78-102 db) constant duty type. The alarm horn shall be provided with a panel mounted manual silence pushbutton. The alarm horn circuit shall also be provided with a timer to automatically silence the horn during unattended

operation (adjustable from 0-60 seconds). The automatic timer silencing circuit shall have an on – off switch to allow it to be either utilized (in automatic silence mode) or disabled (requiring manual reset of the horn.).

m. Engine warning conditions shall be grouped to provide a common alarm. All shutdown alarms shall be grouped to provide a common alarm. Provide a status indication for generator run status. These items shall be available for remote monitoring via isolated NO/NC contacts.

n. Complete engine start control which operates on closing contact and stop control which operates on hardwired contact from the Automatic Transfer Switch (ATS).

o. Cranking limiter to disconnect the starting motor from the battery supply after completing a total of four 15 second cranking periods separated by 15 second rest periods before shutting down completely and alarming.

p. Automatic voltage regulation system which is matched and prototype tested with the governing system provided. It shall be immune from mis-operation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below a threshold of (48-49) HZ. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alpha-numeric LED readout to indicate setting level.

q. AC over/under voltage monitoring system which responds only to true RMS voltage conditions. The system shall initiate alarm and shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown and alarm shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.

r. Battery monitoring system which initiates alarms when the DC control and starting voltage is less than 25VDC or more than 32 VDC. During engine starting, the low voltage limit shall be disabled.

s. Run Status Contacts: The controls shall include four normally open and four normally closed electrical relay contacts, rated 120 volts, 10 amps, a.c. The contacts shall be used for remote indication of engine run, operation of combustion air and ventilation air dampers, etc. The contacts shall actuate upon initiation of engine starting sequence and remain actuated until the engine shuts down.

2.13 GENERATOR OUTPUT CIRCUIT BREAKERS

A. The breaker shall be manually operated 3-pole, molded case circuit type, with solid state trip device.

B. The circuit breaker shall have the following adjustments as a minimum: long time, short time and instantaneous (amps pickup and time delay) and ground fault (amps pickup and time delay).

C. The EGSS shall recommend the set points of the breaker based on the characteristics of the equipment furnished. Breaker interrupting ratings shall be suitable for the generator furnished, however shall be 25,000 AIC minimum.

D. The output circuit breaker shall be UL listed to be applied at 100% of its rating.

2.14 AC DISTRIBUTION PANEL

A. All 120 or 240 volt power required by the engine generator and its auxiliary equipment shall be supplied from the building circuit breaker distribution panel as indicated on the Drawings.

2.15 ALTERNATOR AND EXCITATION SYSTEM

A. The alternator shall be of the open drip proof bracket type, especially designed for connection to the engine. The generator shall have Class H insulation rated for 105 degree C temperature rise. The generator shall have Amortisseur windings.

B. The alternator shall have a forged or cast alloy steel flanged shaft for direct connection through a suitable flywheel type coupling to the engine, or with suitable adapter and disc coupling and shall be of the single bearing type with anti-friction bearing.

C. The alternator windings shall be braced to withstand short stresses and shall be designed to withstand overheating or stresses caused by harmonics generated by up to 15% non-linear loads. The unit influence shall be "Radio Interference Proof" (RIP) and the "Telephone Influence Factor" (TIF) shall be within the limits of Section 9, ANSI C50.12.

D. The alternator shall be three phase, 60 Hertz, 4 wire, 480Y/277 volt operation with brushless with a rotating permanent magnet generator type exciter system, 3 phase solid state voltage regulator, filters and associated controls. Exciter shall have Class H insulation rated for Class F temperature rises.

E. The alternator stator core shall be built of low carbon steel laminations, precision-punched, deburred and individually insulated. Stator coils shall be random wound and inserted in insulated core slots. Wound core shall be insulated. Armature lamination followers and frame ribs shall be welded integral with frame. Enclosure shall be drip-proof guarded.

F. Alternator rotor poles shall be built up of individually insulated steel punchings. Poles shall be wet layer wound and insulated with VPI/epoxy resin. Cage connections shall be brazed for strong construction and permanent electrical characteristics. Each pole shall be securely bolted to rotor shaft.

G. A directional blower shall be mounted to draw cooling air from exciter end, over rotor poles and through louvered openings in drive end.

H. The alternator shall have grease lubricated anti-friction bearings. The designed bearing life, based on B-10 curve of the Anti-Friction Bearing Manufacturers Association, shall be not less than 40,000 hours.

2.16 MISCELLANEOUS EQUIPMENT

A. Hearing Protection : Provide two circumaural hearing protection devices per unit, MSA Noisefoe Mark IV ear muffs or equal for the protection of operating personnel. Provide with high impact plastic window type cabinet, suitable for wall mounting.

2.17 SURFACE PREPARATION AND SHOP PAINTING

A. The entire engine generator and associated equipment shall be shop primed and finished coated per the manufacturer's standard practice prior to shipment.

PART 3 EXECUTION

3.01 PROTOTYPE TESTING

A. Submit evidence of prototype testing; (manufacturer‟s certificate etc.).

3.02 SHOP TESTS

A. Before shipment to the project site, the engine generator system shall be shop tested. Tests shall be performed at the EGSS‟s service shop. Shop tests performed at the manufacturer‟s factory are not a substitute for the required EGSS shop test.

B. Shop tests for each system shall be sufficient to demonstrate that the systems will operate successfully and meet all specified operational requirements.

C. The EGSS shall furnish all necessary instruments, filters, starting air, fuel, cooling water, electric power and load banks for the test.

D. During shop testing, all automatic safety and shutdown devices shall be tested and their respective activation points shall be recorded.

E. Voltage and frequency regulation and transient response shall be tested and recorded to show full compliance with this Section. Strip chart graphs of the response upon application of the generator rated load in a single step shall be submitted with the test documentation. The chart shall be annotated to indicate the calibration of each axis. The transient response shall be demonstrated and recorded a minimum of three (3) times. The initial transient test shall be performed with a cold engine. The final transient test shall be performed on the engine at the completion of the four hour load test.

F. The Shop Test shall consist of, but not be limited to, four continuous hours of operation. During the Shop Test, readings shall be taken and recorded every thirty minutes for each of the following parameters at a minimum:

1. Time

2. Ambient temperature

3. Under no-load conditions: Volts for each phase

4. Under loaded conditions:

   a. Amps for each phase

   b. Voltage for each phase

   c. KW

   d. Power factor

   e. Frequency

   f. Engine jacket water temperature

   g. Cooling water temperature (in and out)

   h. Lubricating oil pressure

   i. Lube oil temperature

   j. Exhaust gas temperature

   k. Gallons of fuel consumed per hour

5. Shop Test shall also include verification all alarm, status, and shutdown points listed above, plus fuel tank level and analog electrical values shall be included as a minimum.

6. After successful completion of Shop Tests, the EGSS shall perform the following:

   a. The load limit shall be sealed. The seal shall be applied, using a seal press which embosses the manufacturer's initials on the lead seal.

   b. All entrapped water shall be drained, and protection applied to prevent the entry of water during shipment or a long period in storage while waiting for installation.

   c. The engine generator shall be given proper treatment for its protection for extended storage while waiting for the installation contract.

7. Certified test records for each system shall be submitted to the OWNER for review. Systems shall not be shipped to the installation sites unless results have been given „No Exceptions Noted" or „Make Corrections Noted" status. The testing shall be repeated and certified results resubmitted for review at no extra cost to the OWNER as often as necessary for the test results to be considered „No Exceptions Noted" or „Make Corrections Noted" by the OWNER.

8. Beginning at the time when the Shop Tests have been completed and favorably reviewed, the EGSS shall make the engine generator systems available for delivery to the Installing Contractor.

G. Storage of Equipment

1. Upon successful completion of the Shop Tests, the EGSS shall be responsible for storing the engine generator system as required in these specifications, until such time as the project CONTRACTOR requests delivery.

H. Delivery of Equipment

1. The EGSS shall deliver the engine generator system to the installation site when scheduled by project CONTRACTOR and in accordance with the requirements described of these specifications.

I. Field Service Technician

1. The EGSS shall coordinate, assist, place into operation, and certify the installation of each unit.

2. The EGSS shall provide support services for the engine generator system until notice of Final Completion is issued by the OWNER. Support services shall include maintenance and exercise services for the system at maximum of every six months. Exercise services shall include fueling, load bank, and services as specified herein.

3. The EGSS shall provide 4 hour minimum for each generator set to assist the CONTRACTOR with installation of the engine generator system. Assistance shall include location of anchor bolts; setting, leveling and field erection; and coordination of electrical connections.

4. The EGSS shall provide the services of a service technician for 4 hour minimum for each generator set, for the engine generator system start-up, testing, and calibration at each site. Minimum work-day requirements listed are exclusive of travel time and do not relieve EGSS of the obligation to provide sufficient service to place the equipment specified herein in satisfactory operation.

5. Operation and maintenance instruction shall be as described in this Section.

J. Field Start-up and Tests

1. Field start-up and testing shall be provided for the engine generator system by the EGSS. Field start-up and testing will be a joint effort with the project CONTRACTOR as necessary to assure that each system functions as specified. All tests shall be performed in the presence of the OWNER.

2. After the EGSS field service technician‟s check of the installed systems, the engine generator system shall be tested to demonstrate its ability to operate continuously without vibration, jamming, leakage or overheating and to perform specified functions. During start-up and operation, the project CONTRACTOR will comply with the manufacturer's operating and maintenance instructions.

3. The Field Test shall consist of two separate steps, the engine generator Load Test and the Standby Power System Test. The Load Test shall demonstrate the capability of the installed engine generator and related systems to produce rated power and operate in accordance with manufacturer‟s recommendations. The Standby Power System Test shall demonstrate the capability of the installed engine generator system to function as a part of the standby power system.

4. Load test:

   a. Test duration shall be for four continuous hours at the full rated load of the engine generator unit.

   b. The EGSS shall supply a portable resistive load bank for this test.

   c. During the test, all parameters recorded during the Shop Test shall be taken and recorded at 30 minute intervals.

   d. During the test, all of the automatic shutdown devices shall be retested and the actuation values shall be recorded. Field adjustments shall be made as required to make the operating values correspond to those recommended by the engine generator manufacturer and as recorded during the Shop Test.

5. Standby Power System Test

   a. After the field Load Test has been successfully completed, additional testing shall be performed by the EGSS to demonstrate the standby power supply system's ability to meet the motor starting requirements. Field testing to demonstrate generator automatic start and load transfer shall be performed at the same time.

   b. The engine generator system shall be tested by the EGSS to demonstrate the automatic startup, transient response, load carrying, cool down and shutdown modes of operation.

6. Provide a pressure test port with threaded plug in the double wall piping termination fitting of each double wall fuel oil line or tank. Containment structures

and piping shall be subjected to an air test of 10 psig with a zero allowable leakage rate.

7. Field tests shall also include the vibration tests.

8. Conduct sound level testing to take and record octave band sound pressure level readings full load. These readings shall be within the limits permitted by this specification.

9. If the standby power supply system fails to fulfill the performance requirements of this specification, corrective action shall be taken and the system retested to assure full compliance. Expenses associated with the field tests, including any corrective action, shall be at no additional cost to the OWNER.

10. The project CONTRACTOR will be responsible for all fuel and other fluids required by the diesel driven generator for the field tests and will refill the tank on completion of testing at no additional cost to the OWNER.

K. Training

1. All training for the engine generator system shall be complete as a condition for Substantial Completion. Training shall be in accordance with the requirements of Specification Section 16000 and PART 1 of this specification.

END OF SECTION

SECTION 16231

NATURAL GAS ENGINE DRIVEN GENERATOR

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section describes materials, installation, and testing of standby natural gas driven electrical generators that are to be installed as a part of this project.

1. A single Engine Generator System Supplier (EGSS) shall furnish materials, equipment defined in this Specification Section.

2. The EGSS shall also furnish the diesel driven generators specified in Section 16230.

3. The EGSS shall furnish materials, equipment, and test the skid mounted standby engine driven generator systems and required supporting systems as shown in Table 16231-A and specified herein.

4. Each engine generator system will be used to provide standby power to a Pump Station. Multiple pump stations and associated generator systems are included in this contract.

5. The EGSS shall provide storage until engine generator unit is shipped to the installation site.

6. The EGSS shall review and certify installation of the installed equipment.

7. The EGSS shall provide to the OWNER all documentation required to allow the OWNER to complete, submit and obtain air quality permits and fire code permits for the engine generator systems furnished.

1.02 RELATED WORK

A. Automatic Transfer Switch: Section 16492.

B. Generator site-specific requirements are shown in Tables 16231-A and 16231-B.

C. Diesel driven generators: Section 16230.

D. Miscellaneous Electrical Equipment: Section 16191.

E. Seismic Design Criteria: Section 01615.

F. Section 16950 – Electrical System Testing and Settings.

G. The natural gas fuel piping up to the generator is included in Division 15.

H. Mechanical installation details for the engine generator set including the exhaust silencer, combustion and cooling air inlet and outlet louvers, sound attenuators, etc., are shown on the Mechanical Drawings.

1.03 REFERENCES

A. Design, manufacture and assembly of elements of the equipment herein specified shall be in accordance with but not limited to published standards of the following, as applicable:

1. American Gear Manufacturers Association (AGMA)
2. American Institute of Steel Construction (AISC)
3. American Iron and Steel Institute (AISI)
4. American Society of Mechanical Contract Administrators (ASME)
5. American National Standards Institute (ANSI)
6. American Society for Testing Materials (ASTM)
7. American Welding Society (AWS)
8. Anti-Friction Bearing Manufacturers Association (AFBMA)
9. Institute of Electrical and Electronics Engineers (IEEE)
10. National Electrical Code (NEC)
11. National Electrical Manufacturers Association (NEMA)
12. Occupational Safety and Health Administration (OSHA)
13. Society for Protective Coatings (SSPC)
14. Underwriters Laboratory, Inc. (UL)
15. National Fire Protection Association (NFPA)
16. Society of Automotive Engineers (SAE)
17. American Petroleum Institute (API)
18. International Society of Automation (ISA)
19. Factory Mutual Engineering and Research Corp. (FM)

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.04 SYSTEM DESCRIPTION

A. The standby engine generator shall have continuous standby power rating (site rated) of the larger of the value shown on the Table 16231-A or the EGSS calculated rating for the specific equipment to be powered. The generator shall be rated at 80 percent lagging power factor, 480Y/277 volt, 3-phase, 4-wire, 60 Hertz.

B. The standby engine generator shall be arranged for automatic starting and stopping and load transfer upon failure of the normal source of power as sensed and signaled from the remote automatic transfer switch.

C. The standby engine generator package shall be complete in all respects and shall include all equipment and controls necessary for a fully operational system. Skid-mounted equipment shall be completely factory assembled and shipped to the project site.

D. The equipment to be furnished under this Section includes, but shall not be limited to the following:

1. Skid mounted gas engine and generator.

2. Exhaust system.

3. Skid mounted natural gas fuel system, including transfer piping, valves, pressure regulator(s), automatic control solenoid valve(s) and appurtenances.

4. Skid mounted piping, wiring and valves.

5. Flexible connectors and/or expansion joints for connection of the field piping to the engine-generator unit.

6. Engine mounted electric starter with skid mounted batteries.

7. Spring vibration isolators for the support of the generator skid frame.

8. Skid mounted engine generator control panel and appurtenances.

9. Spare parts and special tools.

10. Factory test.

11. Field services, testing and training.

E. Performance Requirements

1. The voltage regulation shall be within plus or minus one percent from zero load to full-rated load. Upon application or removal of full- rated load in one step, the transient voltage and recovery to steady state operation shall be within three seconds.

2. Frequency regulation shall be isochronous from steady state no load to steady state full load. Random frequency variation shall not exceed plus or minus 0.25 percent (0.15 Hertz).

3. The engine-generator set shall be capable of single step load pick up of 100% nameplate kW and power factor, at site conditions, with the engine generator at the standby temperature as maintained by the engine water jacket heaters.

4. The engine generator shall be capable of sustaining a minimum of 90% of rated no load voltage with the specified kW load at near zero power factor applied to the generator set.

5. The engine generator shall be capable of starting the loads with a maximum of 25% starting voltage dip.

6. The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic, and no 3rd order harmonics or their multiples. Telephone influence factor shall be less than 40.

7. Noise levels at the property line with the unit operating at full rated load shall be no more than 45dB(A).

8. Refer to Tables 16231-A and 16231-B for additional performance requirements and size criteria.

Table 16231-A
Natural Gas Generators

Station Name	Rated kW	Min. Starting KVA (@ 25% Max. Transient Voltage Dip)	Maximum Sound Level	Maximum Physical Size (Exclusive of the Exhaust Silencer)
East Paso	35	60 SKVA	Refer to Table 16231-B	76”L x 38”W x 47”H
East Ysabel	50	100 SKVA	Refer to Table 16231-B	93”L x 40”W x 75”H
Lupine	80	290 SKVA	Refer to Table 16231-B	116”L x 50”W x 85”H
Solano	35	60 SKVA	Refer to Table 16231-B	76”L x 38”W x 47”H
Sunny Oaks	35	60 SKVA	Refer to Table 16231-B	76”L x 38”W x 47”H
Mountain View	80	190 SKVA	Refer to Table 16231-B	71”L x 40”W x 53”H

Table 16231-B
Maximum Generator Sound Power Levels (dBA)

Noise Source	Octave Band Center Frequency, Hz								Total Sound Power
	63	125	250	500	1,000	2,000	4,000	8,000	
Generator	71	88	94	102	102	100	98	95	108
Exhaust	54	71	98	89	95	100	103	102	108

F. Equipment Anchorage Requirements

1. The requirements of this Work for anchorage are more stringent than the California Building Code, Uniform Building Code, or other model building code's standard recommendations because of the importance of this facility and the seismicity of the region. Anchorage of the equipment and engineering calculations furnished under this specification section shall be in accordance with 01615.

2. EGSS shall provide the installing contractor with details of anchor type, size, layout and embedment depth, and connections to engine-generator skid. The anchor bolts shall be 304 stainless steel and designed specifically for equipment furnished. Anchors shall be post-installed adhesive anchors.

3. The installing CONTRACTOR will be responsible for providing anchorage system and for installing the generator set skid. Equipment shall be installed in accordance with final submittals and contract documents. Installation shall comply with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.

1.05 SUBMITTALS

A. Submit shop drawings in accordance with Sections 01300 and 16000.

B. Equipment submittals shall include the following:

1. Shop drawings, catalog cuts, internal wiring schematics and other materials required to completely describe the systems and equipment being furnished.

2. Identification, description and dimensions for each separately installed sub-assembly or piece of equipment and associated piping and electrical connection schematics.

3. Seismic anchoring information as described above.

4. Performance specifications of all items of equipment.

5. Control panel layout drawings and component bill of materials for all control devices.

6. Complete electrical, instrumentation, control and wiring diagrams of instrumentation and controls and electrical components. Specifically, the following is required:

a. One line diagrams and wiring diagrams for assembly and components

b. Complete electrical circuit schematics, including generator control, alarms and power to all motors, accessories, and instruments furnished with the unit. Schematics shall include all termination points in each control panel. Wiring shall be identified by numbers and every termination point shall be assigned a number. Termination point number (including wire number) shall appear on the schematics for each wiring termination shown. Submit written description of the operational control theory with the schematics.

c. Complete external electrical interconnection diagrams detailing exact terminals of connection, conduit sizes, and recommended wire sizes.

d. Complete Operations and Maintenance Manuals. Provide separate manual for each installation. The manuals shall be prepared specifically for the individual installation and shall include all required cuts, drawings, equipment lists, descriptions, etc. that are required to instruct operation and maintenance personnel unfamiliar with such equipment.

7. Specific submittal information for the following components shall be included:

a. Engine Data

(1) Manufacturer

(2) Model

(3) Number and arrangement of cylinders

(4) RPM

(5) Maximum power at rated RPM and site temperature and altitude conditions

(6) Maximum allowable engine exhaust back pressure (inches H_2O)

(7) Engine cold cranking amps

(8) Engine fuel gas minimum supply pressure (inches H_2O)

(9) Make, model, and characteristics of governor

(10) EPA Tier 3 certification

(11) Certification of Emissions for the engines, including data on particulate matter, precursor organic compounds (POC), non-precursor organic compounds (NPOC), nitrogen oxides (NOx), and carbon monoxide (CO)

b. Generator Data

(1) Manufacturer

(2) Model

(3) Rated KVA

(4) Rated KW

(5) Voltage

(6) Insulation rating and temperature rise data

(7) Frequency

c. Generator efficiency, including excitation losses, at 80 percent PF

(1) Full load

(2) Three quarters load

(3) Half load

d. Guaranteed fuel consumption rate (905 BTU/cu ft)

(1) Full load, cu ft/hr

(2) Three quarters load, cu ft/hr

(3) Half load, cu ft/hr

e. Generator unit and accessories

(1) Weight of skid mounted unit

(2) Overall length

(3) Overall width

(4) Overall height

(5) Fuel piping details

(6) Exhaust pipe size, silencer manufacturer and silencer attenuation curve

(7) Size and locations of conduit stub-up areas

(8) Details of the power and control cables and connectors

f. Details of battery system including calculations for sizing batteries that indicates compliance with battery load and environmental starting requirements listed herein.

8. The size, attenuation curve, and design back pressure for the silencing equipment as offered to accomplish the specified silencing for this installation.

9. Exhaust gas emissions data, maximum values at loads varying from full to 1/4 load:

   a. Temperature (degrees F)

   b. Flow (ACFM)

10. CFM of air required for combustion based upon inlet air temperature of 40 degrees C: (CFM)

11. Heat radiated to room by engine and alternator: (BTU/min)

12. Heat rejected to jacket water including lubricating oil: (BTU/min)

13. Heat rejected to aftercooler: (BTU/min)

14. Details of engine starting batteries including nominal ampere hour and cold cranking ampere ratings

15. Draft copy of the written service contract specified herein.

16. Operational Certification: Submit certification that is guaranteed to be adequate for load served. Include site-specific information on the loads to be served by the generator.

17. Test Reports: Furnish copies of the certified factory test and field test records of the complete engine driven generator unit.

18. Manufacturer‟s recommendations for long-term storage, including specific types and grades of fluids, lubricants, etc.

19. Air and Fire Certifications

   a. Submit certification that the engine generator system complies with the particulate and combustion gas emission limits of the San Luis Obispo County Air Pollution Control District (APCD) and is permittable under the regulations in effect at the time of bidding. The unit shall be capable of meeting these emission limits without diminishing the 200 hour per year testing and maintenance time allowed by APCD for standby natural gas generator units. Units unable to meet these limitations will not be accepted.

b. The EGSS shall provide all required backup documentation regarding the engine and its components that is required by APCD for the air emission installation and operational permits.

c. The EGSS shall provide all required backup documentation for the engine and its components that is required by the San Luis Obispo County Fire Department Fire Code Compliance Permit.

1.06 QUALITY ASSURANCE

A. The engine generator systems shall be the standard product, as modified by these Specifications, of a manufacturer regularly engaged in the production of this type of equipment.

B. The engine generator systems and all specified and required accessories shall be furnished by a single Engine Generator System Supplier (EGSS). The EGSS shall have sole responsibility for furnishing all items required for a complete and operable system and shall perform all work necessary to select, furnish, customize, and debug hardware specified within this Specification Section.

C. The EGSS shall be regularly engaged in the design and the installation of engine generator systems and their associated subsystems. The EGSS shall be the same entity that furnishes the diesel generators specified in Section 16230, and that complies with all the criteria described in that Section.

1. The Engine Generator System Supplier (EGSS) shall be:

a. Energy Systems Power Systems; Stockton, CA;

b. Cummins-West;

c. Peterson Power; San Leandro, CA

d. Or equal

D. The engine generator systems and major components shall be manufactured and furnished to the EGSS by one of the following:

1. Generac

2. Onan-Cummins;

3. Caterpillar ;

4. Or Equal

1.07 MAINTENANCE CONTRACT

A. Provide to the OWNER at no additional cost a separate written two year manufacturer's standard routine and preventative Maintenance Contract for each engine generator system, commencing on the Substantial Completion date established for the associated system. Maintenance contract shall include all parts, labor, and travel.

1.08 DELIVERY, STORAGE, AND HANDLING

A. After successful factory tests and other required milestones required for Ready-to-Deliver status the systems shall be stored at the EGSS‟s expense until the installation site is ready to accept shipment. The units shall be stored at a storage facility acceptable to the OWNER in accordance with all manufacturer‟s requirements for long-term storage. OWNER shall have access to the unit during storage.

B. Ship equipment, material and spare parts to the site complete except where partial disassembly is required by transportation regulations or for protection of components.

C. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which intended.

D. Mechanical and electrical equipment shall be coated, wrapped and otherwise protected from snow, rain, drippings of any sort, dust, dirt, mud, flood and condensed water vapor during shipment and while stored before construction.

1.09 PROJECT/SITE REQUIREMENTS

A. The engine generator and associated equipment shall be suitable for continuous operation at the intended site conditions. The engine generator system shall be installed indoors.

1.10 WARRANTY

A. The manufacturer shall warrant the material and workmanship of the generator system for a minimum of two (2) years from registered commissioning and start-up date.

B. The manufacturer shall offer an extended ten (10) years coverage.

C. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc. shall be allowed during the minimum noted warranty period described in paragraph A above.

1.11 OPERATION AND MAINTENANCE MANUALS

A. Provide Operations and Maintenance information per Section 01730. Separate operation and maintenance manuals are required for each engine generator system supplied.

B. Initial Operation and Maintenance Manual submittal: Operation and maintenance manuals are required for the engine generator system after successful completion of the Shop Tests. The Initial Operation and Maintenance Manuals shall include Shop Test results which have been given status „No Exceptions Noted‟ or „Make Corrections Noted‟. Initial Operation

and Maintenance Manuals shall be submitted in accordance with Section 01300. Favorable review status is „No Exceptions Noted" or „Make Corrections Noted". Initial Operation and Maintenance Manuals shall include all information required to install the systems properly and for training of OWNER personnel required by under "Manufacturer"s Services" below.

C. Final Operation and Maintenance Manuals: Final Operation and Maintenance Manuals shall be submitted for the engine generator system. Final Operation and Maintenance Manuals shall include successfully completed Field Test results. The Final Operation and Maintenance Manuals shall be favorably reviewed as a requirement for final acceptance of the system. Favorable review status is „No Exceptions Noted" or „Make Corrections Noted".

1.12 MAINTENANCE

A. Spare Parts

1. Provide the following spare parts for each generator set furnished:

a. One air filter element.

b. One lube oil filter element.

c. One fuel gas filter element.

d. One set of hoses and belts including one of each different size and type.

e. Three complete replacement sets of fuses of each different size and type.

f. One complete change of lube oil plus one gallon of make-up lube oil supplied in unopened containers.

g. Six pilot lamps of each type and voltage.

h. One quart of touch-up paint in each color used on the main assembly and housing.

i. One complete change of ethylene glycol anti freeze solution to provide a 50 percent solution in the engine cooling system supplied in unopened containers

2. The spare parts and maintenance tools shall be packed in containers, permanently labeled by word and part number for easy identification of the items and properly packed for an extended period of storage before use.

1.13 MANUFACTURER"S SERVICES

A. Provide equipment manufacturer"s services for each generator set furnished for the minimum labor days listed below, travel time excluded:

1. Four hours to check the installation and advise OWNER during start-up, testing, and adjustment of the equipment.

2. Four hours to instruct the OWNER‟s personnel in the operation and maintenance of the equipment. The OWNER reserves the right to videotape any training sessions.

PART 2 PRODUCTS

2.01 GENERAL

A. Equipment and controls specified in this Section shall be new and be considered part of the engine generator system; the EGSS shall be responsible for integrating and furnishing the system in its entirety as specified herein

B. The engine generator and related equipment shall be designed and constructed in conformance with the requirements of UL 2200 Standby Engine Generator Assemblies and NFPA110.

C. The generator set shall operate at 1800 rpm and at a voltage of 480Y/277 Volts AC, three phase, 4 wire, 60 hertz.

D. The complete generator set shall be rated per ISO8528 at no less than the kW ratings shown in table 16231-A, standby rating, with a 0.8 Power Factor. In addition, the rating of the complete generator set shall be sufficient for starting and running the site equipment as specified.

E. Mechanical equipment shall be designed and built for 24 hour continuous service at any and all points within the specified range of operation without overheating or excessive vibration or strain, and require only that degree of maintenance generally accepted as peculiar to the specific type of equipment required. Parts and components of all units shall be designed and built for interchangeability so that replacement parts may be installed without any additional fitting or machining.

F. The engine generator systems shall allow easy access to the various parts for maintenance purposes. All parts shall be properly enclosed to prevent the throwing or dripping of oil.

G. The engine generator systems shall be pre-piped and pre-wired insofar as possible.

H. Provide terminals for connection of all remote alarm, control and indications to and from the generator control panel. Generator power output cables shall be connected directly to the generator output breaker terminals

2.02 ENGINE AND GOVERNOR

A. The engine-generator set shall be a factory assembled unit, specifically designed and equipped for operation on pipeline quality natural gas (905 BTU/cu ft). The engine and alternator shall be directly connected with a semi-flexible steel coupling, shall be free from injurious torsional or other vibration and shall be mounted on a heavy steel sub-base. The gas engine shall be of the vertical in-line construction, four or six cylinders, four stroke cycle, turbo-charged, remote radiator cooled; complete with electronic spark ignition, natural gas fuel system carburetor, secondary gas regulator and electric solenoid fuel shutoff valve. The unit shall operate at a speed of not more than 1800 rpm and shall develop its full power

rating at a brake mean effective pressure (BMEP) not to exceed 200 psi and a piston speed not to exceed 1950 fpm.

B. The engine and alternator shall be directly connected and shall operate at the same rotative speed. The use of gearing or other speed adjustment between the engine and the alternator, such that the engine and alternator operate at different rotative speeds will not be allowed.

C. The complete engine-generator unit shall be free from harmful torsional or other vibration throughout the entire operating range of speed and load. The engine generator manufacturer shall make, or have made, the mass-elastic system analysis of the complete engine- generator unit, and shall submit to the Engineer certification that the analysis has been performed and shows the unit to be free from harmful torsional or other vibration.

D. The engine shall be spark ignition, four cycle, turbo- charged, and aftercooled. The engine shall be capable of satisfactory operation on utility natural gas.

E. The engine shall be provided with removable wet-type cylinder liners of close grained alloy steel, heat treated for proper hardness as required for maximum liner life. The engine block shall be a one piece stress relieved grey iron casting.

F. Intake and exhaust valves shall be heat-resisting alloy steel with high tungsten-chrome alloy steel exhaust valve seat inserts.

G. Governor

1. The governor actuator shall be an all electronic type, DC motor driven, capable of maintaining isochronous regulation from no load to full rated load within 0.25 percent of rated frequency.

2. The governor controller shall be all electric, mounted in the generator control panel. The governor controller shall have the capability for manual adjustment of speed setting, speed droop, and load limit. Speed droop shall be adjustable from 0 to 5 percent from no load to full load. It shall be designed and installed to eliminate all electromagnetic interference.

3. The governor actuator and the governor controller shall be as manufactured by Woodward Governor Co.; Barber Coleman or equal, and shall operate on 24 volt dc from the engine starting batteries.

4. Furnish also a separate overspeed shutdown device which shall, in case of predetermined overspeed or the operation of various protective devices as later specified, instantly stop the engine.

2.03 SUPPORTING STRUCTURE

A. The engine generator shall be directly bolted, doweled, and aligned on a rigid, fabricated steel base, suitably sized to maintain the correct alignment, supported by heavy duty spring type vibro isolators. Isolators shall be suitable for anchoring to the level surface of a concrete pad.

B. All exposed surfaces on the structural steel members of the fabricated base frame and isolator spring restraints shall be shop primed and finished in accordance with Section 09901.

2.04 FUEL SYSTEM (NATURAL GAS)

A. The gas engine will be connected to a utility gas service complete with meter and primary regulator located outside the building. Gas supplied to the generator will have a low heat value of 905 BTU per standard cubic foot and at a minimum pressure of 7 to 10-in water column and at a required rate of not less than 3100 cu ft/hr.

B. The necessary connecting piping from the utility service connection to the engine shall be furnished and installed under Division 15. Furnish for installation in the gas supply piping, a 2-in diameter gas pressure gage with a scale of 0 to 30-in of water complete with petcock, an electric (DC) solenoid operated shut-off valve, a low gas supply pressure switch, a Y-type dry fuel strainer, and a flexible connector to the engine fuel supply connection.

C. The arrangement of the gas supply is shown schematically on Drawings. Piping shall be black steel and of a size recommended by the engine manufacturer.

D. All parts of the fuel system shall meet the approval of, and be installed in complete compliance with, all applicable local, State and Federal codes, laws and regulations.

2.05 ELECTRIC (BATTERY) STARTING SYSTEM

A. Starting shall be accomplished by an engine mounted, solenoid shift electric starter, capable of withstanding four consecutive continuous cranking periods of 15 seconds duration each separated by 15 seconds rest period before shutting down completely and sounding the overcrank alarm.

B. The starting battery(ies) shall be low maintenance, long life, lead acid type, especially designed for gas engine cranking service. Batteries shall be of a capacity as recommended by the battery manufacturer for cranking the engine being furnished, for the necessary break-away current as required and the spinning current for four consecutive starts of 15 seconds of cranking on each start, without being recharged, , with the system at the site conditions. An insulated protective covering, skid mounted battery rack and suitable cables and connectors shall be provided. The rack shall be finished with an acid and fire resistant epoxy coating.

C. Cell containers shall be sealed, shock absorbing, heat resistant plastic with spray proof, flame arresting type vents. Battery shall be furnished with all connectors and hardware, lifting device, cables, and grease.

D. Battery charger shall be a UL listed, fully automatic, filtered, float-type, charger designed for heavy-duty industrial service, primarily to quickly recharge and maintain batteries that start internal combustion engines and suitable for mounting on the generator skid base. The D.C. output shall be regulated to within one percent with plus or minus 10 percent fluctuations of the input voltage and shall be current limited at 120 percent of rated output. have a continuous power rating sufficient to power all generator control devices in both the standby mode and the running mode, while maintaining correct charge voltage on the batteries. Accessories shall include D.C. ammeter and voltmeter, adjustable float and equalize controls,

A.C. and D.C. circuit breakers, A.C. power failure alarm relay and low D.C. voltage alarm relay. A common battery charger malfunction alarm shall be indicated on the engine control panel. The charger shall be Chloride, LaMarche, or equal.

2.06 AIR INTAKE SYSTEM

A. The engine shall be equipped with suitably sized dry type air intake filter(s) to protect working parts of the engine from dirt and grit with replaceable type filter element. A crankcase breather and service indicators shall be included.

2.07 LUBRICATION SYSTEM

A. The engine shall be provided with a full pressure positive displacement, mechanical lubricating oil pump which shall have ample capacity to circulate the amount of lubricating oil and cooling oil required by the engine and turbocharger. The system shall be arranged to cool the pistons and to distribute oil to all moving parts of the engine including the turbocharger bearings and including full flow filter with replaceable spin on canister elements and dipstick oil level indicator and a suitably sized shell and tube type oil cooler and an automatic temperature regulator if required. The engine shall be provided with a sump type crankcase arrangement of sufficient capacity to suit the requirements of the engine.

2.08 ENGINE COOLING SYSTEM

A. The engine shall be equipped with a dual core radiator cooling system for the jacket water, lubricating oil and aftercooler systems provided.

B. Suitable jacket water treatment for the prevention of both scale formation and corrosion in the engine water jackets and cooling system components which are in contact with the engine jacket water. This treatment shall be added to the cooling system prior to running the field acceptance test. Before adding the recommended treatment, the engine jacket water system shall be thoroughly cleaned and conditioned, in accordance with the manufacturer's instructions.

C. Provide manufacturer's recommended anti-freeze to prevent freezing of coolant to 25° F in sufficient quantity to fill all radiators.

D. Provide valved drains in the low point of the engine cooling system for both circuits to allow easy drainage of coolant.

2.09 EXHAUST SYSTEM

A. Exhaust silencer(s), GT Exhaust, Maxim, Donaldson, or equal, for hospital grade type silencing, shall be installed. The exhaust pipe shall be ASTM A106 with wall thickness of 0.250 in, black steel with flanged fittings and of the size recommended by the engine manufacturer. Suitable expansion joints shall be provided and installed where required to provide for expansion of the pipe caused by a 1000 degree F temperature change. The exhaust line shall be connected to the engine by a suitable section of flexible stainless steel metal exhaust corrugated tubing suitable for the maximum temperature condition which may

be encountered. Exhaust line elbows shall be long radius. Refer to Table 16231-B for maximum allowable exhaust dBA.

B. Furnish and install suitable equipment for the engine exhaust to attenuate the sound as specified.

C. The exhaust silencer shall be furnished loose for field mounting as indicated on the Drawings. The exhaust pipe shall terminate in a device to prevent the entrance of rain.

D. A suitable drain with valve shall be installed at the low point of the exhaust line.

E. Furnish and install all exhaust pipe spool pieces, elbows, pipe hangers, silencer supports, and appurtenance to allow installation of the system as shown on the Drawings, Exhaust pipe shall be Schedule 20 steel or approved equal.

F. Furnish and install insulation on all exhaust piping and silencer(s) located inside the building. Insulation shall be minimum 4" thick Fibrex FBX-1200 Series, or equal, with outer aluminum jacket and stainless steel band.

G. A stainless steel bellows type expansion joint as recommended by the engine manufacturer and suitable for the maximum engine exhaust operating temperature shall be used to connect the exhaust pipe to the engine.

H. Furnish and install all required steel support framing and hangers in accordance with the provisions of Section 15140 for mounting and supporting of the exhaust piping and silencer. Furnish Type 304L stainless steel support cradles and hold-down clamps to support the silencer from the concrete pads provided on the mezzanine.

2.10 JACKET WATER HEATERS

A. Automatic thermostatically controlled heater(s) shall be sized as recommended by the engine manufacturer to warm the engine to a minimum of 40C in a 15C ambient, in compliance with NFPA110 requirements, as a minimum, or the temperature required for starting and load pickup requirements of this specification.

B. The coolant heater shall be installed on the engine with SAEJ20 compliant materials. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run exceeds 12 inches. The coolant heater installation shall be specifically designed to provide proper venting of the system. The coolant heaters shall be installed using isolation valves to isolate the heater for replacement of the heater element. The design shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.

C. A separate manual power disconnect switch shall be provided for each heater.

D. Heaters shall be automatically deactivated when the engine generator unit is in operation.

2.11 ENGINE MOUNTED GAUGE PANEL

A. The engine generator system shall include an integrally mounted, vibration isolated engine gauge panel. This NEMA-12 enclosure shall include, but not be limited to, the following:

1. Lubricating oil pressure gauge.

2. Jacket water temperature gauge.

3. Combustion air filter manometer.

4. Elapsed time meter calibrated in hours and tenths of hours.

5. Fuel level gauge.

B. The gauges shall have a sealed case pulsation dampener and shall be a minimum of 2-in in diameter; time meter shall have 3-1/2 inch face. Digital readout gauges and meters are acceptable as an alternative. The scale range shall be as required for the particular application.

2.12 ENGINE GENERATOR CONTROLS

A. General

1. The engine generator shall include an integrally mounted engine generator control system. The components of this section shall be shop mounted on the skid. The controls shall include, but not be limited to, the following:

a. Generator output circuit breaker.

b. Generator voltage regulator control.

c. Battery charger.

d. Alarm and status annunciator system.

e. Engine start and stop controls.

f. Emergency stop switch

2. The control system including all covers, barriers, and supports shall be listed and labeled under the requirements of UL 891.

3. The generator set shall be provided with an electronic microprocessor-based control system designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall be designed to allow local monitoring and control of the generator set, with digital displays visible in any lighting condition.. The control system shall also allow remote monitoring of the generator set, as shown on Drawings, using dry relay contacts. Provide nameplates adjacent to each device to identify the device's function

4. The control panel shall be shock mounted at the alternator end of the unit, and oriented to be easily viewed, and shall be housed in a NEMA 12 enclosure. The controls shall be UL508 labeled.

5. Control system equipment shall be factory mounted and wired on or within the engine generator enclosure. Wiring shall be numbered in accordance with the numbering system used on the wiring/connection diagrams.

6. Panel wiring shall be stranded copper conductor, 600 volt, insulation type SIS, or equal. Minimum size shall be No. 14 AWG for A.C. power wiring and No. 16 AWG for D.C. control wiring. Wire for voltage regulator power and field circuits shall be shielded.

7. All DC control power for the engine generator system shall be derived from the engine generator set starting batteries.

B. Control Functions and Components

1. At a minimum, the control system shall contain the following components and functions.

a. Generator output frequency meter, ammeter, voltmeter, with phase selector switches.

b. Running time meter and start counter.

c. Engine generator mode selector switch: The controls shall include a three-position RUN-OFF-AUTO switch. In RUN, the engine shall start and run without load transfer; in OFF, the engine shall stop and will not start; in AUTO, the engine shall start and run and stop from the remote engine start contact provided by hardwired contact from the automatic transfer switch.

d. Reset pushbutton with indicator. Indicator shall flash to indicate that generator set is locked out due to a fault condition.

e. Lamp test pushbutton. Operation of this pushbutton shall cause all lamps on the panel to be simultaneously tested. As an alternative, provide push-to-test type pilot lights or digital indicators.

f. Emergency Stop push-button. The emergency stop push-button shall be a red, mushroom head push-button which maintains its position until manually reset.

g. Precision voltage and frequency adjust raise/lower switches or potentiometers. Switches (or potentiometers) shall allow the generator set frequency and voltage to be adjusted plus or minus 5%. Voltage and frequency adjustment switches shall be located inside of the control panel or shall be sealed in a manner to prevent unauthorized adjustment.

h. Alarm and status indicating panel to indicate the following conditions ("*" indicates required points; "-" indicates not required);

Function	Alarm (Amber)	Shutdown (Red)	Status (Green)
Low DC Voltage	*	-	-
High DC Voltage	*	-	-
Battery Charger Malfunction	*	-	-
Low Oil Pressure	*	*	-
High Oil Temperature	*	*	-
Fuel – Low Pressure	*	-	-
Fuel - Low-Low Pressure	*	*	-
Not in Auto	*	-	-
Low Water Jacket Temp	*	-	-
High Water Jacket Temp	*	*	-
Low Coolant Level	*	-	-
Gen Breaker Tripped	*	*	-
Overcrank	*	*	-
Overspeed	*	*	-
Under Frequency	*	-	-
Under Voltage	*	*	-
Over Voltage	*	*	-
In Automatic	-	-	*
Generator Running	-	-	*

i. Visual alarms shall be resettable only after the fault condition has been corrected. The audible alarm shall include a silencing circuit which after manual silencing of the current alarms will permit audible annunciation of subsequent failures.

j. The alarms shall have a type AM alarm sequence (manual reset of lamp required after the field contact returns to normal) as detailed below.

Condition	Contact	Lights	Horn
Normal	Normal	Off	Off
Alarm (Timed to Steady-On)	Abnormal	Flashing	On (Timed Off)
Silence	Abnormal	Steady-On	Off
Reset	Normal	Off	Off
Return to Normal	Normal	Off	Off
Test	---	Flashing	On

k. The control system shall also incorporate a data logging and display provision to allow logging of a minimum of the last 20 warning or shutdown indications on the generator set, the time of the last fault of each type, and the number of faults of each type, and total time of operation at various loads as a percent of the standby rating of the generator set.

l. The audible alarm horn shall be an adjustable volume (approximately 78-102 db) constant duty type. The alarm horn shall be provided with a panel mounted manual silence pushbutton. The alarm horn circuit shall also be provided with a timer to automatically silence the horn during unattended operation (adjustable from 0-60 seconds). The automatic timer silencing circuit shall have an on – off switch to allow it to be either utilized (in automatic silence mode) or disabled (requiring manual reset of the horn.).

m. Engine warning conditions shall be grouped to provide a common alarm. All shutdown alarms shall be grouped to provide a common alarm. Provide a status indication for generator run status. These items shall be available for remote monitoring via isolated NO/NC contacts.

n. Complete engine start control which operates on closing contact and stop control which operates on hardwired contact from the Automatic Transfer Switch (ATS).

o. Cranking limiter to disconnect the starting motor from the battery supply after completing a total of four 15 second cranking periods separated by 15 second rest periods before shutting down completely and alarming.

p. Automatic voltage regulation system which is matched and prototype tested with the governing system provided. It shall be immune from mis-operation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below a threshold of (48-49) HZ. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alpha-numeric LED readout to indicate setting level.

q. AC over/under voltage monitoring system which responds only to true RMS voltage conditions. The system shall initiate alarm and shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown and alarm shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.

r. Battery monitoring system which initiates alarms when the DC control and starting voltage is less than 25VDC or more than 32 VDC. During engine starting, the low voltage limit shall be disabled.

s. Run Status Contacts: The controls shall include four normally open and four normally closed electrical relay contacts, rated 120 volts, 10 amps, a.c. The contacts shall be used for remote indication of engine run, operation of combustion air and ventilation air dampers, etc. The contacts shall actuate upon initiation of engine starting sequence and remain actuated until the engine shuts down.

2.13 GENERATOR OUTPUT CIRCUIT BREAKERS

A. The breaker shall be manually operated 3-pole, molded case circuit type, with solid state trip device.

B. The circuit breaker shall have the following adjustments as a minimum: long time, short time and instantaneous (amps pickup and time delay) and ground fault (amps pickup and time delay).

C. The EGSS shall recommend the set points of the breaker based on the characteristics of the equipment furnished. Breaker interrupting ratings shall be suitable for the generator furnished, however shall be 25,000 AIC minimum.

D. The output circuit breaker shall be UL listed to be applied at 100% of its rating.

2.14 AC DISTRIBUTION PANEL

A. All 120 or 240 volt power required by the engine generator and its auxiliary equipment shall be supplied from the building circuit breaker distribution panel as indicated on the Drawings.

2.15 ALTERNATOR AND EXCITATION SYSTEM

A. The alternator shall be of the open drip proof bracket type, especially designed for connection to the engine. The generator shall have Class H insulation rated for 105 degree C temperature rise. The generator shall have Amortisseur windings.

B. The alternator shall have a forged or cast alloy steel flanged shaft for direct connection through a suitable flywheel type coupling to the engine, or with suitable adapter and disc coupling and shall be of the single bearing type with anti-friction bearing.

C. The alternator windings shall be braced to withstand short stresses and shall be designed to withstand overheating or stresses caused by harmonics generated by up to 15% non-linear loads. The unit influence shall be "Radio Interference Proof" (RIP) and the "Telephone Influence Factor" (TIF) shall be within the limits of Section 9, ANSI C50.12.

D. The alternator shall be three phase, 60 Hertz, 4 wire, 480Y/277 volt operation with brushless with a rotating permanent magnet generator type exciter system, 3 phase solid state voltage regulator, filters and associated controls. Exciter shall have Class H insulation rated for Class F temperature rises.

E. The alternator stator core shall be built of low carbon steel laminations, precision-punched, deburred and individually insulated. Stator coils shall be random wound and inserted in insulated core slots. Wound core shall be insulated. Armature lamination followers and frame ribs shall be welded integral with frame. Enclosure shall be drip-proof guarded.

F. Alternator rotor poles shall be built up of individually insulated steel punchings. Poles shall be wet layer wound and insulated with VPI/epoxy resin. Cage connections shall be brazed for strong construction and permanent electrical characteristics. Each pole shall be securely bolted to rotor shaft.

G. A directional blower shall be mounted to draw cooling air from exciter end, over rotor poles and through louvered openings in drive end.

H. The alternator shall have grease lubricated anti-friction bearings. The designed bearing life, based on B-10 curve of the Anti-Friction Bearing Manufacturers Association, shall be not less than 40,000 hours.

2.16 MISCELLANEOUS EQUIPMENT

A. Hearing Protection : Provide two circumaural hearing protection devices per unit, MSA Noisefoe Mark IV ear muffs or equal for the protection of operating personnel. Provide with high impact plastic window type cabinet, suitable for wall mounting.

2.17 SURFACE PREPARATION AND SHOP PAINTING

A. The entire engine generator and associated equipment shall be shop primed and finished coated per the manufacturer's standard practice prior to shipment.

PART 3 - EXECUTION

3.01 PROTOTYPE TESTING

A. Submit evidence of prototype testing; (manufacturer‟s certificate etc.).

3.02 SHOP TESTS

A. Before shipment to the project site, the engine generator system shall be shop tested. Tests shall be performed at the EGSS‟s service shop. Shop tests performed at the manufacturer‟s factory are not a substitute for the required EGSS shop test.

B. Shop tests for each system shall be sufficient to demonstrate that the systems will operate successfully and meet all specified operational requirements.

C. The EGSS shall furnish all necessary instruments, filters, starting air, fuel, cooling water, electric power and load banks for the test.

D. During shop testing, all automatic safety and shutdown devices shall be tested and their respective activation points shall be recorded.

E. Voltage and frequency regulation and transient response shall be tested and recorded to show full compliance with this Section. Strip chart graphs of the response upon application of the generator rated load in a single step shall be submitted with the test documentation. The chart shall be annotated to indicate the calibration of each axis. The transient response shall be demonstrated and recorded a minimum of three (3) times. The initial transient test shall be performed with a cold engine. The final transient test shall be performed on the engine at the completion of the four hour load test.

F. The Shop Test shall consist of, but not be limited to, four continuous hours of operation. During the Shop Test, readings shall be taken and recorded every thirty minutes for each of the following parameters at a minimum:

1. Time

2. Ambient temperature

3. Under no-load conditions: Volts for each phase

4. Under loaded conditions:

    a. Amps for each phase

    b. Voltage for each phase

    c. KW

    d. Power factor

    e. Frequency

    f. Engine jacket water temperature

    g. Cooling water temperature (in and out)

    h. Lubricating oil pressure

    i. Lube oil temperature

    j. Exhaust gas temperature

    k. Fuel consumed per hour

5. Shop Test shall also include verification all alarm, status, and shutdown points listed above, plus analog electrical values shall be included as a minimum.

6. After successful completion of Shop Tests, the EGSS shall perform the following:

    a. The load limit shall be sealed. The seal shall be applied, using a seal press which embosses the manufacturer's initials on the lead seal.

b. All entrapped water shall be drained, and protection applied to prevent the entry of water during shipment or a long period in storage while waiting for installation.

c. The engine generator shall be given proper treatment for its protection for extended storage while waiting for the installation contract.

7. Certified test records for each system shall be submitted to the OWNER for review. Systems shall not be shipped to the installation sites unless results have been given „No Exceptions Noted" or „Make Corrections Noted" status. The testing shall be repeated and certified results resubmitted for review at no extra cost to the OWNER as often as necessary for the test results to be considered „No Exceptions Noted" or „Make Corrections Noted" by the OWNER.

8. Beginning at the time when the Shop Tests have been completed and favorably reviewed, the EGSS shall make the engine generator systems available for delivery to the Installing CONTRACTOR.

G. Storage of Equipment

1. Upon successful completion of the Shop Tests, the EGSS shall be responsible for storing the engine generator system as required in these specifications, until such time as the project CONTRACTOR requests delivery.

H. Delivery of Equipment

1. The EGSS shall deliver the engine generator system to the installation site when scheduled by project CONTRACTOR and in accordance with the requirements described of these specifications.

I. Field Service Technician

1. The EGSS shall coordinate, assist, place into operation, and certify the installation of each unit.

2. The EGSS shall provide support services for the engine generator system until notice of Final Completion is issued by the OWNER. Support services shall include maintenance and exercise services for the system at maximum of every six months. Exercise services shall include fueling, load bank, and services as specified herein.

3. The EGSS shall provide 4-hour minimum for each generator set at each site to assist the CONTRACTOR with installation of the engine generator system. Assistance shall include location of anchor bolts; setting, leveling and field erection; and coordination of electrical connections.

4. The EGSS shall provide the services of a service technician for 4-hour minimum for each generator set, for the engine generator system start-up, testing, and calibration at each site. Minimum work-day requirements listed are exclusive of travel time and do

not relieve EGSS of the obligation to provide sufficient service to place the equipment specified herein in satisfactory operation.

5. Operation and maintenance instruction shall be as described in this Section.

J. Field Start-up and Tests

1. Field start-up and testing shall be provided for the engine generator system by the EGSS. Field start-up and testing will be a joint effort with the project CONTRACTOR as necessary to assure that each system functions as specified. All tests shall be performed in the presence of the OWNER.

2. After the EGSS field service technician‟s check of the installed systems, the engine generator system shall be tested to demonstrate its ability to operate continuously without vibration, jamming, leakage or overheating and to perform specified functions. During start-up and operation, the project CONTRACTOR will comply with the manufacturer's operating and maintenance instructions.

3. The Field Test shall consist of two separate steps, the engine generator Load Test and the Standby Power System Test. The Load Test shall demonstrate the capability of the installed engine generator and related systems to produce rated power and operate in accordance with manufacturer‟s recommendations. The Standby Power System Test shall demonstrate the capability of the installed engine generator system to function as a part of the standby power system.

4. Load test:

   a. Test duration shall be for four continuous hours at the full rated load of the engine generator unit.

   b. The EGSS shall supply a portable resistive load bank for this test.

   c. During the test, all parameters recorded during the Shop Test shall be taken and recorded at 30 minute intervals.

   d. During the test, all of the automatic shutdown devices shall be retested and the actuation values shall be recorded. Field adjustments shall be made as required to make the operating values correspond to those recommended by the engine generator manufacturer and as recorded during the Shop Test.

5. Standby Power System Test

   a. After the field Load Test has been successfully completed, additional testing shall be performed by the EGSS to demonstrate the standby power supply system's ability to meet the motor starting requirements. Field testing to demonstrate generator automatic start and load transfer shall be performed at the same time.

b. The engine generator system shall be tested by the EGSS to demonstrate the automatic startup, transient response, load carrying, cool down and shutdown modes of operation.

6. Field tests shall also include the vibration tests.

7. Conduct sound level testing to take and record octave band sound pressure level readings at full load. These readings shall be within the limits permitted by this specification

8. If the standby power supply system fails to fulfill the performance requirements of this specification, corrective action shall be taken and the system retested to assure full compliance. Expenses associated with the field tests, including any corrective action, shall be at no additional cost to the OWNER.

9. The project CONTRACTOR will be responsible for all fuel and other fluids required by the generator for the field tests.

K. Training

1. Training for the engine generator system shall be complete as a condition for Substantial Completion. Training shall be in accordance with the requirements of Specification Section 16000 and PART 1 of this Specification.

END OF SECTION

SECTION 16425

MAIN SWITCHBOARDS (MSB) (LOW VOLTAGE)

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install the main switchboard (MSB) equipment as shown on the Drawings and as specified herein.

B. Automatic Transfer Switch (ATS) shall be factory installed in the MSB as shown on the Drawings. Refer to Section 16492.

1.02 RELATED SECTIONS

A. Section 01300 – Submittals.

B. Section 16000 – Electrical General Provisions.

C. Power system studies are included in Section 16015.

D. Automatic transfer switches are included in Section 16492.

E. Section 16950 – Electrical System Testing and Settings.

F. Seismic design criteria are included in Section 01615.

1.03 SUBMITTALS

A. Submit shop drawings and product data in accordance with Section 01300 and 16000.

B. Shop drawings shall include the following information:

1. Master drawing index
2. Front elevation view
3. Floor plan layout
4. Top view
5. Dimensions, weight, and shipping splits
6. Single line diagrams
7. Schematic diagrams
8. Nameplate schedules
9. Component list including metering, protective relays, accessories and control equipment
10. Conduit entry/exit locations

11. Assembly ratings including:
    1. Short-circuit rating
    2. Voltage
    3. Continuous current
    4. Bus material and ratings
12. Major component ratings including:
    1. Voltage
    2. Continuous current
    3. Interrupting ratings
13. Cable terminal lug sizes
14. Product data sheets and catalog numbers for circuit breakers and fused switches. List all options, trip adjustments and accessories furnished specifically for this project.
15. Detailed shop drawings of the utility pull and metering compartment to the Power Company for review.
16. Engineering calculations shall be furnished in accordance with Section 01615 – Seismic Design Criteria. As a minimum, these shall demonstrate that each of the MCCs will adequately transfer the design seismic forces to the anchor bolts and foundation.
17. Submit field test reports as specified in Section 16950.

C. Submit manufacturer's installation instructions for the complete assembly and each major component:
    1. Shipping, storage, and handling instructions
    2. Installation bulletins
    3. Supplemental instruction bulletins.
    4. Application software

D. Operation and Maintenance Data:
    1. Submit operation and maintenance manuals in accordance with Section 01730.
    2. Provide equipment operation and maintenance manuals with each shipped assembly including instruction leaflets, instruction bulletins and renewal parts lists for the complete assembly and each major component.

3. Manuals shall include the following as a minimum:

    1. A comprehensive index.

    2. A list of the equipment supplied, including serial numbers, ranges and pertinent data.

    3. Full product specifications for each item.

    4. Service, maintenance and operation instructions for each item.

    5. Special maintenance requirements particular to this system shall be clearly defined, along with set up and test procedures.

    6. A complete set of manufacturers "As Built" shop drawings incorporating all changes made during the manufacturing or construction process.

    7. Confirm and record all protective device settings

    8. Renewal parts list with stock numbers.

1.04 REFERENCE STANDARDS

A. American National Standards Institute (ANSI)

    1. ANSI C37.50 - Test Procedures for Low-Voltage AC Power Circuit Breakers Used In Enclosures.

B. National Electrical Manufacturers Association (NEMA)

    1. NEMA PB 2 – Deadfront Distribution Switchboards.

    2. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less.

C. Institute of Electrical and Electronics Engineers (IEEE)

    1. ANSI/IEEE C37.13 - Low-Voltage AC Power Circuit Breakers Used in Enclosures.

    2. ANSI/IEEE C37.90.1 - Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus

D. Underwriters' Laboratories (UL).

    1. UL 891 - Dead-Front Switchboards.

    2. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.

    3. UL 1066 - Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures.

E. National Fire Protection Association (NFPA)

1. NFPA 70 - National Electrical Code.

F. International Electrical Testing Association (NETA)

1. NETA ATS - Acceptance Testing Specifications.

G. Where reference is made to one of the above standards, the revision in effect at the time of the bid shall apply.

1.05 QUALITY ASSURANCE

A. Qualifications

1. The equipment furnished under this Section shall be the product of a manufacturer who has produced this same type of equipment for a period of at least 10 consecutive years.

2. The switchboard equipment shall be designed, assembled and tested by the manufacturer of the major components and circuit protective devices used within the switchboard assembly.

B. Regulatory Requirements

1. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 (NEC) unless more stringent requirements are specified or indicated.

C. Certifications

1. The manufacturer shall maintain a documented ISO 9001 or 9002 quality assurance program implementing suitable procedures and controls to monitor all aspects of production and testing.

2. All sections and devices shall be UL listed and labeled. Service equipment shall be UL labeled as suitable for use as service entrance equipment.

3. The equipment manufacturer shall certify that the equipment will function following a seismic event, including both vertical and lateral required response spectra referenced in the specified codes.

1.06 SYSTEM DESCRIPTION

A. General

1. The CONTRACTOR furnish and install free-standing, dead-front type switchboard equipment, utilizing compartmentalized circuit protective devices as specified herein, and as shown on the contract Drawings.

2. Where shown on the Drawings, provide a utility metering compartment per the requirements of the Power Company, including CT bus bars, concealed hinge door, 3-point catch and lock, handle seal, and top, bottom and rear barriers and any other equipment required by the Power Company.

B. System Responsibility

1. Equipment specified under this Section shall be furnished as an integrated assembly by the manufacturer who shall have sole responsibility for furnishing all the parts and components required for a complete and operable system; however, all equipment need not be manufactured by a single manufacturer.

C. Design Requirements

1. The switchboard shall be arranged so that the uppermost operating handle shall not exceed 6-ft 6-in from the floor when the switchboard is mounted on a 4-in high equipment pad.

2. Equip useable blank spaces and spaces indicated on the Drawings for future devices with all hardware necessary for the future addition of a protective device including doors, bus, device supports, mounting plates, and connections.

D. Performance Requirements

1. Minimum short circuit interrupting rating: The assembly shall be rated to withstand mechanical forces exerted during short-circuit conditions when connected directly to a power source having available fault current of 65,000 amperes symmetrical at rated voltage unless otherwise shown on the Drawings.

2. Voltage and current ratings: as indicated on the Drawings.

3. Surge Withstand Capability: per ANSI/IEEE C62.41 without damage.

4. The equipment and components shall operate continuously at its rated current under the following environmental conditions without damage or degradation of operating characteristics or life:

    1. Operating Ambient Temperature: 0 degrees C to 40 degrees C maximum.

    2. Storage Temperature: -40 degrees C to 65 degrees C.

    3. Relative Humidity: 0 to 95%, non-condensing.

    4. Altitude: Operating to 6500 ft.

5. Metering accuracy: minimum accuracy of the complete system, including current sensors, auxiliary CTs, and the meter display, shall be +/- 1% of full scale for current values, and +/- 2% of full scale for power and energy values.

E. Power System Coordination and Protection

1. Provide a coordinated power system as specified in Section 16015.

2. The switchboard and protective devices shall be fully rated for the specified short circuit current. Systems employing series connected ratings shall not be used.

3. Molded case circuit breaker: provide the following minimum independent time-current curve shaping adjustments for each molded case breaker with an electronic trip unit:

1. Adjustable long-time setting (set by adjusting the trip setting dial or rating plug)

2. Adjustable short-time setting and delay with selective curve shaping

3. Adjustable instantaneous setting

4. Adjustable ground fault setting and delay

4. Protective features: provide the following adjustable protective features at each main breaker location. This protection may be integral to the manufacturer's standard trip unit offering, or may be provided via separate protective relays, however it shall be furnished as a complete and functional package:

1. Voltage phase loss.

2. Current phase loss.

3. Line voltage phase unbalance, selectable from 5 to 40 percent of nominal in 5 percent increments.

4. Voltage phase reversal.

5. Overvoltage, selectable from 105 to 140 percent in 5 percent increments.

6. Undervoltage, selectable from 95 to 60 percent in 5 percent increments.

7. Time delay (adjustable from 0 to 8 seconds in 1 second intervals) for overvoltage, undervoltage, and phase unbalance trip and alarm settings.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping

1. Equipment shall be handled and stored in accordance with manufacturer's instructions and NEMA PB 2.1.

B. Storage and Protection

1. Refer to Section 16000.

1.08 MAINTENANCE

A. Provide the following materials in the quantity specified. Materials shall match those installed in all respects and where possible shall come from the same production lot. Materials shall be properly packaged for long storage and containers shall be clearly and indelibly labeled on the exterior.

1. One quart of touch-up paint.

2. One dozen each of cover bolts, spring nuts and door fasteners.

B. Spare Parts

1. Provide the following spare parts in the quantities specified:

1. 3 Fuses of each type and size for each switchboard.

2. One Pilot lamp of each type for each switchboard.

2. Spare parts shall be boxed or packaged for long term storage and clearly identified on the exterior of package. Identify each item with manufacturers name, description and part number.

C. Tools

1. Provide a single hand- held portable test kit capable of testing each of the microprocessor-based trip device functions.

1.09 NOMENCLATURE AND IDENTIFICATION

A. Provide engraved laminated plastic nameplates on all doors for unit load description and for each control or indicating device. Nomenclature shall be as shown on the Drawing or as directed, using lettering approximately 3/8-in high for unit identification nameplates and 1/4-in high elsewhere. The nameplates shall use black letters on a white background. The engraving shall extend through the exterior lamination to the core. Nameplates shall be screw fastened.

B. The manufacturer shall fasten a master NEMA nameplate to the front of the switchboard indicating model number, serial number, order number, manufacturing date, bus amperes, volts, overall short circuit rating, etc.

C. Provide permanent electrical hazard warning signs marked per OSHA requirements.

D. Provide permanent arc flash PPE signs marked per Section 16015 requirements.

1.10 MANUFACTURERS' SERVICES

A. Provide services of a manufacturer's service representative for testing and start-up.

B. Provide services of a manufacturer's service representative for training, as required in Section 16000.

C. Furnish the services of a manufacturer’s representative for a minimum period of 4 hours for setup and programming of the power management system and metering devices at each switchboard furnished. The manufacturer’s representative shall be factory-trained and shall have a thorough knowledge of the software, hardware, and system programming.

PART 2 PRODUCTS

2.01 GENERAL

A. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

B. Products of the following manufacturers are acceptable.

1. Eaton / Cutler-Hammer

2. General Electric

3. Siemens

4. Square D

C. Like items of materials/equipment shall be the end products of one manufacturer in order to provide standardization for appearance, operation, maintenance, spare parts, and manufacturer's service.

2.02 MATERIALS

A. Wiring

1. Low voltage instrument and control wiring: Stranded copper, minimum size No. 14 AWG, with 600 Volt, 90 degree C, flame retardant, Type SIS, bundled and secured with nylon ties. Provide wire markers at each end of all control wiring.

2. Control wiring terminations: provide insulated locking spade terminals, except where saddle type terminals are provided integral to a device. Current transformer secondary leads shall first be connected to conveniently accessible shorting type terminal blocks before connecting to any other device.

3. Terminal blocks: Groups of control wires leaving the motor control center shall be provided with terminal blocks with numbering strips.

4. Wiring identification: provide heat shrinkable wire markers at each termination point, marked with identification corresponding to appropriate designations on manufacturer’s wiring diagrams, color coding per NEMA standards and the NEC.

5. Component identification: fuse blocks, relays, pushbuttons, switches, etc., shall be marked with identification corresponding to appropriate designations on manufacturer’s wiring diagrams.

6. Line and load terminations: mechanical type terminals, suitable for 75 or 90 degrees C, copper or aluminum cable of the size indicated on the Drawings.

7. Grounding lugs: provided in the incoming line section for connection of the main conductor with additional lugs for supplemental grounding conductors as indicated on the Drawings.

B. Buses

1. Buses: non-tapered, silver plated copper. Provide a fully rated neutral bus where a neutral bus is indicated on the Drawings.

2. Bus bracing: exceed the specified equipment short circuit current rating, but not less than 65,000 amperes RMS symmetrical.

3. Bus joints: welded connections or accessible bolted joints with high-tensile strength, zinc-plated hardware and conical spring-type washers.

4. Ground bus: provide a copper ground bus extending throughout the entire length of the switchboard, firmly secured to each vertical section structure and equipped with lugs for external ground connections, sized for cables shown on the Drawings.

C. Control and Metering Transformers

1. Potential transformers: Two-winding, encapsulated type with primary and secondary fuses. Voltage ratings shall be as required for the application. Thermal rating and metering accuracy per ANSI Standard C57.13.

2. Current transformers: 600 volt rated, toroidal type with accuracy class per ANSI Standard C57.13 requirements for the specified metering application.

3. Control power transformers: Two-winding dry type with primary fuses, secondary circuit breaker, sized for the application per NFPA 70 (NEC).

2.03 EQUIPMENT

A. Switchboard shall consist of the required number of vertical sections bolted together to form a rigid assembly. The sides and rear shall be covered with removable bolt-on covers. All edges of front covers or hinged front panels shall be formed. Provide adequate ventilation within the enclosure.

B. All sections of the switchboard shall be rear aligned with depth as shown on the drawings. Devices shall be front removable and load connections front accessible enabling switchboard to be mounted against a wall. Side access shall not be required. All connections and bus maintenance shall be from the front or the top.

C. Enclosure

1. NEMA 1 enclosure consisting of side, top and rear covers bolted to steel frame structure members. Front doors shall be hinged and gasketed with captive quarter turn fasteners.

D. Main Section

1. Main section: consists of an incoming cable compartment with main lugs or a main disconnecting device as shown on the Drawings.

2. Main breaker: individually mounted, molded-case circuit breaker as indicated on the Drawings.

E. Distribution Sections

1. The distribution sections shall consist of individually mounted, molded-case circuit breakers as indicated. Feeder sections shall be isolated from main section, and from adjacent feeder sections. Feeder devices shall be mounted in individual compartments with an external operating handle located on the compartment door.

2.04 MOLDED CASE CIRCUIT BREAKERS

A. Molded case circuit breakers: provide inverse time and instantaneous tripping characteristics, listed per UL 489 for applications at 100% of their continuous ampere rating in their intended enclosure.

B. Trip mechanism: quick-make, quick-break, mechanically trip-free over-center switching mechanism operated by a toggle-type handle. Handle shall indicate breaker position. A push-to-trip button on the front of the circuit breaker shall provide a local manual means to exercise the trip mechanism.

C. Contacts: non-welding silver alloy with arc extinction accomplished via arc chutes.

D. Minimum symmetrical interrupting capacity: not less than overall switchboard interrupting rating. Provide current limiting circuit breakers where indicated or required to meet the specified short circuit rating.

E. Trip units for circuit breakers below 250 ampere frame: thermal-magnetic trip units, unless otherwise shown.

F. Trip units for 250 ampere frame circuit breakers and larger and where shown on Drawings: adjustable, microprocessor-based, electronic overcurrent trip device with true three phase RMS sensing of sinusoidal and non-sinusoidal currents, and the following minimum features and functions:

1. Rating plugs shall be adjustable and interlocked so they are not interchangeable between frames, and interlocked such that a breaker cannot be closed and latched with the rating plug removed.

2. Trip mode indicators for ground fault, overload and short circuit.

3. An operator interface display panel showing diagnostic information and metering information.

G. Display the following minimum metered values at each breaker location. This metering may be integral to the manufacturer's standard trip unit offering, or may be provided via separate metering devices, however it shall be furnished as a complete and functional package:

1. Instantaneous value of phase current

2. Instantaneous value of line-to-line voltage

2.05 METERING AND CONTROL

A. Where indicated on the drawings, provide an Electronic Meter and Analyzing Panel (EMAP) having the features and functions specified below:

1. The device shall consist of a single microprocessor-based unit capable of monitoring and displaying the functions listed below with the accuracy indicated; the device shall auto range between units, kilounits and megaunits and shall provide the adjustable protection functions indicated. The device shall be UL listed, CUL and CE certified and also meet ANSI standard C37.90.1 for surge withstand.

Metered Values (Accuracy % Full Scale)	Alarm Functions
AC Phase Amperes +/- (0.3%)	Voltage Phase Loss
AC Phase Voltage +/- (0.3%)	(less than 50% rms)
Watts +/- (0.6%)	Current Phase Loss
VA +/- (0.6%)	(1/16 largest phase)
vars +/- (0.6%)	Phase Voltage Unbalance
Power Factor 1.0% (+/- 1 digit)	(5 to 40% – 5% steps)
Frequency +/- (0.1 Hz)	Phase Voltage Reversal
Watthours +/- (0.6%)	Overvoltage
varhours +/- (0.6%)	(105 to 140% – 5% steps)
VA hours +/- (0.6%)	Undervoltage (95 to 60% – 5% steps)
Watt Demand with 10-, 15-, 20-, 25-, 30-, 45-, 60-minute interval)	Time Delay for Overvoltage, Undervoltage, and Phase Unbalance (0 to 20 seconds – 1-sec. steps)
%THD (through 31st harmonic)	
Voltage – minimum/maximum	
Current – minimum/maximum	
Power – minimum/maximum	
Power Factor – minimum/maximum	
Frequency – minimum/maximum	
Peak % THD	
Peak Demand	

2. Input ranges shall accommodate external current transformers with ranges from 5/5 through 12,800/5 amperes. Provide external current transformers with rating as indicated on the drawing or sized for incoming service. Potential transformers shall be self included and fused.

3. Control power shall be capable of being supplied from the monitored incoming AC line without the need for a separate AC supply control circuit.

4. Provide the following features:

    a. Synchronizing pulse input shall be provided, and when activated, shall override the preset watt demand interval and let the utility control the demand window.

    b. Load shed feature which activates the pulse initiation relay when a user selected parameter exceeds a pre-programmed range.

    c. Outputs shall have separate Form C (NO/NC) trip and alarm contacts with ratings of 10 amperes at 115/240V AC or 30V DC resistive.

5. The EMAP shall be one of the following:

    a. Cutler- Hammer; IQ Analyzer Series,

    b. General Electric PQM,

    c. Or equal.

2.06 SURFACE PREPARATIONS AND SHOP COATINGS

A. All exterior and interior steel surfaces of the switchboard shall be properly cleaned and provided with a rust-inhibiting phosphatized coating. Color and finish of the switchboard shall be manufacturer's standard light gray.

B. Unpainted non-current carrying parts shall be galvanized to prevent corrosion.

2.07 SHOP TESTING

A. Perform manufacturers standard production testing and inspection in accordance with NEMA and UL standards. If requested by the ENGINEER, the manufacturer shall submit certified copies of test results to indicate proof of compliance with NEMA and UL Standards.

2.08 LIGHTNING ARRESTER AND SURGE CAPACITOR

A. Lightning arrester shall be 650 Volt, 3 Phase, "Tranquell" type; General Electric Co., Catalog No. 9L15ECC001; Square D Co., No. J9200; Eaton Electrical, Type MW, or equal.

B. Surge Capacitor shall be 650 Volt, 3 Phase, non-toxic liquid insulated, General Electric Co., Catalog No. 9L18BAB301; Square D Co.; Eaton Electrical, or equal.

PART 3 EXECUTION

3.01 GENERAL

A. Install the switchboard as shown on the Drawings and in accordance with manufacturer's instructions and approved shop drawings.

B. Install the equipment in accordance with NEMA PB 2.1.

3.02 FIELD CONNECTIONS

A. Provide bare copper cable not smaller than No. 4/0 AWG not less than 24 -inches below grade connecting to the grounding electrode system. Provide compression connectors at equipment ground bus.

B. Make wiring interconnections between shipping splits.

C. Install bus splice plates and torque the connections.

D. Install field wiring per Section 16120. Field wiring shall be grouped by circuit and tie wrapped. Terminations shall not be stressed.

3.03 INSTALLATION

A. Remove temporary lifting angles, lugs and shipping braces. Remove all current transformer shunts after completing secondary circuits.

B. Mount indoor switchboards on concrete housekeeping pads as detailed in the structural drawings.

C. Locate conduit and cable entrances in the space designated by the equipment manufacturer. Bond all conduits to the equipment ground bus. Cut off and bush conduits three inches above slab surface.

D. Where field painting of enclosures is required to correct damage to the manufacturer's factory applied coatings, provide manufacturer's recommended coatings and apply in accordance with manufacturer's instructions.

3.04 FIELD TESTING

A. Perform physical, electrical, and mechanical inspections in accordance with the manufacturer's recommendations and the following. Provide all temporary power for testing.

1. Compare equipment nameplate data with specifications and approved shop drawings.

2. Inspect physical, electrical, and mechanical condition.

3. Confirm correct application of manufacturer's recommended lubricants.

4. Verify appropriate anchorage, required area clearances, and correct alignment.

5. Inspect all doors, panels, and sections for paint, dents, scratches, fit, and missing hardware.

6. Verify that fuse and circuit breaker sizes and types correspond to approved shop drawings.

7. Verify that current transformer ratios correspond to approved shop drawings.

8. Confirm correct operation and sequencing of electrical and mechanical interlock systems.

9. Inspect insulating materials and structure for evidence of physical damage, reduced clearances, or contaminated surfaces.

10. Verify that field wiring is adequately separated from live busses. Physically secure the field wiring to withstand the effects of fault currents.

11. Check all devices for damage and make all necessary repairs or replacements, prior to energizing.

12. Verify correct barrier and shutter installation and operation.

13. Exercise all active components.

14. Inspect all mechanical indicating devices for correct operation.

15. Verify that vents are clear.

16. Test operation, alignment, and penetration of disconnecting contacts.

17. Inspect control power transformers.

18. Verify all ground connections have been made.

19. Verify operation of space heaters.

B. Perform the following electrical acceptance tests on the switchboard in accordance with NETA ATS.

1. Conduct an electrical insulation resistance test to verify that the equipment and field wiring are free from short circuits and grounds. Test phase-to-ground, phase-to-phase, and phase-to-neutral, with the switches or circuit breakers opened.

2. Overpotential tests.

3. Insulation-resistance test on control wiring; do not perform this test on wiring connected to solid-state components.

4. Control wiring performance test.

5. Primary current injection tests on the entire current circuit in each section of assembly.

6. Conduct earth resistance ground testing.

C. Perform the following electrical acceptance tests on insulated case and molded case circuit breakers with solid state trips in accordance with NETA ATS.

1. Contact resistance tests.

2. Insulation resistance tests.

3. Long-time delay time-current characteristic tests.

D. Perform the following before energizing the equipment in accordance with NEMA PB 2.1:

1. Retighten all accessible electrical connections to the manufacturer's torque values.

2. Retighten the wire clamping members of all accessible mechanical pressure wire type connectors to the values specified by the manufacturer.

3. Retighten conical spring washers according to manufacturer's instructions.

4. Turn all circuit breakers and fusible switches to the OFF position before energizing the bus.

5. Adjust ground fault and instantaneous protective devices to their most sensitive settings during start-up. Reset the devices after startup is complete and the equipment has been successfully energized.

6. Reinstall all parts and barriers removed to facilitate wiring and installation.

7. Before closing the enclosure, remove all metal chips, scrap wire, and other debris from the motor control center interior. Remove accumulated dust and dirt by using a brush, vacuum cleaner or clean, lint-free rags.

8. Install covers, close doors, and make certain that no wires are pinched and that all enclosure parts are properly aligned and tightened.

E. Performance Test.

1. Verify complete system operation including all hardware, software and communication devices.

2. Verify networking performance with all interfacing systems by other manufacturers.

3.05 ADJUSTMENT

A. The CONTRACTOR shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short circuit and protective devices coordination study.

B. The manufacturer's representative shall provide the following services for starting up and programming of the EMAP devices:

1. Set all the adjustable or programmable parameters of all devices in the equipment.

3.06 CLEANING

A. Remove all rubbish and debris from inside and around the switchgear. Remove dirt, dust, and concrete spatter from the interior and exterior of the equipment using brushes, vacuum cleaner, or clean, lint free rags.

B. Vacuum clean the interior of the equipment. Do not use compressed air.

END OF SECTION

SECTION 16431

PAD MOUNTED TRANSFORMERS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install the outdoor, liquid filled, pad mounted transformers as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Section 16000- Electrical General Provisions

B. Power system studies are included in Section 16015.

C. Section 16950 – Electrical System Testing and Settings

D. Seismic design criteria are included in Section 01615.

1.03 SUBMITTALS

A. Submit, in accordance with Section 16000, shop drawings and product data, for the following:

1. Equipment sectional and plan views, bottom plan showing conduit openings and anchor bolt pattern, bushing arrangement, dimensions, weight and construction details.

2. Winding and core arrangement, materials, ratings and insulation details.

3. Transformer diagrammatic nameplate information.

4. Itemized bill of materials for accessories.

5. Certified shop test reports.

6. Field test reports.

7. Installation and maintenance manuals.

8. Seismic anchorage calculations for padmounted transformers in accordance with Sections 01615 and 16000.

1.04 REFERENCE STANDARDS

A. Transformers shall be designed, built and tested in accordance with the following standards:

1. ANSI C57.12.00 - Standard General Requirements for Liquid-Immersed Distribution, Power and Regulating Transformers.

2. Western Underground Committee Guide 2.13 for vandal resistance.

3. NEMA Standard TRI - Transformers, Regulators and Reactors.

4. IEEE Sta. 462A, B-1978 "Short Circuit Requirements Supplement to ANSI C57.12.00-1973".

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. The equipment furnished under this Section shall be the product of a manufacturer who has produced this same type of equipment for a period of at least 10 consecutive years.

B. Transformers shall be designed, assembled and tested by the manufacturer of the core and coil assemblies used in the transformer.

1.06 SYSTEM DESCRIPTION

A. Pad mounted transformers will be used to provide medium voltage transmission of electricity from one of the OWNER's 480 volt distribution systems to another.

1.07 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions.

B. Equipment space heaters shall be connected to a temporary power source during storage.

1.08 PROJECT/SITE REQUIREMENTS

A. Transformers will be installed out of doors as shown on the Drawings.

1.09 MAINTENANCE

A. Provide the following spare parts specified:

1. One set (total of three fuses) replacement primary power fuses for each transformer.

2. One refinishing kit for field touch-up of paint.

B. Spare parts shall be boxed or packaged for long term storage and clearly marked on the exterior of the package. Identify each item with manufacturers name, description and part number.

1.10 MANUFACTURERS

A. Acceptable Manufacturers:

1. ABB - ASEA Brown Boveri

2. Cooper Power Systems (RTE)

3. Square D

4. General Electric

5. Or approved equal

PART 2 PRODUCTS

2.01 RATINGS

A. Transformer self cooled kVA rating shall be as shown on the Drawings. Winding temperature rise shall not exceed 65 degrees C above a 30 degree C average ambient temperature, with a maximum ambient not to exceed 40 degrees C, operating at full rated kVA load.

B. Transformers shall be designed for step-up or step-down connections as detailed on the Drawings.

C. Primary windings shall have the following ratings:

1. Voltage: 12470/7200 Volts, 3 Phase, 60 Hz

2. Connection: Grounded wye or Delta, as shown on Drawings

3. Basic Impulse Level (BIL): 95 kV

D. Secondary windings shall have the following ratings:

1. Voltage: 480/277 Volts

2. Connection: Grounded wye or Delta, as shown on Drawings

3. Basic Impulse Level (BIL): 30 kV

E. Transformer impedance shall range between 2.6 and 5.4 percent for 500 kVA units and smaller.

2.02 CONSTRUCTION

A. Transformers shall be compartmental type, liquid filled, self-cooled, tamper resistant, weatherproof and suitable for mounting on a concrete pad.

B. Transformer tank(s) shall utilize welded steel construction, sealed to withstand an internal pressure of up to 7 psi without distortion, and top oil temperatures ranging from 50 to 105 degrees C. Tank cover shall be designed to permit access to internal components for inspection or repair. Heavy duty, non-removable lifting lugs and jacking pads shall be provided. When required, welded cooling panels or radiators shall be provided on the back and sides of the tank.

C. The high and low voltage compartments shall be located side-by-side separated by a steel barrier. When facing the transformer, the low voltage compartment shall be on the right. Terminal

compartments shall be full height, air filled with individual doors. The high voltage door fastenings shall not be accessible until the low voltage door has been opened. The low voltage door shall have a 3-point latching mechanism with vault type handle having provisions for a single padlock. The doors shall be equipped with lift-off type stainless steel hinges and door stops to hold the doors open when working in the compartments. The front sill of the compartment shall be removable to allow the transformer to be rolled or skidded into position over conduit stubs. ANSI tank grounding provisions shall be furnished in each compartment.

D. The core shall be five-legged. Windings and internal leads shall be aluminum, insulated and braced to prevent phase flashovers during fault conditions. Transformers with wye connected primary and secondary windings shall have the primary neutral insulated from the secondary neutral and brought out into the primary compartment through a separate bushing. Both neutral bushings shall be externally connected to the tank with removable copper straps.

E. Transformer insulating oil shall be Exxon Univolt 33 Hydrofined (R) oil, or equal. Insulating oil shall be free of P.C.B. contamination or any E.P.A. listed toxic chemical. The transformer manufacturer shall test the insulating oil for P.C.B. after filling the tank.

F. Furnish a no load, externally operated, lockable, five-position primary winding tap changer located in the secondary terminal compartment. Tap setting must be clearly visible with the compartment door in the open position. Tap adjustments shall be (2) - 2.5 percent taps above and below rated primary voltage.

G. Terminations

1. High voltage primary terminations shall be arranged for live front radial feed and conform to ANSI C57.12.22 requirements. High voltage bushings shall be electrical grade wet process porcelain with clamp type terminals arranged for vertical takeoff. Bushings shall be externally clamped to allow external replacement.

2. Tie connections between primary loop feed bushings shall be rated for 200 Amps.

3. Low voltage secondary bushings shall be externally clamped, molded epoxy, spade type with NEMA standard four or six hole arrangement. Neutral shall be brought out through an insulated bushing and grounded to the tank wall with a removable grounding strap.

2.03 HIGH VOLTAGE PRIMARY SWITCHING AND PROTECTIVE EQUIPMENT

A. Furnish an oil immersed, three phase, gang operated, two position radial feed, load break primary switch, mounted inside the transformer tank. An external, hook stick type switch operator and index plate shall be mounted in the high voltage primary terminal compartment. Switch positions shall be clearly marked. Minimum switch ratings shall be as follows:

1. 15 kV; continuous Amp rating as shown on Drawings.

2. Momentary and fault close: 10,000 Amps symmetrical.

3. One minute 60 Hz withstand: 50 kV

B. Furnish three, 1 Pole, 200 Amp, fused air break switches. Fuses shall be current limiting with an interrupting capacity of 50,000 Amps RMS symmetrical. Phase to phase and phase to ground insulating barriers shall be furnished.

C. Primary Fuse Arrangement

1. Provide oil immersed partial range current limiting fuses in series with externally removable Bay-O-Net type expulsion fuses. Fuse mounts shall be dead front, externally removable, hot stick operated, load-break, individual fused disconnect devices, located in the high voltage compartment above the primary bushings to permit fuse replacement without opening the tank. Current limiting fuses shall be accessible through a handhole in the tank cover.

2. The CLF and expulsion fuses shall be properly coordinated such that the CLF protects for fault values above the expulsion fuse interrupting rating, the expulsion fuse protects the CLF for current values below the CLF interrupting capability and the CLF will not operate for low side faults beyond secondary terminals.

D. Lightning Arresters

1. Furnish three 15 kV distribution class lightning arresters mounted in the high voltage primary compartment for surge protection.

2. Furnish lightning arrester/surge capacitors mounted in the low voltage secondary compartment.

2.04 ACCESSORIES

A. Each transformer shall be furnished with the following accessories:

1. Nameplate in the low voltage compartment.

2. 1-in drain plug

3. 1-in upper filter press and filling plug.

4. Dial type thermometer with maximum temperature indicator, mounted in a sealed drywell in the low voltage compartment.

5. Auxiliary, sealed, dry contact in thermometer for remote indication of high temperature alarm.

6. Pressure-vacuum gauge mounted in the low voltage compartment.

7. Pressure relief device.

8. Magnetic liquid level gauge located in the low voltage compartment at the 25 degree C level mark.

2.05 SURFACE PREPARATION AND SHOP COATINGS

A. All welds shall be ground smooth and all metal surfaces cleaned of oil, grease and weld spatter using a hot phosphate chemical treatment. A zinc-rich, heat cured epoxy primer shall be applied to inhibit rust.

B. The equipment shall receive an intermediate coat of heat cured epoxy finish color, followed by an air dried finish coat of Outdoor green, Munsell No. 7GY3.29/1.5. After finish painting, all bottom surfaces, and sides up to a minimum of 1-in above the ground shall be protected against corrosion by an epoxy tar coating.

2.06 SHOP TESTING

A. Perform manufacturers standard production testing and inspection in accordance with ANSI Test Code C57.12.90 and/or NEMA TR1. Testing shall include the following as a minimum:

1. Resistance measurements of all windings on the rated voltage connection of each unit and at the tap extremes of one unit only of a given rating on this project.

2. Ratio tests on the rated voltage connection and on all tap connections.

3. Polarity and phase-relation tests on the rated voltage connections.

4. No-load loss at rated voltage on the rated voltage connection.

5. Exciting current at rated voltage on the rated voltage connection.

6. Impedance and load loss at rated current on the rated voltage connection of each unit and on the tap extremes of one unit only of a given rating on this project.

7. Temperature Test or tests shall be made on one unit only of a project covering one or more units of given rating. Tests shall not be required when there is available a record of a temperature test on an essentially duplicate unit.

8. Applied potential test.

9. Induced potential tests.

10. Toxic chemical (e.g. P.C.B.) test.

11. Short circuit capability of transformer design.

B. Manufacturer shall certify compliance with transformer coating performance per ANSI C57.12.28.

C. Results of the above tests including no load loss data shall be submitted with final drawings in the form of certified test reports.

PART 3 EXECUTION

3.01 INSTALLATION

A. The equipment shall be leveled and anchored directly to a concrete equipment pad as shown on the Drawings. Provide hardware and metal shims for installation. Minimum anchor bolt diameter shall be 3/4 inch galvanized steel minimum or as required by the seismic anchorage calculations of Section 01615.

B. Install the equipment in accordance with the manufacturer's instructions.

C. Remove temporary packing and shipping braces. Touch-up damaged paint finishes.

3.03 FIELD TESTING

A. Perform testing per the requirements of Sections 16000 and 16950 and as specified herein.

B. Equipment testing and inspection shall be performed in accordance with NETA Standard ATS and shall include the following:

1. Visual and mechanical inspection.

2. Ground resistance test.

3. Insulation resistance tests, winding-to-winding and winding-to-ground, using a megohmmeter, at nominal tap position with all cables disconnected.

4. Perform insulation power factor tests or dissipation factor tests on all windings and bushings. Test voltage shall be limited to the line-to-ground voltage rating of the winding.

5. Sample and test insulating liquid for dielectric breakdown voltage, acid neutralization number, specific gravity, interfacial tension, color and visual condition. Perform PPM water and P.C.B. tests on 25 kV units and higher and on silicone filled transformers.

6. Perform individual excitation current tests on each phase.

C. In the event of an equipment fault, notify the ENGINEER immediately. After the cause of the fault has been identified and corrected, a joint inspection of the equipment shall be conducted by the CONTRACTOR, the ENGINEER and the equipment manufacturer’s factory service technician. Repair or replace the equipment as directed by the ENGINEER prior to placing the equipment back into service.

3.04 CLEANING

A. Remove all rubbish and debris from inside and around the equipment. Remove dirt, dust, or concrete spatter from the interior and exterior of the equipment using brushes, vacuum cleaner, or clean, lint-free rags. Do not use compressed air.

END OF SECTION

SECTION 16460

ELECTRIC MOTORS TO 250 HP

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Random wound, NEMA frame motors up to 250 Hp furnished under other Sections shall comply with the requirements listed in this Section.

B. This standard motor specification covers technical requirements for performance, materials of construction, efficiency, power factor correction capacitors and accessories for motors. It does NOT apply to special motors, such as submersible motors.

1.02 RELATED WORK

A. Section 16000 - Electrical General Provisions

1.03 SUBMITTALS

A. Submit motor nameplate data and test characteristics per NEMA Standard MG1-12.54 "Report of Test Form for Routine Tests on Induction Motors" in accordance with Section 16000, including:

1. Efficiency at 1/2, 3/4 and full load
2. Power factor at 1/2, 3/4 and full load
3. Motor outline, dimensions and weight
4. Descriptive bulletins, including full description of insulation system
5. Bearing design data
6. Special features (i.e., space heaters, temperature detectors, etc.)

1.04 REFERENCE STANDARDS

A. American Bearing Manufacturer's Association (ABMA)

1. ANSI/ABMA 7 - Shaft and Housing Fits for Metric Radial Ball and Roller Bearings (Except Tapered Roller Bearings) Conforming to Basic Boundary Plans
2. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings
3. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings

B. American National Standards Institute (ANSI)

1. ANSI/NCSL Z540-1 – Calibration Laboratories and Measuring and Test Equipment, General Requirements

C. American Society for Testing Materials (ASTM)

1. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) apparatus

D. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE 1 - Recommended Practice - General Principles for Temperature Limits in the Rating of Electric Equipment and for the Evaluation of Electrical Insulation

2. IEEE 43 - Recommended Practice for Testing Insulation Resistance of Rotating Machinery

3. IEEE 85 - Test Procedures for Airborne Sound Measurements on Rotating Electric Machinery

4. IEEE 112 - Standard Test Procedure for Polyphase Induction Motors and Generators

5. IEEE 792 - Recommended Practice for the Evaluation of the Impulse Voltage Capability of Insulation Systems for AC Electric Machinery Employing Form-Wound Stator Coils

6. IEEE 841 - Standard for Petroleum and Chemical Industry - Severe Duty Squirrel Cage Induction Motors - Up to and Including 500 HP

E. International Organization for Standardization (ISO)

1. ISO 10012-1 - Quality assurance requirements for measuring equipment

2. ISO 1940-1- Mechanical Vibration, Balance Quality Requirements of Rigid Rotors

3. ISO 1940-2 - Determination of Permissible Residual Unbalance

4. ISO 10816-1- Mechanical Vibration, Evaluation of Machine Vibration by Measurements on Non-Rotating Parts - Part 1: General Requirements

5. ISO 9001- Quality Management Systems - Requirements

F. National Electrical Manufacturers Association (NEMA)

1. NEMA MG1 - Motors and Generators

2. NEMA MG2 - Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators

3. NEMA MG3 - Sound Level Prediction for Installed Rotating Electrical Machines

4. NEMA MG10 - Energy Management Guide for selection and use of Polyphase Motors

G. National Fire Protection Association (NFPA)

1. NFPA 70 - National Electric Code

H. Underwriters Laboratories (UL)

1. UL 674 - Motors and Generators, Electric, for Use in Hazardous Locations, Class I - Groups C and D, Class II - Groups E, F and G.

I. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. Motors shall be listed under UL recognized component file as applicable.

B. The motor manufacturer shall maintain a documented ISO 9001 quality assurance program implementing suitable procedures and controls to monitor all aspects of production and testing.

C. Motor manufacturer shall maintain authorized service centers capable of providing training, parts, and emergency maintenance and repairs.

D. Electric motors driving identical machines shall be identical.

1.06 SYSTEM DESCRIPTION

A. To assure unity of responsibility, the motors shall be furnished and coordinated by the manufacturer of the driven equipment. The CONTRACTOR shall assume responsibility for the satisfactory installation and operation of the entire system as specified.

1.07 DELIVERY, STORAGE AND HANDLING

A. Motors shall be shipped fully assembled with the driven equipment. Provide storage and handling per motor manufacturers installation instructions.

B. When furnished, energize motor space heaters to prevent moisture condensation throughout the storage and construction period. Perform periodic motor insulation resistance tests per manufacturer’s storage recommendation.

C. Maintain the bearings during storage and construction and periodically rotate the motor shaft according to manufacturer’s instructions.

1.08 DEFINITIONS

A. Definition of terms used in this specification shall be in accordance with NEC Article 100, ANSI/IEEE Standard 100, and UL Standards Glossary.

PART 2 PRODUCTS

2.01 GENERAL

A. Torque output: minimum performance characteristics for locked rotor and breakdown torque with rated voltage and frequency applied as defined by NEMA MG1, to accelerate and operate the load throughout its operating speed range, including conditions imposed by reduced voltage starting methods.

B. Motors shall deliver the specified performance at rated load under the combinations of voltage and frequency variations and voltage unbalance specified in NEMA MG1.

C. Horsepower rating: sized for operation within the full load nameplate rating without applying the service factor, throughout the full range of mechanical or hydraulic operating condition.

D. Service Factor: 1.15 service factor on sine wave power and 1.0 service factor on VFD power in a 40 degree C ambient.

E. Specific motor application data such as Hp, rpm, enclosure type, etc., is specified under the detailed driven mechanical equipment specification.

F. Enclosures: conform to one of the following standard enclosure designs as specified under the detailed driven mechanical equipment specification. If no enclosure type is specified, provide TEFC enclosures.

1. Open Drip Proof (ODP)

2. Totally Enclosed Fan Cooled (TEFC)

3. Totally Enclosed Explosion Proof (TEXP)

4. Severe Duty

G. Nameplates: engraved or embossed on stainless steel fastened to the motor frame with stainless steel screws or drive pins with information per NEMA MG1.

2.02 SINGLE PHASE MOTORS

A. Application: motors smaller than 1/2 Hp shall be 115/230 or 208 Volts single phase, continuous heavy duty, reversible, capacitor start. Small fan motors may be split-phase or shaded pole type if such are standard for the equipment. Wound rotor or commutator type single-phase motors are not acceptable unless their specific characteristics are necessary for the application.

B. Overload protection: provide internal automatic thermal overloads unless otherwise noted.

C. Insulation: Class F or better, with Class B temperature rise, 1.15 service factor. Locked rotor current shall not be greater than specified in NEMA Standard MG1, Design "N".

D. Enclosure: provide fully gasketed, totally-enclosed air over or fan cooled in conformance with NEMA Standard MG1. Small fan motors may be open type if suitably protected from moisture, dripping water and lint accumulation.

E. Washdown duty: Where motor is installed in wet or corrosive areas routinely exposed to washdowns, high humidity or caustic chemicals, provide stainless steel, paint free washdown motors with Inpro bearing isolators, stainless steel T-type condensation drains, nitrile conduit box gasket, and corrosion resistant fans.

F. Bearings: sealed ball bearings permanently lubricated for 10 years normal use, furnished with shaft slinger.

G. Class I, Division 1 and 2 locations: Single phase motors installed in Class I, Division 1 and 2 locations shall be explosion proof, marked with a T3B temperature code label, and UL listed for use in Class I, Division 1, Groups C & D, and Class II, Groups E, F, & G hazardous location. The temperature code marking shall appear on the nameplate.

2.03 THREE PHASE INDUCTION MOTORS

A. Applications

1. Energy efficiency: meet or exceed requirements of NEMA MG1 Part 12 for NEMA Premium Efficient motors, for 1 Hp and larger. Where California laws or Energy Codes dictate higher efficiencies than those listed, comply with the more stringent standard.

2. Severe duty: Motors installed in process areas and wet or corrosive locations shall be of a type designated by the manufacturer as "Corro Duty", "Mill and Chemical", "Severe Duty", or similar quality designation.

3. Class I, Division 2 locations: Motors in Class I, Division 2 locations shall be marked with a temperature code label suitable for use in the hazardous area classification where installed. Motors shall also comply with IEEE 841 severe duty requirements, with the following additional requirements:

a. The Class, Group and Temperature Code shall be one of the following:

i. Class I Group D - T2B (260°C)
ii. Class I Group D, Class II Groups F and G - T3B (165°C)
iii. Class I Groups C and D, Class II Groups F and G - T3C (160°C)

b. Thermostats: Where winding thermostats are used to obtain surface temperature limitation, the thermostats shall be connected in series with the starter holding coil (stop button). Winding temperature detectors and switches shall be UL listed for use in Class I, Division 1 locations.

c. The exposed surface of motor condensation heaters shall not exceed 80 percent of the nameplate temperature code value.

d. Ventilation fan shall be constructed of corrosion resistant, non-sparking material such as bronze.

4. Class I, Division 1 locations: Motors installed in Class I, Division 1 locations shall be explosion proof, temperature code T3C (160°C), listed for use in Class I, Division 1, Group C & D locations in accordance with UL 674. The operating temperature or temperature range marking shall appear on the nameplate, indicating the maximum temperature for all conditions including overload, locked rotor and single-phasing.

B. Construction

1. Stator core: built up, fully processed, high grade, low loss silicon steel laminations keyed or dovetailed to the stator frame and securely held in place at each end.

2. Stator winding: assembled using random wound copper coils. A split component epoxy insulation system shall be used in order to provide high resistance to moisture and other contaminates.

3. Insulation: manufacturer's premium grade non-hygroscopic, chemical and humidity resistant insulation system consisting of Class F or H materials, operated at Class B temperature rise, with at least one impregnation cycle using solventless resin, and multiple additional dip and bake cycles using polyester varnish.

4. Motor leads: non-wicking type, minimum Class F temperature rating and permanently numbered for identification.

5. Rotor shaft: forged or rolled steel, accurately machined, smoothly finished, with sufficient strength to withstand all stresses resulting from normal operation at any speed up to and including a 25 percent overspeed condition. Coordinate shaft end details with driven equipment coupling.

6. Rotor core: solid, built-up stack of fully processed and coated, high-grade, low-loss silicon steel laminations, with die cast aluminum or fabricated copper bars or their respective alloys. Rotors on frames 213T and above shall be keyed to shaft and rotating assembly dynamically balanced.

7. Cooling fan: corrosion-resistant, bi-directional, keyed, clamped and shouldered on the shaft.

8. Rotor assembly: coated with a corrosion resistant epoxy insulating varnish or other protective coating, thermally stable, statically and dynamically balanced. Balance weights shall be securely attached to the rotor resistance ring by welding or similar permanent method.

C. Bearings

1. Horizontal bearings.

a. Bearings: anti-friction open or single-shield, vacuum-degassed steel ball or roller bearings, electric motor quality. Metric size bearings are not acceptable.

b. Maximum bearing temperature rise: 50 degrees C for two pole motors, 45 degrees C for all other motors, measured at rated load by RTD or thermocouple at bearing outer race.

c. Lubrication: factory lubricated with a premium moisture resistant polyurea thickened grease containing rust inhibitors and suitable for operation over temperatures from -30 to 150 degrees C. with standard lube and relief fittings for re-greasing external lubrication while machine is in operation. Motors shall be NEMA size 140 frame motors and smaller than may be permanently lubricated.

d. Minimum Rated fatigue life: L10 life of 100,000 hours per ABMA 9 or ABMA 11 for direct coupled applications and 26,000 hours for belted applications based on NEMA belting application limits per NEMA MG1. Severe duty motors shall have increased bearing life of 150,000 hours for direct coupled applications and 50,000 hours for NEMA belted applications per IEEE 841.

e. Shaft seals: prevent grease leakage and the entrance of foreign materials, such as water and dirt, into the bearing area while running, coasting, or at rest. Severe duty motors shall have improved sealing per IEEE 841.

2. Vertical bearings.

a. Bearings: manufacturer's standard design, constructed with thrust bearings on top to allow inspection and/or replacement without requiring complete disassembly of motor, of type and size to satisfy thrust loading requirements, rated for an in-service B-10 life of 8800 hours per ABMA, designed to support the weight of the rotor plus, if required, the weight of the rotating driven equipment parts and the hydraulic thrust created by the driven equipment, with a 40 degrees C maximum temperature rise. Metric bearings are not acceptable.

b. Coordinate all thrust conditions, including shutoff, and shaft requirements with the manufacturer of the driven equipment.

c. Normal thrust applications: use grease lubricated deep-groove ball type thrust bearings only on normal thrust design motors, capable of handling thrust loads in either direction.

d. High thrust applications: use single or multiple angular contact ball bearings. Anti-friction thrust bearings shall be designed for an L10 life of 100,000 hours including rotor weight. For applications with higher thrust loads which cannot meet the L10 life, spring loaded spherical roller thrust bearings may be used.

e. Guide bearings: deep-groove ball type located at the bottom of the motor, capable of withstanding all stresses incident to the normal operation of the unit and to the specified overspeed condition, with sufficient means for preventing the leakage of lubricant or entrance of foreign matter along the shaft. When furnished as guide bearings for high thrust units, they shall be oil lubricated. Hollow shaft motors shall have a steady bushing to support the head shaft at the lower end of the motor.

f. Grease lubricated bearings: furnished with provisions for in-service positive lubrication and a drain to guard against over lubrication.

g. Oil lubricated bearings: contained in an oil reservoir with sight level gauge, fill and drain openings with plugs, designed to prevent leakage and excessive aeration of the oil.

h. Anti-backspin device: when specified or requested by the pump manufacturer, provide a shaft mounted, mechanical non-reverse ratchet rated at 100 percent of motor full load torque for immediate protection against reversing due to phase reversals or from backspin at shutdown.

D. Enclosures

1. Motor frames: cast iron or welded heavy plate steel construction, stiff enough to withstand the rotating forces and torques generated and shall be designed to limit or avoid any undesirable harmonic resonances. Provide a threaded, forged steel, shouldered eyebolt blind tapped into the motor frame for lifting.

2. Condensate drain openings: locate drain holes at the low points in the end brackets to allow removal of accumulated moisture from enclosures. Provide corrosion resistant, breather drain plugs for severe duty motors.

3. Enclosure type: as specified in the mechanical equipment section, designed in accordance with NEMA MG1. Totally enclosed designs shall be suitable for outdoor use.

4. Hardware: hex head, SAE Grade 5 or better, plated for corrosion protection.

5. Main terminal box: fabricated steel or cast iron, sized per the NEC for number and size of conduit connections as indicated on the drawings, arranged to accommodate conduit entry from any quadrant, with a grounding terminal and gaskets between the box and motor frame and between the box and its cover.

6. Bearing housings: provide machined surfaces for attaching a magnet mounted accelerometer in order to monitor the motor vibration in the vertical, horizontal, and axial directions at each bearing housing.

7. Space heaters: provide silicone rubber strip type enclosure heaters for outdoor motors, or where otherwise specified. Heaters shall be rated 120 Volt, single phase, designed to prevent condensation inside the enclosure when the motor is idle, with leads brought out to the motor terminal box. The heater wattage and voltage shall be embossed on the motor nameplate.

8. Frame grounding: provide motor frame grounding pad or threaded stud where supplemental grounding to frame is indicated on the drawings.

E. Accessories: provide where specified under the detailed mechanical specifications for individual equipment:

1. Winding temperature switch: three, snap action, bi-metallic, temperature actuated switches embedded in the connection end-turns of the motor winding with normally closed contacts and leads terminating in the main conduit box.

2. Stator temperature detectors: Six resistance-type temperature detectors (RTD’s) embedded in the stator windings, two per phase, symmetrically installed between stator coils where highest temperature will occur, with leads brought out to a separate accessory terminal box on the motor frame. One set per phase for TEXP motors.

3. Bearing temperature detectors: replaceable, three wire RTD's, one per bearing with spring loaded tip, mounted as closely as possible to the outer surface of each bearing with conduit connection head and terminal block.

4. Bearing temperature relays: indicating type bearing temperature relays, furnished with iron or copper constantan thermocouples, one per bearing.

5. Vibration monitoring switch: acceleration sensitive, NEMA 4 switch, with DPDT contacts rated 5A at 240 VAC/30 VDC, with starting and monitoring time delay circuits equal to Robertshaw Model 376A Vibraswitch. For TEXP motors use Metrix Model 5550, or equal, mounted per manufacturer's instructions.

6. Bearing vibration sensors: provision for mounting sensors per vibration monitoring system manufacturer's instructions. Coordinate with the supplier of the machine monitoring equipment.

2.04 SURFACE PREPARATION AND SHOP COATINGS

A. Cast and Fabricated Components

1. Motor cast iron and fabricated metal components shall be cleaned; free of grease, oil, dirt, or other contaminants, then oxide primed and painted with manufacturer's standard finish coating.

2. Severe duty motors: surpass the 250 hour salt spray test per ASTM B117.

B. Internal Surfaces

1. Internal surfaces: shaft, rotor, end bells and parts shall be covered with a corrosion resistant coating of epoxy paint or equal material of 2 mils minimum dry film thickness for increased life against adverse environmental conditions. The stator bore and end turns shall be coated with clear epoxy varnish in addition to the insulating varnish treatment.

2. Shaft extension: protected with a rust preventive strippable coating capable of being peeled off or unwrapped.

3. Machined joints and threaded parts: coated with rust inhibiting compound.

2.05 FACTORY TESTING

A. Each motor shall be given an unwitnessed routine short commercial test per NEMA MG1 and IEEE 112.

PART 3 EXECUTION

3.01 INSTALLATION

A. Motors to be installed on their driven equipment by the equipment manufacturer.

B. Pre-Commissioning Inspection

1. Inspect for physical damage. Verify all shipping materials and braces are removed.

2. Compare equipment nameplate information with site conditions and report any discrepancies.

3. Inspect for proper mounting, grounding, and wiring connections. Check all hardware for looseness and re-tighten as necessary.

4. Verify that the motor and the coupled load are properly aligned. Inspect bearings for proper lubrication and rotate motor shaft by hand to check for binding. Oil lubricated bearing housings that have been filled with preservative oil shall be drained and re-filled with the proper grade of bearing oil before putting the machine into service.

5. Clean motor externally, on completion of installation. Vacuum dirt and debris; do not use blown compressed air to assist in cleaning.

C. Field Commissioning

1. Perform insulation resistance tests in accordance with manufacturer's instructions. If the test fails consult the manufacturer and dry out the machine.

2. Perform a phase rotation test to ensure proper shaft direction with load uncoupled.

3. Check all connections with wiring diagrams prior to energizing.

4. Inspect for unusual mechanical or electrical noise or signs of overheating during initial test run.

5. Measure running current and evaluate relative to load conditions and nameplate full load amperes.

END OF SECTION

SECTION 16470

PANELBOARDS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install all panelboards as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Transformer-Panel Assembly is included in Section 16191.

1.03 SUBMITTALS

A. All submittals shall be in accordance with Sections 01300 and 16000. The submittals shall contain the following:

1. Submit catalog cuts and descriptive literature for each type of panelboard and breaker provided.

2. Submit individual panelboard schedule for each panelboard provided under this Work.

1.04 REFERENCE STANDARDS

A. Panelboards shall be in accordance with the Underwriter Laboratories (UL) "Standard for Panelboards" and "Standard for Cabinets and Boxes" and shall be so labeled where procedures exist. Panelboards shall also comply with NEMA Standard for Panelboards and the National Electrical Code (NEC).

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 MANUFACTURERS

A. 120/240 Volt, single phase, 3 Wire and 120/208 Volt, 3 Phase, 4 Wire panelboards shall be Sentron Type P1 as manufactured by Siemens; Type NQOD by Square D Co.; Type Pow-R-Line C by Cutler-Hammer; or Type AQ as manufactured by the General Electric Co.

B. 277/480 Volt, 3 Phase, 4 Wire panelboards shall be Sentron Type P1or P2 as manufactured by Siemens; Type NF by Square D Co.; Type Pow-R-Line C by Cutler-Hammer or Type AE as manufactured by the General Electric Co.

C. 480 Volt, 3 Phase, 3 Wire Power panelboards shall be Sentron Type P3 as manufactured by Siemens; Type NF by Square D Co.; Type Pow-R-Line C by Cutler-Hammer; or Type AD by General Electric Co.

D. 480 Volt, 3 Phase, 3 Wire Distribution panelboards shall be Pow-R-Line C by Cutler-Hammer; Spectra Series by General Electric Co.; I-Line series by Square D Co.; Sentron Type P4 or P5 as manufactured by Siemens; or equal.

PART 2 PRODUCTS

2.01 GENERAL

A. Rating

1. Panelboard ratings shall be as shown on the Drawings. All panelboards shall be rated for the intended voltage.

2. Circuit breaker panelboards shall be fully rated for the specified circuit breaker fault current interrupting capacity. Series connected short circuit ratings will not be acceptable.

2.02 MATERIALS (NEMA 1)

A. Interiors

1. All interiors shall be completely factory assembled with circuit breakers, wire connectors, etc. All wire connectors, except screw terminals, shall be of the anti-turn solderless type and all shall be suitable for copper or aluminum wire of the sizes indicated.

2. Interiors shall be so designed that circuit breakers can be replaced without disturbing adjacent units and without removing the main bus connectors and shall be so designed that circuits may be changed without machining, drilling or tapping.

3. Branch circuits shall be arranged using double row construction except when narrow column panels are indicated. Branch circuits shall be numbered by the manufacturer.

4. A nameplate shall be provided listing manufacturer's name, panel type and rating.

B. Buses

1. Bus bars for the mains shall be of copper. Full size neutral bars shall be included. Phase bussing shall be full height without reduction. Cross connectors shall be copper.

2. Spaces, provision for future breakers, shall have bus straps bolted onto the bus so that future breakers can be bolted into the panel.

3. Equipment ground bars shall be furnished.

C. Boxes

1. Recessed or flush mounted boxes shall be made from galvanized code gauge steel having multiple knockouts, unless otherwise noted. Boxes shall be of sufficient size to provide a minimum gutter space of 4-in on all sides.

2. Surface mounted boxes and trims shall have an internal and external finish as specified in Paragraph 2.04D4 below. Surface mounted boxes shall be field punched for conduit entrances.

3. At least four studs for mounting the panelboard interior shall be furnished.

D. Trim

1. Hinged doors covering all circuit breaker handles shall be included in all panel trims.

2. Doors shall have semi flush type cylinder lock and catch, except that doors over 48-in in height shall have a vault handle and 3-point catch, complete with lock, arranged to fasten door at top, bottom and center. Door hinges shall be concealed. Furnish two keys for each lock. All locks shall be keyed alike; directory frame and card having a transparent cover shall be furnished on each door.

3. The trims shall be fabricated from code gauge sheet steel.

4. All exterior and interior steel surfaces of the panelboard shall be properly cleaned and finished with ANSI Z55.1, No. 61 light gray paint over a rust-inhibiting phosphatized coating. The finish paint shall be of a type to which field applied paint will adhere.

5. Trims for flush panels shall overlap the box by at least 3/4-in all around. Surface trims shall have the same width and height as the box. Trims shall be fastened with quarter turn clamps.

2.03 MATERIALS (NEMA 3, 4 and 12)

A. Interiors and Buses

1. Interiors and buses shall be as specified for NEMA 1 construction.

B. Boxes and Covers

1. Boxes and covers shall be made from copper-free aluminum or stainless steel with natural finish.

2. Boxes and covers shall be bolted together and gasketed.

3. Conduit openings shall be tapped.

2.04 CIRCUIT BREAKERS

A. Panelboards shall be equipped with circuit breakers with frame size and trip settings as shown on the Drawings.

B. Circuit breakers shall be molded case, bolt-in type.

C. Each circuit breaker used in 120/208 Volt, 3 phase, 4 wire panelboards shall have an interrupting capacity of not less than 10,000 Amps, RMS symmetrical.

D. Each circuit breaker used in 120/240 Volt, single phase, 3 wire panelboards shall have an interrupting capacity of not less than 10,000 Amps, RMS symmetrical.

E. Each circuit breaker used in 480 Volt, 3 phase, 3 wire panelboards shall have an interrupting capacity of not less than 65,000 Amps, RMS symmetrical.

F. GFCI (ground fault circuit interrupter) shall be provided for circuits where shown on the Drawings. GFCI units shall be 1 Pole, 120 Volt, molded case, bolt-on breakers, incorporating a solid state ground fault interrupter circuit insulated and isolated from the breaker mechanism. The unit shall be UL listed Class A Group I device (5 milliamp sensitivity, 25 millisecond trip time) and an interrupting capacity of 10,000 Amps, RMS

G. GFCI for ground fault protection on heat trace equipment shall be provided for branch circuits where shown on the Drawings. GFCI units shall be rated properly for the intended voltage and trip setting indicated on the drawings and shall be molded case, bolt-on breakers, incorporating a solid state ground fault interrupter circuit insulated and isolated from the breaker mechanism. The unit shall be UL listed Class A Group I device (30 milliamp sensitivity, 25 millisecond trip time) and an interrupting capacity of 10,000 Amps, RMS.

H. Each circuit breaker used as switches in Fluorescent Lighting circuits or High Intensity Discharge lighting circuits shall be listed and shall be marked as HID.

I. Circuit breakers shall be as manufactured by the panelboard manufacturer.

J. Two and three-pole circuit breakers shall be constructed as a single unit and shall not require handle-ties.

2.05 IDENTIFICATION

A. All panels shall be furnished with factory installed nameplates engraved as shown on the Drawings or as directed by the OWNER using lettering approximately 3/8-inch high. Nameplates shall be black and white laminated phenolic material approximately 1”H x 3”L. The engraving shall extend through the black exterior lamination to the white core.

B. Nameplates shall be fastened to the panel exterior trim with epoxy adhesive and stainless steel screws.

PART 3 EXECUTION

3.01 INSTALLATION

A. Mount boxes for surface mounted panelboards so there is at least 1/2-in air space between the box and the wall.

B. Connect panelboard branch circuit loads so that the load is distributed as equally as possible between the phase busses.

C. Type circuit directories giving location and nature of load served. Install circuit directories in each panelboard.

D. Install markers on the front cover of all panelboards which identify the voltage rating. Markers shall be made of self sticking B-500 vinyl cloth printed with black characters on an Alert Orange background, 2-1/4-in high by 9-in wide, Style A as manufactured by W.H. Brady Co. or equal.

E. Install a 1-in by 3-in laminated plastic nameplate with 1/4-in white letters on a black background on each panelboard. Nameplate lettering shall be as shown on the Drawings. Nameplates shall be stainless steel screw mounted.

END OF SECTION

SECTION 16480

LOW VOLTAGE MOTOR CONTROL CENTERS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install the low voltage motor control center equipment as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Power system studies are included in Section 16015.

B. Wind design criteria are included in Section 01614.

C. Seismic design criteria are included in Section 01615.

D. Section 16950 – Electrical System Testing and Settings.

1.03 SUBMITTALS

A. Submit shop drawings and product data in accordance with Section 01300 and 16000.

B. Shop drawings shall include the following information:

1. Master drawing index
2. Front elevation view
3. Floor plan layout
4. Top view
5. Dimensions, weight, and shipping splits
6. Single line diagrams
7. Schematic diagrams
8. Nameplate schedules
9. Component list including metering, protective devices, accessories and control equipment
10. Conduit entry/exit locations
11. Assembly ratings including:
    a. Short-circuit rating

b. Voltage

c. Continuous current

d. Bus material and ratings

12. Major component ratings including:

a. Voltage

b. Continuous current

c. Interrupting ratings

13. Cable terminal lug sizes

14. Product data sheets and catalog numbers for circuit breakers and trip units. List all options, trip adjustments and accessories furnished specifically for this project.

15. Manufacturer's unit elementary and compartment wiring diagrams for metering, relay, power and control circuits in accordance with the NEMA wiring class specified. Show wire and terminal numbers. Devices shall be identified using the same designations as detailed on the Project Drawings. Each compartment shall have a custom wiring diagram (standard or typical wiring diagrams are not acceptable).

C. Design Data

1. Provide manufacturer's published time-current curves of the main breaker and feeder devices per Section 16015.

2. Engineering calculations shall be furnished in accordance with Section 01615 – Seismic Design Criteria. As a minimum, these shall demonstrate that each of the MCCs will adequately transfer the design seismic forces to the anchor bolts and foundation.

D. Test Reports

1. Submit field test reports as specified in Section 16950.

E. Submit manufacturer’s installation instructions for the complete assembly and each major component:

1. Shipping, storage, and handling instructions

2. Installation bulletins

3. Supplemental instruction bulletins.

F. Operation and Maintenance Data

1. Submit operation and maintenance manuals in accordance with Section 01730.

2. Provide equipment operation and maintenance manuals with each shipped assembly

including instruction leaflets, instruction bulletins and renewal parts lists for the complete assembly and each major component.

3. Manuals shall include the following as a minimum:

   a. A comprehensive index.

   b. A list of the equipment supplied, including serial numbers, ranges and pertinent data.

   c. Full product specifications for each item.

   d. Service, maintenance and operation instructions for each item.

   e. Special maintenance requirements particular to this system shall be clearly defined, along with set up and test procedures.

   f. Renewal parts list with stock numbers.

   g. A list of "as left" settings for all motor circuit protectors, PLCs and other control devices, and circuit breakers.

   h. A table listing cubicle number, load description, installed overload heater size and motor horsepower, Amps, service factor and starting code letter.

   i. A complete set of manufacturers "As Built" shop drawings incorporating all changes made during the manufacturing process and construction phase.

1.04 REFERENCE STANDARDS

A. American National Standards Institute (ANSI)

   1. ANSI C37.50 - Test Procedures for Low-Voltage AC Power Circuit Breakers Used In Enclosures.

B. National Electrical Manufacturers Association (NEMA)

   1. NEMA ICS 1 - Industrial Control and Systems General Requirements

   2. NEMA ICS 2 - Standard for Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated Not More than 2000 Volts AC or 750 Volts DC

   3. NEMA ICS 2.3 - Industrial Control & Systems: Controllers. Instructions for the Handling, Installation, Operation, and Maintenance of Motor Control Centers

   4. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices

   5. NEMA ICS 6 - Industrial Control and Systems: Enclosures

   6. NEMA ICS 61800-2 - Adjustable Speed Electrical Power Drive Systems, Part 2: General Requirements--Rating Specifications for Low Voltage Adjustable Frequency A.C. Power Drive Systems

7. NEMA 250 - Enclosures for Electrical Equipment (1000 volts maximum)

C. Institute of Electrical and Electronics Engineers (IEEE)

1. ANSI/IEEE C37.13 – Low Voltage AC Power Circuit Breakers Used in Enclosures.

2. ANSI/IEEE C37.90.1 - Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus

3. ANSI/IEEE C62.41-1991 - Surge Withstand Capacity

4. ANSI/IEEE 519 - Standard Practices and Requirements for Harmonic Control in Electrical Power Systems

5. ANSI/IEEE 1531 - Guide for the Specification and Application of Active Harmonic Filters

D. Underwriters' Laboratories (UL)

1. UL 845 - Standard for Safety Motor Control Centers.

2. UL 489 – Molded Case Circuit Breakers, Molded Case Switches, and Circuit-Breaker Enclosures.

3. UL 508 – Industrial Control Equipment

4. UL508C - Power Conversion Equipment

5. UL 1066 – Low Voltage AC and DC Power Circuit Breakers Used in Enclosures.

E. National Fire Protection Association (NFPA)

1. NFPA 70 - National Electric Code.

F. International Electrical Testing Association (NETA)

1. NETA ATS - Acceptance Testing Specifications.

G. Where reference is made to one of the above standards, the revision in effect at the time of the bid shall apply.

1.05 QUALITY ASSURANCE

A. Qualifications

1. The equipment furnished under this Section shall be the product of a manufacturer who has produced this same type of equipment for a period of at least 10 consecutive years.

2. The motor control center equipment shall be designed, assembled and tested by the manufacturer of the major components and circuit protective devices used within the motor control center assembly.

B. Regulatory Requirements

1. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 (NEC) unless more stringent requirements are specified or indicated.

C. Certifications

1. The manufacturer shall maintain a documented ISO 9001 or 9002 quality assurance program implementing suitable procedures and controls to monitor all aspects of production and testing.

2. All sections and devices shall be UL listed and labeled. Service equipment shall be UL labeled as suitable for use as service entrance equipment.

3. The equipment manufacturer shall certify that the equipment will function following a seismic event, including both vertical and lateral required response spectra referenced in the specified codes.

4. The manufacturer may certify the seismic withstand capability of the equipment based on a detailed computer analysis of the entire assembly structure and its components. Guidelines for the installation consistent with these requirements shall be provided by the switchgear manufacturer and be based upon testing of representative equipment. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment.

1.06 SYSTEM DESCRIPTION

A. General

1. Furnish and install totally enclosed, free-standing motor control centers with one or more vertical sections in which combination motor control units, transformers, panels, and associated control equipment units are group-mounted in an integrated assembly as specified herein and as shown on the contract drawings.

B. System Responsibility

1. Equipment specified under this Section shall be furnished as an integrated assembly by the manufacturer who shall have sole responsibility for furnishing all the parts and components required for a complete and operable system.

C. Design Requirements

1. Wiring method: NEMA Class II, II-S, Type B.

a. Class II motor control centers shall be the same as Class I motor control centers except with the addition of manufacturer-furnished electrical interlocking and wiring between units per the control system diagrams. Furnish drawings that indicate factory interconnections within the motor control center.

b. Class I-S and II-S motor control centers shall be the same as Class I and Class II motor control centers except custom drawings shall be provided in lieu of standard

drawings. Provide control systems engineering to produce custom unit elementary Drawings showing interwiring and interlocking between units and to remotely mounted devices. Show all field devices, switches, lights, wire and terminal numbers. Indicate special identifications for electrical devices per the Drawings. AutoCad produced Drawings shall be provided.

c. Type A wiring: provided on Class I motor control centers, consisting of field wiring directly connected to internal unit device terminals.

d. Type B wiring: field wiring connects to unit terminal blocks located in or adjacent to each combination motor control unit. Type B wiring for combination motor-control units Size 3 and smaller shall be designated as Type B-D or B-T, as follows:

(1) Type B-D: field connections directly to the device terminals located immediately adjacent, and readily accessible, to the vertical wireway.

(2) Type B-T: field connections to a load terminal block in, or adjacent to, the unit.

e. Type C wiring: Size 3 and smaller combination motor control units shall be factory wired to master terminal blocks mounted at the top or bottom of vertical sections.

f. Type B and C load wiring connects directly to unit device terminals for combination motor control units larger than Size 3, and for feeder-tap units.

2. Enclosure: NEMA Type 1A unless otherwise noted on the Drawings.

3. The Drawings indicate the approximate horsepower and intended control scheme of the motor driven equipment. Provide the NEMA size starter, circuit breaker trip ratings, control power transformers and thermal overload heater element ratings matched to the motors and control equipment actually supplied, in compliance with the NEC and the manufacturers' heater selection tables. All variations necessary to accommodate the motors and controls as actually furnished shall be made without extra cost to the OWNER.

4. The motor control center shall be arranged so that the uppermost operating handle position shall not exceed 6-ft 6-in from the floor when the equipment is mounted on a 4-in high equipment pad.

5. Equip useable blank spaces with all hardware necessary for the future addition of a unit cubicle, including doors, bus, device supports, mounting plates, and connections.

D. Performance Requirements

1. Minimum short circuit interrupting rating: The assembly shall be rated to withstand mechanical forces exerted during short-circuit conditions when connected directly to a power source having available fault current of 65,000 amperes symmetrical at rated voltage unless otherwise shown on the drawings.

2. Voltage and current ratings: as indicated on the drawings.

3. Surge Withstand Capability: per ANSI/IEEE C62.41 without damage.

4. The equipment and components shall operate continuously at its rated current under the following environmental conditions without damage or degradation of operating characteristics or life:

   a. Operating Ambient Temperature: 0 degrees C to 40 degrees C.

   b. Storage Temperature: -40 degrees C to 65 degrees C.

   c. Relative Humidity: 0 to 95%, non-condensing.

   d. Altitude: Operating to 6500 ft.

5. Audible Noise: not to exceed 65 dbA measured 1 meter from surface of equipment.

E. Power System Coordination and Protection

1. Provide a coordinated power system as specified in Section 16015.

2. The motor control center and protective devices shall be fully rated for the specified short circuit current. Systems employing series connected ratings shall not be used.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions and NEMA ICS-2.3

B. The assembly shall be provided with adequate lifting means for moving into the installation position.

1.08 MAINTENANCE

A. Provide the following materials in the quantity specified. Materials shall match those installed in all respects and where possible shall come from the same production lot. Materials shall be properly packaged for long storage and containers shall be clearly and indelibly labeled on the exterior.

1. One quart of touch-up paint.

2. One dozen each of cover bolts, spring nuts and door fasteners.

B. Spare Parts

1. Provide the following spare parts in the quantities specified:

   a. 10% (minimum of 4) fuses of each type and size.

   b. 10% (minimum of 4) pilot lamps of each type.

   c. One complete reduced voltage solid state starter, including MCP, CPT, fuses, etc., and ready for plug-in installation to an MCC.

2. Spare parts shall be boxed or packaged for long term storage and clearly identified on the exterior of package. Identify each item with manufacturers name, description and part number.

1.09 NOMENCLATURE AND IDENTIFICATION

A. Provide engraved laminated plastic nameplates on all doors for unit load description and for each control or indicating device. Nomenclature shall be as shown on the Drawing or as directed, using lettering approximately 3/8-in high for unit identification nameplates and 1/4-in high elsewhere. The engraving shall extend through the lamination to the core. Nameplates shall be screw fastened.

B. The manufacturer shall fasten a master NEMA nameplate to the front of the motor control center indicating model number, serial number, order number, manufacturing date, bus amperes, volts, overall short circuit rating, etc.

C. Provide permanent electrical hazard warning signs marked per OSHA requirements.

D. Provide permanent arc flash PPE signs marked per OSHA requirements.

E. Compartments with voltages from sources outside of the compartment shall have a sign mounted inside the compartment door marked "CAUTION - THIS UNIT CONTAINS A VOLTAGE FROM AN EXTERNAL SOURCE". Letters shall be black on a high visibility yellow background.

1.10 MANUFACTURERS' SERVICES

A. Provide services of a manufacturer's service representative for testing and start-up, as required in Section 16000.

B. Provide services of a manufacturer's service representative for training, as required in Section 16000.

C. Furnish the services of a manufacturer’s representative for a minimum period of 4 hours per motor control center for setup and programming of the power management system and metering devices. The manufacturer’s representative shall be factory-trained and shall have a thorough knowledge of the software, hardware, and system programming.

PART 2 PRODUCTS

2.01 GENERAL

A. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

B. Products of the following manufacturers are acceptable.

1. Eaton / Cutler-Hammer

2. General Electric

3. Siemens

4. Square D

C. Like items of materials/equipment shall be the end products of one manufacturer in order to provide standardization for appearance, operation, maintenance, spare parts, and manufacturer's service.

2.02 MATERIALS

A. Wiring

1. Wiring: Stranded copper, minimum size No. 14 AWG, with 600 Volt, 90 degree C, flame retardant, Type MTW thermoplastic insulation. Line side power wiring shall be sized for the full rating or frame size of the connected device.

2. Control wiring terminations: provide insulated locking spade terminals, except where saddle type terminals are provided integral to a device. Current transformer secondary leads shall first be connected to conveniently accessible shorting type terminal blocks before connecting to any other device.

3. Terminal blocks: Groups of control wires leaving the motor control center shall be provided with terminal blocks with numbering strips.

4. Wiring identification: provide heat shrinkable wire markers at each termination point, marked with identification corresponding to appropriate designations on manufacturer's wiring diagrams, color coding per NEMA standards and the NEC. Foreign voltage control wiring shall be yellow.

5. Component identification: fuse blocks, relays, pushbuttons, switches, etc., shall be marked with identification corresponding to appropriate designations on manufacturer's wiring diagrams.

6. Line and load terminations: mechanical type terminals, rated for 75 degrees C, suitable for copper or aluminum cable of the size required for the cables indicated on the drawings.

7. Grounding lugs: provided in the incoming line section for connection of the main conductor with additional lugs for supplemental grounding conductors as indicated on the drawings.

B. Buses

1. Horizontal buses: non-tapered, tin plated copper. Neutral bus, where required, shall be fully rated.

2. Vertical buses: non-tapered, tin plated copper, minimum rating of 300 amperes, securely bolted to the horizontal main bus. Completely isolated and insulated by means of a labyrinth design barrier effectively isolating the vertical buses to prevent any fault-generated gases to pass from one phase to another. A shutter mechanism shall isolate the vertical bus when a unit is removed.

3. Bus bracing: to meet the specified equipment short circuit current rating, but not less than 65,000 amperes RMS symmetrical.

4. Bus joints: high-tensile strength, zinc-plated hardware with front-accessible connections for ease of maintenance.

5. Horizontal ground bus: copper ground bus extending throughout the entire length of the motor control center, firmly secured to each vertical section structure and equipped with lugs for external ground connections, sized for cables shown on the Drawings.

C. Control and Metering Transformers

1. Potential transformers: Two-winding, encapsulated type with primary and secondary fuses. Voltage ratings shall be as required for the application. Thermal rating and metering accuracy per ANSI standards.

2. Current transformers: Toroidal type per ANSI and NEMA standards. Metering accuracy shall meet NEMA standard requirements for the particular application.

3. Control power transformers: Two-winding dry type with primary and secondary fuses, sized for the application per NFPA 70 (NEC) to supply power to the actual connected loads. Provide extra capacity as required or where shown on the Drawings.

D. Control Relays

1. Provide control relays and timers as required by the control schemes on the Drawings. Material shall be as specified in Section 16191.

2.03 EQUIPMENT

A. Structure

1. Motor control centers shall consist of a series of metal enclosed, free-standing, dead front vertical sections bolted together to form double wall construction between sections. Individual vertical sections shall be nominally 90-in high, 20-in wide and 20-in deep unless otherwise shown on the Drawings. Bottom channel sills shall be mounted front and rear of the vertical sections extending the full width of each shipping split. Top of each section shall have removable plates with lifting angle. Make provisions for field installation of additional sections to each end and provide full depth cover plates (rodent barriers) at each end of the motor control center channel sills.

2. Provide continuous top and bottom horizontal wireways extending the full width of the line-up, isolated from the horizontal bus. Provide a 4-in wide, full height, vertical wireway in each section, equipped with a hinged door and cable supports. Vertical wireway shall be isolated from the bus and device compartments. Wireway openings shall have rolled edges or protective grommets.

3. Provide individual, flange formed, pan type door with concealed hinges and quarter turn latches for each device compartment and future space. Doors shall be removable. Door removal shall not be required to withdraw starter units or feeder tap devices.

4. Motor control centers shall be designed for against-the-wall mounting. All wiring, bus joints and other mechanical parts requiring tightening or other maintenance shall be accessible from the front or top.

B. Outdoor Low Profile NEMA 4X Enclosure

1. All MCCs installed in outdoor locations or where specifically noted shall be furnished in low profile, 316 stainless steel NEMA 4X enclosures.

2. MCCs furnished in accordance with the low profile, NEMA 4X requirements shall be in conformance with all other provisions of this section (16480) except as specifically noted.

3. Enclosure shall have a roof sloping downward toward the rear.

4. Outer sections shall be the same widths as indoor structures, except each end of the outdoor assembly shall have an end trim.

5. The enclosure shall be provided with bolt-on rear covers for each section if rear maintenance access is required.

6. Doors shall have provisions for padlocking.

7. Provide thermostatically controlled space heaters for each structure with adequate wattage to prevent the accumulation of condensed moisture.

8. Each bay shall have a single tube, 20 Watt fluorescent light fixture, mounted internally to the ceiling of the panel. Light fixture shall be switched and shall be complete with the lamp.

9. Each panel shall have a specification grade duplex convenience receptacle with ground fault interrupter, mounted internally within a stamped steel device box with appropriate cover and protected by a dedicated fuse or circuit breaker.

10. All low profile NEMA 4X MCCs shall include a closed circuit air conditioning system to minimize the degradation affects of the salt air environment on the MCC internal components.

11. Power for air conditioners, space heaters, lights and receptacles shall be obtained from a control power transformer within the motor control center. Supply voltage shall be 120 volts AC.

12. The Motor Control Center shall be furnished in an enclosure with the reduced height as indicated. The low profile MCC shall be a standard product of the MCC manufacturer and shall conform to all other requirements of this Specification Section.

13. Stainless steel exterior and interior enclosure surfaces do not need to be painted unless required by the enclosure manufacturer for NEMA 4X salt air exposure.

14. Provide limit (position) switches on each door for remote monitoring of panel intrusion.

C. Three Phase Monitor

1. Microprocessor-based 3 phase module.

2. Protection against under- and over-voltage, phase loss, unbalance, shift, and reversal, and frequency shift.

3. Adjustment for time delay, voltage, and mode of operation.

4. Delay on make timer

5. Auto or manual reset

6. LED fault indications

7. DPDT output contact

8. Fused potential taps as shown on the drawings.

9. ATC Diversified SLM-440-ASE or equal.

D. Main Section

1. The main section shall consist of an incoming cable compartment with main lugs or a main disconnecting device as shown on the drawings. Main lug terminations shall have adequate dedicated space for the type and size of cable used and the lugs shall be standard mechanical screw with anti-turn feature. Main breakers shall be provided as indicated on the drawings and shall be molded case circuit breakers.

E. Unit Compartments

1. Provide individual compartments for each removable combination starter and feeder tap device unit. Each vertical section shall accommodate a maximum of six compartments. Steel barriers shall isolate the top, bottom and sides of each compartment from adjacent units and wireways. Removable units shall connect to the vertical bus in each section with tin plated, self aligning, pressure type copper plug connectors. Size five and larger starter units may be wired directly to the bus. Removable units shall be aligned in the structure on guide rails or shelves and secured with a cam latch mechanism or racking screw.

2. Provide individual, isolated compartments for fixed mounted devices such as circuit breakers, cable lugs, metering, relaying and control devices. Main and bus tie circuit breakers shall be wired directly to the main horizontal bus. All bus connections shall be fully rated.

3. Provide the following features:

a. Provision to padlock removable units in a partially withdrawn TEST position, with the bus stabs disengaged.

b. Provision to padlock unit disconnect handles in the OFF position with up to three padlocks.

c. Mechanical interlock with bypass to prevent opening unit door with disconnect in the ON position, or moving disconnect to the ON position while the unit door is open.

d. Mechanical split-type terminal blocks for disconnecting external control wiring.

e. Auxiliary contact on unit disconnects to isolate control power when fed from an external source.

f. Disconnect operating handles and control devices mounted on the removable units.

g. Provide mechanical interlock on reversing contactors of a pivot-type mechanism to prevent closing of one contactor when the other is closed. Coil controller energizes both forward and reverse contactors providing one control point for wiring.

h. Compartments containing motor starters shall have wiring diagrams and heater tables fastened to the compartment door. Compartments containing panelboards shall have circuit directories fastened to the compartment door.

2.04 MOTOR CONTROLLERS

A. Combination Starter Units

1. Combination starters shall include a motor circuit protector (MCP) in series with a motor controller and an overload protective device. The MCP shall have an adjustable magnetic trip range and a trip test feature. MCPs shall be labeled in accordance with UL489.

B. Electromechanical Motor Starters

1. Motor starters: three Pole, 600 Volt, electrically operated, of the types shown on the Drawings, minimum size shall be NEMA Size 1. IEC rated starters shall not be used. Starters shall have 120 Volt encapsulated operating coils, an individual control power transformer with primary and secondary fuses, and silver cadmium oxide renewable line contacts.

2. Multi-speed and reversing starters: provide two motor rated contactors mechanically and electrically interlocked so that only one device may be energized at any time.

3. Auxiliary contacts: Form C, NEMA A600 rating, as required by the control schemes on the Drawings. Provide 1 normally open and 1 normally closed spare contacts on each starter. Additional auxiliary contacts shall be furnished as shown on the Drawings or as required by the control schematic and this Section.

4. Each starter shall be equipped with a control power transformer, two winding type, 120 VAC secondary, fused in accordance with the NEC. Provide extra capacity as required or where shown on the Drawings.

5. Motor overload protection: Ambient compensated, bimetallic-type with interchangeable heaters, visual trip indication, calibrated for 1.0 and 1.15 service factor motors. Electrically isolated normally open and normally closed contacts shall be provided on the relay. Overload relays for submersible pump motors shall be ambient compensated, quick trip, Class 10. A test trip feature shall be provided for ease of troubleshooting and shall be conveniently operable without removing components or the motor starter. Overload relays shall be manually reset from outside the enclosure by means of an insulated pushbutton.

2.05 REDUCED VOLTAGE STARTERS

A. Solid State Reduced Voltage Starters

1. Reduced voltage starters: where shown on the contract drawings, provide UL and CSA listed solid-state reduced-voltage starters in the motor control center, consisting of an

SCR-based power section, logic board and run bypass contactor. Starters shall be sized for continuous operation up to a maximum of 115% of the connected motor full load ampere rating.

2. Power section: six back-to-back SCRs rated for a minimum peak inverse voltage rating of 1500 volts PIV. Resistor/capacitor snubber networks shall prevent false firing of SCRs from dV/dT effects.

3. Logic board: identical for all ampere ratings and voltage classes with quick disconnect plug-in connectors for current transformer inputs, line and load voltage inputs and SCR gate firing output circuits for ease of testing, service and replacement.

4. Run bypass contactor: intelligent type motor controller to limit contact bounce and optimize coil voltage during varying system conditions, energized when the motor reaches 90% of full speed and close/open under one times motor current.

5. Overload protection: electronic overload protection based on inverse time-current algorithm, capable of being disabled during ramp start for long acceleration loads. Overload protection adjustments via the device keypad shall include:

    a. Motor full load ampere adjustment from 30 to 100% of the maximum continuous ampere rating of the starter

    b. Selectable overload class setting of 5, 10, 20 or 30

    c. Electronic or mechanical reset capability after a fault

6. Provide the following protection features enabled from the device keypad:

    a. Heat sink over-temperature protection.

    b. Improper line-side phase rotation shut down if a line-side phase rotation other than A-B-C exists.

    c. Phase loss or unbalance condition shut down if a 50% current differential between any two phases is encountered.

    d. Motor stall protection.

    e. Motor jam protection.

7. Alarm contacts: Form C normally open (NO), normally closed (NC) contacts shall change state when a fault condition exists and an LED display on the device keypad shall indicate type of fault.

8. Provide the following control function adjustments on the device keypad:

    a. Selectable Torque Ramp Start or Current Limit Start

    b. Adjustable Kick Start Time

    c. Adjustable Kick Start Torque

d. Adjustable Ramp Start Time

e. Adjustable Initial Starting Ramp Torque

f. Adjustable Smooth Stop Ramp Time

9. Pump Control Option: Provide a factory installed control algorithm for pump start-up and shut down sequences to reduce the potential for water hammer in a centrifugal pump system. Upon a start command, the soft starter microprocessor ramps the speed of the motor to achieve a gentle start. The bypass contactors close after the speed reaches its nominal value. Upon a stop command, the bypass contactors are opened and the motor speed shall be decreased in a tapered manner to gradually slow the flow until the motor is brought to a stop. The start and stop ramp times shall be user adjustable and shall be set for the application requirements.

10. Digital interface module: door mounted display used to program the soft starter and monitor parameters including line currents, pole currents, pole voltages, number of starts, and DC control voltage. Soft starter shall display motor status and the previous five fault conditions.

2.06 MOLDED CASE CIRCUIT BREAKERS

A. Molded case circuit breakers: provide inverse time and instantaneous tripping characteristics, listed per UL 489 for applications at 100% of their continuous ampere rating in their intended enclosure.

B. Trip mechanism: quick-make, quick-break, mechanically trip-free over-center switching mechanism operated by a toggle-type handle. Handle shall indicate breaker position. A push-to-trip button on the front of the circuit breaker shall provide a local manual means to exercise the trip mechanism.

C. Contacts: non-welding silver alloy with arc extinction accomplished via arc chutes.

D. Minimum symmetrical interrupting capacity: not less than overall motor control center interrupting rating. Provide current limiting circuit breakers where indicated or required to meet the specified short circuit rating.

E. Unless otherwise noted on the drawings, trip units for circuit breakers below 250 ampere frame: thermal-magnetic trip units.

F. Trip units for 250 ampere frame circuit breakers and larger, and where noted on Drawings: adjustable, microprocessor-based, electronic overcurrent trip device with true three phase RMS sensing of sinusoidal and non-sinusoidal currents, and the following minimum features and functions:

1. Rating plugs shall be adjustable and interlocked so they are not interchangeable between frames, and interlocked such that a breaker cannot be closed and latched with the rating plug removed.

2. Trip mode indicators for ground fault, overload and short circuit.

3. Operator interface display panel showing diagnostic information and metering information.

4. Independent time-current curve shaping adjustments for each molded case breaker equipped with an electronic trip unit:

   a. Adjustable long-time setting (set by adjusting the trip setting dial or rating plug)

   b. Adjustable short-time setting and delay with selective curve shaping

   c. Adjustable instantaneous setting

   d. Adjustable ground fault setting and delay

2.07 METERING AND CONTROL

A. Where indicated on the drawings, provide an Electronic Meter and Analyzing Panel (EMAP) having the features and functions specified below:

1. The device shall consist of a single microprocessor-based unit capable of monitoring and displaying the functions listed below with the accuracy indicated; the device shall auto range between units, kilounits and megaunits and shall provide the adjustable protection functions indicated. The device shall be UL listed, CUL and CE certified and also meet ANSI standard C37.90.1 for surge withstand.

Metered Values (Accuracy % Full Scale)	Alarm Functions
AC Phase Amperes +/- (0.3%)	Voltage Phase Loss
AC Phase Voltage +/- (0.3%)	(less than 50% rms)
Watts +/- (0.6%)	Current Phase Loss
VA +/- (0.6%)	(1/16 largest phase)
vars +/- (0.6%)	Phase Voltage Unbalance
Power Factor 1.0% (+/- 1 digit)	(5 to 40% – 5% steps)
Frequency +/- (0.1 Hz)	Phase Voltage Reversal
Watthours +/- (0.6%)	Overvoltage
varhours +/- (0.6%)	(105 to 140% – 5% steps)
VA hours +/- (0.6%)	Undervoltage (95 to 60% – 5% steps)
Watt Demand with 10-, 15-, 20-, 25-, 30-, 45-, 60-minute interval)	Time Delay for Overvoltage, Undervoltage, and Phase Unbalance (0 to 20 seconds – 1-sec. steps)
%THD (through 31st harmonic)	
Voltage – minimum/maximum	
Current – minimum/maximum	
Power – minimum/maximum	
Power Factor – minimum/maximum	
Frequency – minimum/maximum	
Peak % THD	
Peak Demand	

2. Input ranges shall accommodate external current transformers with ranges from 5/5 through 12,800/5 amperes. Provide external current transformers with rating as indicated on the drawing or sized for incoming service. Potential transformers shall be self included and fused.

3. Control power shall be capable of being supplied from the monitored incoming AC line without the need for a separate AC supply control circuit.

4. Provide the following features:

   a. Synchronizing pulse input shall be provided, and when activated, shall override the preset watt demand interval and let the utility control the demand window.

   b. Load shed feature which activates the pulse initiation relay when a user selected parameter exceeds a pre-programmed range.

   c. Outputs shall have separate Form C (NO/NC) trip and alarm contacts with ratings of 10 amperes at 115/240V AC or 30V DC resistive. In addition, provide a separate Form C (NO/NC) contact to provide a programmable kilowatt-hour pulse output.

5. The EMAP shall be one of the following:

   a. Cutler- Hammer; IQ Analyzer Series,

   b. General Electric PQM,

   c. Or equal.

2.08 SURFACE PREPARATIONS AND SHOP COATINGS

A. All exterior and interior steel surfaces of the motor control center shall be properly cleaned and provided with a rust-inhibiting phosphatized coating. Color and finish of the motor control center shall be manufacturer's standard light gray.

B. Unpainted non-current carrying parts shall be galvanized to prevent corrosion.

2.09 SHOP TESTING

A. Perform manufacturers standard production testing and inspection in accordance with NEMA and UL standards. If requested by the ENGINEER, the manufacturer shall submit certified copies of test results to indicate proof of compliance with NEMA and UL Standards.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the motor control center as shown on the Drawings and in accordance with manufacturer's instructions and approved shop drawings.

B. Install the equipment in accordance with NEMA ICS-2.3.

C. All motor control centers shall be set flush with the equipment pad or concrete floor as detailed on the Drawings. The motor control centers shall be bolted to the concrete floor or concrete equipment pad with not less than 3/4" bolts as required to comply with the seismic anchorage calculations. Proper anchorage of motor control centers shall be determined by the CONTRACTOR in conformance with Sections 01615 and 16000. Motor control center

anchorage, installed in accordance with the approved seismic calculations, shall be completed before any field wiring is installed.

D. Remove temporary lifting angles, lugs and shipping braces. Remove all current transformer shunts after completing secondary circuits.

E. Make wiring interconnections between shipping splits.

F. Install bus splice plates and torque the connections.

G. Locate conduit and cable entrances in the space designated by the equipment manufacturer. In general, all conduit entering or leaving a motor control center shall be stubbed up into the bottom horizontal wireway directly below the vertical section in which the conductors are to be terminated. Install conduits to prevent water from entering the enclosure. Bond all conduits including stubs to the equipment ground bus. Seal voids around conduit openings in the slab with water- and oil-resistant caulking or sealant. Cut off and bush conduits three inches above slab surface.

H. Where field painting of enclosures is required to correct damage to the manufacturer's factory applied coatings, provide manufacturer's recommended coatings and apply in accordance with manufacturer's instructions.

I. Repair damage to galvanized coatings using zinc rich paint.

3.02 FIELD TESTING

A. Engage the services of an independent testing firm to inspect and test the installed equipment prior to energizing.

B. Perform physical, electrical, and mechanical inspections in accordance with the manufacturer's recommendations and the following. Provide all temporary power for testing.

1. Compare motor nameplate data with approved shop drawings. Ensure that overload relays or heater elements are installed and selected for the full load current shown on the nameplate of each motor and the manufacturer's instructions.

2. Confirm correct application of manufacturer's recommended lubricants.

3. Verify appropriate anchorage, required area clearances, and correct alignment.

4. Inspect all doors, panels, and sections for paint, dents, scratches, fit, and missing hardware.

5. Verify that fuse, circuit breaker, and starter sizes and types correspond to approved shop drawings.

6. Verify that current transformer ratios correspond to approved shop drawings.

7. Confirm correct operation and sequencing of electrical and mechanical interlock systems.

8. Inspect insulating materials and structure for evidence of physical damage, reduced clearances, or contaminated surfaces.

9. Check the integrity of all bus mounting means.

10. Verify that field wiring is adequately separated from live busses. Physically secure the field wiring to withstand the effects of fault currents.

11. Check all devices for damage and make all necessary repairs or replacements, prior to energizing.

12. Verify correct barrier and shutter installation and operation.

13. Exercise all active components.

14. Inspect all mechanical indicating devices for correct operation.

15. Verify that vents are clear.

16. Test operation, alignment, and penetration of disconnecting contacts.

17. Inspect control power transformers.

18. Verify all ground connections have been made.

19. Verify operation of space heaters.

20. See also Section 16950.

C. Perform the following electrical acceptance tests on the motor control center in accordance with NETA ATS.

1. Conduct an electrical insulation resistance test to verify that the equipment and field wiring are free from short circuits and grounds. Test phase-to-ground, phase-to-phase, and phase-to-neutral, with the switches or circuit breakers opened.

2. Insulation-resistance test on control wiring; do not perform this test on wiring connected to solid-state components.

3. Control wiring performance test.

4. Conduct earth resistance ground testing.

D. Perform the following electrical acceptance tests on insulated case and molded case circuit breakers with solid state trips in accordance with NETA ATS.

1. Contact resistance tests.

2. Insulation resistance tests.

3. Long-time delay time-current characteristic tests.

E. Perform the following before energizing the equipment in accordance with NEMA ICS-2.3:

1. Retighten all accessible electrical connections to the manufacturer's torque values.

2. Retighten the wire clamping members of all accessible mechanical (pressure wire) type connectors to the values specified by the manufacturer.

3. Retighten conical spring washers according to manufacturer's instructions.

4. Turn all circuit breakers and fusible switches to the OFF position before energizing the bus.

5. Adjust ground fault and instantaneous protective devices to their most sensitive settings during start-up. Reset the devices after startup is complete and the equipment has been successfully energized.

6. Reinstall all parts and barriers removed to facilitate wiring and installation.

7. Before closing the enclosure, remove all metal chips, scrap wire, and other debris from the motor control center interior. Remove accumulated dust and dirt by using a brush, vacuum cleaner or clean, lint-free rags.

8. Install covers, close doors, and make certain that no wires are pinched and that all enclosure parts are properly aligned and tightened.

F. Performance Test.

1. Verify complete system operation including all hardware, software and communication devices.

3.03 ADJUSTMENT

A. Perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short circuit and protective device coordination study.

B. The manufacturer’s representative shall provide the following services for starting up and programming of the EMAP devices:

1. Set all the adjustable or programmable parameters of all devices in the equipment.

3.04 CLEANING

A. Remove all rubbish and debris from around the equipment. Remove dirt, dust, and concrete spatter from the exterior of the equipment using brushes, vacuum cleaner, and clean, lint free rags.

B. Do not use compressed air for cleaning.

3.05 TRAINING

A. Provide training in accordance with the requirements of Section 16000.

B. One 4-hour training course shall be provided.

END OF SECTION

SECTION 16492

AUTOMATIC TRANSFER SWITCHES

PART 1 GENERAL

1.01 SCOPE OF WORK

A Furnish, install, test and place into operation the automatic transfer switches (ATS) with features, accessories, number of poles, amperage, voltage and withstand current ratings as shown on the Drawings and in accordance with these Specifications.

B Each automatic transfer switch shall consist of an inherently double throw power transfer switch unit utilizing circuit breakers and a controller interconnected to provide complete automatic operation. All transfer switches and controllers shall be the product of the same manufacturer.

C. ATS to be factory installed in the main switchboard.

1.02 RELATED WORK

A. Electrical work not herein specified is included in other Sections of Division 16.

B. Low voltage main switchboards are included in Section 16425.

C. Power system studies are included in Section 16015.

1.03 SUBMITTALS

A. Submit shop drawings and product data, in accordance with Section 16000. Include the following submittal information with the submittal for the low voltage switchboard:

1. Equipment outline drawings showing elevation, plan and interior views, dimensions, weight, and front panel layouts.

2. A list of all options, special features, ratings and deviations from the Specifications.

3. Complete Bill of Materials indicating manufacturer's part numbers.

5. Product data sheets and catalog numbers for over current protective devices, control relays, control stations, meters, pilot lights, etc. List all options, trip adjustments and accessories furnished specifically for this Project.

6. Provide control systems engineering to produce custom unit elementary drawings showing inter-wiring and interlocking between units and remotely mounted devices. Show wire and terminal numbers. Indicate special identifications for electrical devices per the Contract Drawings.

7. Assembly ratings including short circuit rating, voltage and continuous current.

8. Major component ratings including voltage, continuous current rating and interrupting ratings.

9. Cable terminal sizes.

10. Instruction and renewal parts books.

11. Itemized list of spare parts furnished specifically for this Project, including part numbers.

1.04 REFERENCE STANDARDS

A. The automatic transfer switches shall be UL listed for use in standby systems and services in accordance with Sections 230, 517, 700, 701 and 702 of the National Electrical Code and shall be designed, built and tested in accordance with the latest editions and revisions of the following standards and codes:

1. UL 1008 - Transfer Switches

2. UL 891- Switchboards Nominally Rated at 600 V or Less

3. UL 896A - Service Equipment Requirements

4. UL 489 - Molded-Case Circuit Breakers

5. UL 1558 - Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear Assemblies

6. NFPA 110 - Emergency and Standby Power Systems

7. NEMA ICS 10-1993 (formerly NEMA ICS 2-477) - AC Transfer Switch Equipment

5. IEEE 446 - Recommended Practice for Emergency and Standby Power Systems

6. IECC 947-6-1 - Low Voltage Switchgear and Control Gear; Multifunction Equipment; Automatic Transfer Switching Equipment

7. NFPA 99 - Essential Electrical Systems of Health Care Facilities

8. UL 508 Industrial Control Equipment

9. International Standards Organization ISO 9001

10. IEC 801 -2,3,4,and 5

11. CISPR 11

12. Compliant with FCC Part 15, Subpart B, Class A

13. See also Section 16425

1.05 QUALITY ASSURANCE

A. Equipment components and devices shall be UL listed to the extent possible wherever UL standards exist for such equipment.

B. The automatic transfer switch manufacturer shall demonstrate at least ten years of continuous field operating experience in automatic transfer switch design and fabrication within the last fifteen years.

C. The manufacturer of the assembly shall be the manufacturer of major components and control modules installed within the assembly.

D. The automatic transfer switch shall be certified to ISO 9001 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design, development, production, installation, and servicing.

1.06 OPERATING AND MAINTENANCE MANUALS

A. Operating and maintenance manuals for the ATS shall be included in the O&M for the low voltage switchboard.

B. The manuals shall include:

1. A list of "as left" settings for all timing relays and other programmable parameters.

2. Maintenance schedule and instructions.

3. Product information, instruction leaflets, and instruction and maintenance bulletins for the complete assembly and each major component.

4. All field start-up test results

1.07 MANUFACTURERS

A. Automatic transfer switches shall be one of the following products or equal:

1. Eaton-Cutler Hammer;

2. Or approved equal

1.08 REGULATORY REQUIREMENTS

A. Provide a certificate of compliance with UL 1008 for the automatic transfer switches furnished under this Section.

PART 2 PRODUCTS

2.01 CONSTRUCTION

A. Application: Service Rated ATS, using mechanical and electrical interlocking circuit breaker combination.

1. The ATS shall be labeled and listed as suitable for use as a service entrance disconnecting device.

2. The double circuit breaker scheme shall be designed for a standby and normal source of 480 volts, 3-phase, 4-wire, 60 Hz. Current ratings and withstand ratings (RMS symmetrical short circuit current available at the ATS) shall be as shown on the Drawings but not less than 65 KAIC.

3. The transfer switch shall be adequately constructed to carry its full rated current on a continuous 24-hour basis and shall not show excessive heating or be subject to derating. The transfer switch shall be capable of withstanding inrush current values to 20 times its full load current rating without mechanical distortion of main contact poles or supports. The transfer switch shall be capable of withstanding all available system fault currents without parting of or damage to contacts during the fault clearing time of the system over-current device.

4. Ampere ratings for total system transfer shall include motor, electric-discharge lamp, electric heating and tungsten-filament lamp loads in accordance with Paragraph 38.13 of UL-1008.

5. The ATS shall have three-position operation; closed to normal, open to standby, and closed to standby source. Time delay between opening of the closed contacts and closing of the open contacts shall be a minimum of 400 milliseconds to allow for voltage decay before transfer is complete.

6. The ATS shall be positively interlocked both mechanically and electrically to prevent simultaneous closing of both sources under either automatic or manual operation. Main contacts shall be mechanically locked in position in both normal and standby positions. A neutral position shall not be possible under normal electrical operation. The ATS shall have a manual neutral position for load circuit maintenance. A transfer switch position indicator shall be visible from the front of the switch to show to which source the ATS is connected.

7. Service entrance transfer switches shall be provided with over current trip units, a neutral disconnect link, and a neutral-to-ground main bonding jumper to meet UL service entrance requirements. An external key operated selector switch shall be provided to disconnect the power supplies. Indicators shall be provided to show the availability of each source as well as breakers in a tripped or disconnected position. Provide a neutral disconnect link for three pole solid neutral switches and a neutral-to-ground main bonding jumper to meet UL service entrance requirements. Ground fault protection shall be provided as shown on the Drawings.

8. The ATS shall be provided with a permanently attached manual operation handle or by integrally mounted pushbuttons. The manual operating means shall provide safety to operators performing transfer under load. The manual operator shall transfer the switch with the same contact-to-contact transfer speed as the electrical operator. The inability to manually operate the transfer switch without first disconnecting loads will not be acceptable.

9. A maintained contact TEST-AUTO-RESET switch, NORMAL and STAND-BY pilot lights shall be mounted on the enclosure door. Pilot lights shall be push-to-test type. The TEST position shall simulate a normal source failure. The RESET position shall by-pass the time delays on retransfer to normal source.

10. Controls shall be of industrial grade and shall be easily replaceable for ease of service. All controls shall be accessible from the front of the control panel. All control wire shall be neatly harnessed. All circuitry shall be 120 VAC nominal. Internal components shall be rated for continuous duty.

11. The switching operation shall be provided by 3-pole, 100 percent rated molded case circuit breakers. Breakers shall be as specified in Section 16425.

12. Sequence of Operation

    a. The ATS shall automatically transfer its load circuit to a standby power supply upon failure of its normal source.

    b. Upon loss of phase-to-phase voltage of the normal source below 90 percent of nominal, and after a time delay, a contact shall close to initiate starting of the standby source power plant. Transfer to the alternate source shall take place upon attainment of 90 percent of rated voltage and frequency of that source.

    c. When the normal source has been restored to 90 percent of rated voltage, and after a time delay, the load shall be re-transferred to the normal source.

    d. If the standby source should fail while carrying the load, transfer to the normal power supply shall be made instantaneously upon restoration of the normal source to satisfactory conditions.

2.02 ACCESSORIES

A. Interfacing relays shall be industrial control grade, plug-in type with dust covers.

B. All timers shall be fully adjustable throughout their complete range, without affecting operation. It shall not cause an infinite time delay because of a setting anywhere on their scale..

C. An adjustable time delay of 0 to 30 second to override momentary normal source outages and delay all transfer and engine starting signals, factory set at 3 seconds.

D. Adjustable time delay on retransfer to normal field adjustable from 0 to 30 minutes, factory set at 30 minutes. Time delay shall be automatically bypassed if the generator fails and the normal source is available.

E. An unloaded running time delay for generator cool down. Time delay shall be field adjustable from 0 to 60 minutes, factory set at 5 minutes.

F. A time delay on transfer to standby, factory set at 5 seconds but field adjustable up to 5 minutes.

G. Auxiliary contact to close when normal fails (for engine start).

H. Close differential adjustable relay under voltage protection on all three phases of the normal and standby sources, set to drop out at 80 percent of rated voltage and pick up at 90 percent of rated voltage. Over voltage relay protection shall drop out at 104 percent of rated voltage and pick up at 2 percent below trip.

I. Close differential adjustable relay under frequency sensing on all three phases of the generator source, set to drop out at 85 percent of rated frequency and pickup at 90 percent rated frequency. Over frequency relay protection shall drop out at 104 percent of rated frequency and pick up at 2 percent below trip.

J. Voltage unbalance relay, set to drop out at 5 percent and pick up at 1 percent below drop out.

K. Neutral (OFF) position adjustable time delay 0.1 to 10 seconds.

L. Auxiliary Contacts

1. One to close when normal fails (Remote Status)

2. Two auxiliary contacts to open on normal source failure (for combustion air damper control).

3. One to close on standby (Remote Status)

4. One to close on standby (Spare)

5. One to open on standby (Spare)

6. One to close on normal (Remote Status)

7. One to open on normal (Spare)

M. Timed auxiliary contacts to open 0 to 10 seconds (adjustable) before transfer to either normal or standby source and to close after transfer has occurred. These contacts are available to allow the pumps to come to a complete stop before transfer to either source and allow restart after transfer has occurred. Number of contacts as shown on Drawings.

2.04 MICROPROCESSOR CONTROLLER

A. The controller's sensing and logic shall be provided by a built-in microprocessor, Cutler-Hammer ATC type or equal. The controller shall be hardened against potential problems from transients and surges. Operation of the transfer switch and monitoring of both sources shall be managed by the controller.

B. Voltage sensing shall be true RMS type and shall be accurate to plus/minus 1 percent of nominal voltage. Frequency sensing shall be accurate to plus/minus 0.2 percent. The panel shall be capable of operating over a temperature range of minus 20 to plus 60 degrees C and storage from minus 55 to plus 85 degrees C.

C. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug. Sensing and control logic shall be provided on multi-layer printed circuit boards.

D. All field connections shall be wired to a common terminal block.

E. The controller shall meet or exceed the requirements for electromagnetic compatibility as follows:

1. IEEE 472 (ANSI C37.90A) Ring Wave Test

2. EN 55011 1991 Class A Conducted and Radiated Emission

3. EN 61000-4-2 Electrostatic Discharge Immunity, Direct Contact & Air Discharge

4. EN 61000-4-3 Radiated Electromagnetic Field Immunity

5. EN 61000-4-4 Electrical Fast Transient Immunity

6. EN 61000-4-5 Surge Immunity

7. EN 50141 HF Conducted Disturbances Immunity

2.05 SIGNAGE

A. Furnish on the external side of the front door marked WARNING - DO NOT OPERATE TRANSFER SWITCH WITH INTERNAL MANUAL HANDLE UNLESS BOTH POWER SOURCES ARE DISCONNECTED. Sign shall be of laminated plastic, at least 3/32-in thick, with 1/2-in high white letters on a red background.

2.06 SHOP TESTING

A. Perform manufacturer’s standard production testing and inspection in accordance with NEMA and ANSI standards.

PART 3 EXECUTION

3.01 ADJUSTMENT, START-UP AND TRAINING

A. The automatic transfer switch manufacturer shall provide the services of a factory trained service technician for start-up and training of the OWNER's personnel. The first trip shall be coordinated with the equipment start-up. The second trip shall include any necessary follow-up or punch list work and shall also include instructions to the OWNER or to his or her designated

personnel. The manufacturer's service technician shall demonstrate and test all operational features of the installed equipment to the satisfaction of the OWNER. Submit a certified copy of the field inspection to the ENGINEER. No equipment shall be energized without the approval of the ENGINEER.

B. The automatic transfer switch manufacturer's factory service technician shall make the following inspection, tests and adjustments:

1. Ensure proper operation of the individual components and overall sequence of operation.

2. Ensure that the operating transfer time, voltage, frequency and time delay settings comply with the specification requirements.

3. Inspect the installation for compliance with the manufacturers' recommended installation practices and report all deviations to the ENGINEER.

END OF SECTION

SECTION 16500

LIGHTING SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install a complete lighting system ready for operation as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. All concrete and reinforcing steel required for exterior lighting pole bases shall be as specified under Division 3.

1.03 SUBMITTALS

A. Submittals shall be in accordance with Sections 01300 and 16000.

B. Submittals shall include the following product information as a minimum:

1. Fixtures: Manufacturer, model number, materials of construction, finish type and color, total fixture wattage (ballast plus lamp), mounting hardware.

2. Ballasts: Manufacturer, model number, total harmonic distortion, crest factor, external wiring diagram, power factor.

3. Lamps: Manufacturer, model number, wattage, color rendition index, lumen output.

C. All fluorescent fixtures (except compact fluorescent) and ballasts shall be provided with certification from the manufacturer that they are listed in the latest edition of the California "Directory of Certified Luminaires and Ballasts".

1.04 REFERENCE STANDARDS

A. All lighting fixtures shall be in accordance with the National Fire Protection Association (NFPA) NFPA 70 “National Electrical Code” (NEC) and shall be constructed in accordance with the latest edition of the Underwriters Laboratories (UL) "Standards for Safety, Electric Lighting Fixtures."

B. All lighting fixtures shall be UL labeled. Lighting equipment shall comply with UL standards pertaining to luminaires including: UL 1570 Fluorescent Lighting Fixtures; UL 1598 HID Lighting Fixtures; UL 1029 HID Ballasts; UL 542 Lampholders, Starters and Starter Holders for Fluorescent Lamps and UL 844 Standard for Electric Lighting Fixtures for Use in Hazardous (Classified) Locations.

C. Low mercury lamps shall be defined as passing the Toxic Characteristic Leaking Procedure (TCLP) test established by the U.S. Environmental Protection Agency (EPA).

D. Ballasts, lamps, and controls shall comply with applicable portions of the California regulations.

PART 2 PRODUCTS

2.01 MATERIALS

A. Luminaires (Lighting Fixtures)

1. Luminaire types shall be furnished as required by the "Lighting Fixture Schedule" on the Drawings. The catalog numbers are given as a guide to the design and quality of fixture desired. Equivalent designs and equal quality fixtures of other manufacturers will be acceptable upon approval by the Engineer. Luminaire Efficacy Rating (LER) shall be as required by California Title 24 for High Efficacy Light Sources where applicable.

B. Lamps

1. General Lamps

a. Fluorescent lamps shall be low mercury, tri-phosphors with a correlated color temperature (CCT) of 3500 Kelvin and a color rendering index (CRI) of not less than 80 CRI. Compact types are as shown on the "Lighting Fixture Schedule".

b. Fluorescent tube lamps shall comply with the Table below.

Fluorescent Tube Lamp:

Lamp Type	Minimum Lumen Output	Best Available Lumen Output
Four-Foot Lamps		
T8, 32 watts	2950 lumens	3100 lumens
Eight-Foot Lamps		
T8,59 watts	5900 lumens	6100 lumens

2. Fluorescent T8 Lamps

a. Rated lamp life shall be at least 15,000 and 20,000 hours operating on an instant start and programmed rapid start mode, respectively.

3. HID (Metal Halide and High Pressure Sodium) Lamps

a. Lamps shall be designed for operation with the specified ballast assembly

b. Lamp shall be designed for operation in the specified mounting position.

c. HPS Lamps shall have two arc tubes so that instant restrike will occur in the event of a momentary power failure.

d. Rated lamp life shall be a minimum or 24,000 hours for HPS lamps based on three-hour starts.

e. Rated lamp life shall be a minimum or 20,000 hours for MH lamps based on three-hour starts.

f. Lamps shall be clear or coated, as specified on the “Lighting Fixture Schedule” or as required for proper luminaire performance.

4. Incandescent lamps shall be inside frosted, halogen, 2,500 hour minimum life. Size and type shall be as shown on the “lighting fixture schedule.”

5. Metal Halide lamps shall be ANSI Type O, open-rated protected lamps for use in open or enclosed luminaires. Lamps shall have exclusionary base for use in standard or protected type mogul sockets.

6. All lamps shall be of one manufacturer and shall be as manufactured by Osram Sylvania; General Electric; Philips or equal.

C. Ballasts

1. Fluorescent Ballasts

a. Provide energy efficient fluorescent ballasts conforming where relevant to UL 935, "Fluorescent-Lamp Ballasts," ANSI C82.1, "Ballasts for Fluorescent Lamps - Specification," ANSI C82.11, "High Frequency Fluorescent Lamp Ballasts," and ANSI C82.2 "Methods of Measurement of Fluorescent Lamp Ballasts," ANSI NFPA 70 and Public Law 109-58-2005, as applicable.

b. Shall be electronic (solid state) and have a Certified Ballast Manufacturer (CBM) label, unless noted otherwise.

c. Instant start fluorescent ballasts shall be used with lighting fixtures controlled by a standard wall switch

d. All ballasts used in exterior applications or areas where ambient temperatures may fall below 50 degrees F shall have a minimum starting temperature of 0 degrees F unless otherwise specified.

e. All interior ballasts shall have a minimum starting temperature of 50 degrees F.

f. Ballasts shall be series wired type and designed to operate the number and length of lamps specified.

g. The total harmonic distortion (THD) of each ballast shall be in accordance with the requirements of the utility company and in no case shall it be greater than 10 percent THD.

h. Use Class "P" thermal protected ballasts.

i. Ballasts shall be of high power factor, with a power factor of 0.9 or greater.

j. Ballasts shall have a maximum lamp current crest factor of 1.7.

k. Light output (ballast factor) shall be between 0.85 and 1.0 when tested with a compatible full-wattage lamp (T-8 or T-5).

l. Ballast shall be regulated to maintain light output which does not vary more than plus/minus 5 percent for all rapid start fluorescent lamps in the proper lamp/ballast combination within operating ranges of plus/minus 10 percent of center voltage.

m. Cathode voltage for rapid start lamps during starting shall be between 3.4 and 4.5V across a dummy load and between 2.5 and 4.4V during operation. Ballast shall have a frequency of operation of 40 kHz or greater and incorporate adequate 60 Hz filtering in order to operate with less than 5 percent flicker (maximum 0.20 Flicker Index) with any rare earth phosphor lamp suitable for the ballast.

n. Ballast shall provide normal rated life for the lamp specified.

o. All electronic ballasts shall be warranted for parts and replacement for 1 full year from the date of installation.

p. Ballasts shall have an "A" sound rating or better.

q. Ballast shall not contain polychlorinated biphenyls (PCBs) and shall be labeled “NO PCBS.”

r. Ballasts shall be designed to operate on the voltage system to which they are connected and designated by the ballast manufacturer as suitable and UL listed for operating the specified lamps

s. Ballasts shall meet the requirements of the Federal Communications Commission Rules and Regulations, Part 18, Subpart C (RF Lighting Devices), regarding radio frequency interference (RFI) and electromagnetic interference (EMI).

t. Electronic fluorescent ballasts shall be universal voltage type capable of operating from 110V to 302V rms input.

u. Electronic ballasts shall be as manufactured by Advance, similar by Osram Sylvania; Universal Lighting or equal.

1) Fluorescent Ballast: instant start ballasts shall meet or exceed the following criteria.

Lamp Type	**# of Lamps**	**Instant Start Ballast Efficacy Factor (BEF)**
Four-Foot and U-Tube Lamps		
T8,32 Watts	1	3.11 or higher
	2	1.58 or higher
	3	1.05 or higher
	4	0.8 or higher
Eight-Foot Lamps		
T8,59 Watts	2	0.80 or higher

2. HID (Metal Halide and High Pressure Sodium) Ballasts

   a. Ballast assemblies shall be designed to operate at the specified voltage, and designated by the ballast manufacturer as suitable and UL listed for operating the specified lamps.

   b. Lamp current crest factor shall not exceed 1.8.

   c. Ballast assemblies shall be capable of starting and operating the specified lamps within a range of plus 10 percent of the specified voltage.

   d. Total Line Current Harmonic Distortion shall not exceed 33 percent.

   e. Electronic ballast assemblies shall meet the requirements of the Federal Communications Commission Rules and Regulations, Part 18, Subpart C (RF Lighting Devices), regarding radio frequency interference (RFI) and electromagnetic interference (EMI).

   f. Ballast shall be of high power factor or power factor corrected type, with a power factor of 0.9 or greater.

   g. Insulation shall be Class 180 degree C minimum.

   h. Ballast assemblies shall start lamps at a minimum temperature of minus 20 degrees F.

   i. In addition to the above stated HID Ballast requirements, High pressure sodium ballasts shall be of the constant wattage auto-transformer type of the correct size and voltage for the fixture it is to serve as shown on the "Lighting Fixture Schedule". All ballasts shall be as manufactured by Advance Transformer Co., similar by Holophane Lighting; Universal Manufacturing; Osram Sylvania or equal.

   j. In addition to the above stated HID Ballast requirements, metal halide ballasts shall be Pulse Start of the constant wattage auto-transformer type of the correct size and voltage for the fixture it is to serve as shown on the "Lighting Fixture Schedule". All ballasts shall be as manufactured by Advance Transformer Co.; Holophane Lighting; Universal Manufacturing; Osram Sylvania or equal

D. Flexible Fixture Hangers

   1. Flexible fixture hangers used in non-hazardous areas shall be type ARB and flexible fixture supports used in hazardous areas shall be Type EFH as manufactured by the Crouse-Hinds Co, similar by Appleton Electric Co; Killark a Division of Hubbell Inc; or equal.

   2. All pendant mounted and recessed in suspended ceilings, recessed lighting fixtures shall be provided with four anti-sway supports to meet seismic requirements.

E. Emergency Lighting Battery Units

   1. Emergency lighting units and remote lighting heads shall be as specified in the "Lighting Fixture Schedule" shown on the Drawings.

2. Battery units shall be of the self-contained, fully automatic type with sealed lead acid batteries, volt-meters and ten minute time delay relays where used in H.I.D. lighted areas.

3. Unit enclosures shall be compatible to their environment and units shall comply with the requirements of NFPA 70 (NEC).

4. Provide all necessary mounting hardware.

PART 3 EXECUTION

3.01 INSTALLATION

A. Each fixture shall be a completely finished unit with all components, mounting and/or hanging devices necessary, for the proper installation of the particular fixture in its designated location and shall be completely wired ready for connection to the branch circuit wires at the outlet.

B. All flush mounted fixtures shall be supported from the structure and shall not be dependent on the hung ceilings for their support.

C. Fixtures noted to be installed flush in suspended ceilings shall be of mounting types suited for the type ceiling involved. It shall be the responsibility of the electrical contractor to verify the ceiling types prior to ordering fixtures.

D. Flexible fixture hangers shall be used for all pendant mounted fixtures. Fixtures 2-ft long and larger shall be supported with a minimum of two fixture hangers.

E. Conduit run in areas with hung ceilings shall be installed in the space above the hung ceiling as close to the structure as possible. Conduits shall be supported from the structure.

F. Exterior lighting poles shall be mounted plumb.

G. Fixture locations are shown on the Drawings in approximate locations; however exact locations shall be coordinated so as to avoid conflicts with HVAC ducts, equipment and other obstacles.

H. Where the Drawings state a particular mounting height, it shall imply that the bottom of the fixture shall be mounted at the stated mounting height above the finished floor, unless specifically noted otherwise.

I. The minimum mounting height for the bottom of lights and exit signs shall be 80-in above the finished floor in compliance with Americans with Disabilities Act (ADA).

3.02 REPLACEMENT

A. Lamps (except for HID) used during the construction phase, prior to 2 weeks from completion of the work, shall be removed and replaced with new lamps.

B. Metal halide lamps that produce a green, blue, or pink color shift after 100 hours of operation shall be replaced at no additional cost to the OWNER.

3.03 CLEANING UP

A. All fixtures shall be left in a clean condition, free of dirt and defects, before acceptance by the ENGINEER.

END OF SECTION

SECTION 16600

UNDERGROUND SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install a complete underground system of raceways, manholes and handholes as shown on the Drawings and as specified herein. All below grade raceways that are not inside a below grade structure or encased in the walls, floor, or ceiling of a below grade structure are considered a portion of the underground duct system and shall comply with this Specification Section.

B. Where referred in this Section, raceways are underground conduits. Ductbanks are a collection of underground raceways. Underground system is the collection of underground raceways, manholes and handholes.

C. Set manholes and handholes at the proper elevation such that the pitch of raceways will be towards manholes and handholes and away from structures, vaults and buildings.

D. Ductbank, manhole and handhole depths vary. Coordinate with other utilities, piping, structures and field conditions to determine required depths and install raceways, manholes and handholes at that required depth at no additional cost to the OWNER.

E. Ductbank routing and manhole/handhole locations shown on the Drawings are shown diagrammatically unless specifically dimensioned. Coordinate with other utilities, piping, structures and field conditions to determine required paths and depths and install at that routing and depth at no additional cost to the OWNER. Submit all changes in routing alignment to the OWNER for approval before installation.

1.02 RELATED WORK

A. Excavation and backfilling, including gravel and sand bedding, are included in Division 2.

B. Electrical General Conditions are included in Section 16000.

C. Fiber Optic Conduits Along Pipelines are included in Section 16800.

D. Power Conduits Along Pipelines are included in Section 16800

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300 and 16000, shop drawings and product data, for the following:

1. Manholes and handholes.

2. Plastic duct spacers.

3. Manhole and handhole frames, covers and extension rings.

4. Buoyancy calculations for manholes.

5. Warning tape.

6. Drawings indicating the locations of all manholes with station (location) numbers.

7. Manhole identification number schedule.

PART 2 PRODUCTS

2.01 MATERIALS

A. Raceways shall be polyvinyl chloride conduit unless otherwise specified or shown on the Drawings. Refer to Section 16110 and detail drawings for material requirements.

B. Cable racks, supports, pulling-in irons, manhole steps and hardware shall be galvanized steel as manufactured by Line Materials Co.; Underground Devices, Inc.; Chance or equal.

C. Precast manholes shall be designed as specified below for precast concrete structures.

1. Refer to the drawings for inside dimensions, headroom requirements and minimum thickness of concrete for precast reinforced concrete structures. Dimensions shown on Drawings are the minimum nominal interior dimensions. If dimensions shown do not correspond to a manufacturer's standard sizes, the next larger standard size shall be furnished. Manhole depth shall be increased as necessary to accommodate the depth of the associated ductbanks.

2. Manholes shall be furnished with sump pits and sump pumps as indicated on the drawings.

3. Structural design calculations shall be prepared and stamped by a professional engineer registered in the State of California.

4. Design criteria. Unless otherwise specified, the precast manholes shall comply with the following minimum requirements:

a. Precast concrete

1) Minimum compressive strength shall be 5,000 psi at 28 days.

2) Maximum water to concrete ratio shall be 0.40 by weight.

3) Minimum cement content shall be 600 lbs of cement per cubic yard of concrete.

b. Manufactured Products.

1) Conform to ACI 318.

2) Products shall support their own weight, weight of soil above at 130 pcf and a live load equal to AASHTO H20 applied to top slab. Depth of soil will be calculated from finished grade.

3) Cast base slab and walls together to form a monolithic base section.

4) Structure walls shall be designed for an equivalent lateral fluid pressure of 90 pcf. Originate pressure diagram at finished ground surface. Include lateral pressure from vehicles in accordance with AASHTO.

5) Consider discontinuities in structure produced by openings and joints. Provide additional reinforcing around openings. Frame openings to carry full design loads to support walls.

6) Prevent flotation, with ground water level at finished ground surface, by dead weight of structure and soil load above structure. Do not consider skin friction, soil friction, or weight of equipment or contents in structure. Factor of safety against buoyancy shall be 1.15. If a concrete slab is required to prevent flotation, design the slab and provide anchorage of the structure to the slab.

7) Design structure with a minimum number of joints.

8) Provide lifting hooks for the top slab.

9) Locate access openings, knockouts, and penetrations as indicated.

5. The date of manufacture, name and trademark of manufacturer shall be marked on the inside of each precast section.

6. Provide integrally cast knock-out panels in precast concrete manhole sections at locations indicated and with sizes indicated. Knock-out panels shall have no steel reinforcing.

7. Seal tongue and groove joints of precast manhole and handhole sections with rubber O-ring gasket. O-ring gasket shall conform to ASTM C443. In lieu of the O-ring gasket, a flexible joint sealant may be used. Sealant shall be Kent Seal No. 2; ConSeal No. 2; Ram-Nek or equal. Completed joints shall withstand 15 psi internal water pressure without leakage or displacement of gasket or sealant.

D. Precast manholes and handholes shall be as manufactured by Christy Concrete, Chase Precast Corp.; Jensen Precast, Utility Vault, or equal and constructed to the nominal dimensions as shown on the Drawings.

E. Manhole and handhole frames and covers shall be cast iron, heavy duty type for Class H-20 wheel loading. Covers shall be marked and sized as shown on the Drawings.

F. Ground rods and other grounding materials and methods shall be as specified in Section 16660.

G. Bell ends and plastic duct spacers shall be as manufactured by Carlon; Underground Devices Inc. or equal.

H. Pull Line: Pull line shall be low friction, polyethylene jacketed, polypropylene rope with 1800 PSI tensile strength (minimum).

I. Handholes

1. Handholes shall be precast high-density reinforced concrete heavy duty type, designed for a HS20-44 wheel load plus the weight of the soil above (using 120 pcf for the soil weight), impact loads, and hydrostatic loads in accordance with ASTM C857. Frames and covers shall be heavy duty galvanized steel type for Class HS20-44 wheel loading.

2. Handholes and covers shall be as manufactured by Quazite; Jensen Precast, Christy Concrete, Hanson, or equal.

J. Detectable Warning Tape

1. Each ductbank section shall be marked by means of a detectable warning tape (tracer tape) as shown on the Drawings. The detectable warning tape shall be capable of being detected or located by either conductive or inductive location techniques.

2. The detectable warning tape shall consist of 5 mil (.005-in) overall thickness; five-ply composition; ultra-high molecular weight; virgin polyethylene; acid; alkaline and corrosion resistant; with 150 pounds of tensile break strength minimum per 6-in width.

3. The top side of the tape shall be color banded red for electrical and high voltage lines, and orange for signal, communication, telephone and fire alarm lines. Tape shall be 4-in wide with four color bands. The tape shall be inscribed with the warning message for the utility such as “CAUTION – ELECTRICAL LINED BURIED BELOW”. Tape shall be as manufactured by Mutual Industries, Inc.; Terra Tape, Div. of Reef Industries Inc. or equal.

K. Manhole extension and grade rings.

1. Manhole extension rings shall be round high density polyethylene (HDPE) rings. The HDPE rings shall be manufactured from polyethylene plastic as identified in ASTM designation D-1248 Standard Specifications for Polyethylene Plastic Molding and Extrusion Materials. Material properties shall be tested and qualified for usage to assure compliance with impact and loading requirements for use in roadways. The annular space between rings and cone basin, the rings, the rings and cover frame shall be sealed using an manufacturer approved butyl sealant.

2. Adjustment for matching finished grade slopes shall be made utilizing manufacturer provided molded HDPE indexed slope rings. The CONTRACTOR shall be responsible for providing the quantity of rings and adjustment slope rings to match the finished grade.

3. The installation of the HDPE rings shall be done in full compliance with the manufacturer’s recommendations/requirements. HDPE rings and adjustment slope rings shall be as manufactured by LADTECH Inc. or approved equal.

L. Fiberoptic (FOMH) Manholes

1. Fiberoptic manholes shall be precast and approximately 32 inches wide by 49-5/8 inches long by 36 inches deep, designed for H-20 traffic loading unless otherwise indicated. Covers shall be galvanized steel with the words “Fiber Optics” in raised letters on the upper surface. Covers shall have locking devices and form a watertight seal to prevent surface water from entering. Knockouts in the sidewalls shall permit underground conduit side entry and exit.

2. Minimum manhole inside dimensions shall exceed or equal NEC requirements involving large wire sizes #4 AWG and larger. If larger dimensions are shown in the Drawings the larger size shall be provided.

3. Each fiberoptic manholes shall be provided with a unique identification to specifically identify it in the system. The CONTRACTOR shall develop the identification system. The identification number shall be marked on the manhole cover by arc welding or other permanent method.

PART 3 EXECUTION

3.01 INSTALLATION

A. Existing utilities shall be identified and excavated prior to the start of trenching for underground raceways as specified in Division 2.

B. Install raceways to drain away from buildings. Raceways between manholes or handholes shall drain toward the manholes or handholes. Raceway slopes shall not be less than 3-in per 100-ft.

C. Steel reinforced and concrete encased duct banks shall be provided as and where shown on the Drawings. See Section 03305 and duct bank detail on the Drawings.

D. The minimum cover for raceway (duct) banks shall be 30 inches unless otherwise permitted by the ENGINEER. Cover shall be deeper as required to cross or avoid other existing and new utilities, thrust blocks, and structures. Cover shall also be deeper where required to enter structures. CONTRACTOR shall coordinate depths between electrical, mechanical, yard piping, plumbing, etc., trades. Provide 8 inches minimum separation of duct banks and other utilities.

E. Make raceway entrances to buildings, structures and vaults (except manholes and handholes) with rigid steel conduit not less than 10-ft long.

F. Conduits run below floor slabs in slab-on-grade construction shall be PVC Schedule 40. Concrete encasement is not required for conduits below slab-on-grade.

G. Raceway terminations at manholes and handholes shall be with end bells for PVC conduit and insulated throat grounding bushings for steel conduit.

H. Where bends in raceways are required, use long radius elbows, sweeps and offsets. Elbows and sweeps are to be rigid steel or PVC-coated rigid steel where shown on the drawings.

I. Swab all raceways clean before installing cable.

J. Plug and seal spare raceways watertight at all manholes, buildings and structures.

K. Seal the ends of raceways and make watertight at all manholes, buildings and structures.

L. Install pulling-in irons opposite all raceway entrances to manholes.

M. Train cables in manholes and support and restrain them on racks and hooks. Furnish inserts on all manhole walls for mounting future racks as well as racks required for present installation.

N. PVC-coated rigid steel conduit shall be used for elbows and risers at the utility pole for electrical and telephone service conduits.

O. PVC coated rigid galvanized steel elbows shall be used for pad-mounted transformer stub-ups and all stub-ups through asphalt and concrete floors, walls and slabs.

P. A pull line shall be installed and left in all spare raceways.

Q. Install detectable warning tape above all ductbanks as shown on the Drawings. Where trench exceeds 24-in width, provide additional detectable tape runs to mark each side of the ductbank in addition to the one in the center.

R. Use plastic spacers to hold raceways in place as detailed on the Drawings.

S. Provide shields where cables enter and leave manholes, handholes, and other entrances. Shields shall be of a suitable type manufactured for the purpose of protecting the cable from abrasion or other damage.

T. Restore paved and unpaved surfaces disturbed during the installation of duct or conduit to their original elevation and condition in accordance with Division 2.

U. Manhole and Handhole Installation

1. Set base grade to bring the manhole and handhole frame and cover to final grade. Use HDPE grade rings to adjust manhole frame and cover to final grade.

2. Set precast sections plumb with a 1/4-in maximum out-of-plumb tolerance. Seal joints of precast sections with either a rubber O-ring set in a recess or a flexible joint sealant used in sufficient quantity to fill 75 percent of the joint cavity. Fill the outside and inside joint with non-shrink grout and finished flush with the adjoining surfaces. Caulk the inside of leaking barrel section joints with non-shrink grout. If leaks appear in the manholes or handholes the inside joints shall be cleaned out and remade in a manner that will result in a watertight joint.

3. Allow joints to set for 24 hours before backfilling. Backfilling shall be performed by bringing the fill up evenly on all sides.

4. Plug holes in concrete with non-shrink grout or non-shrink grout in combination with concrete plugs. Finish flush on the inside.

5. Cut holes in precast sections to accommodate conduits prior to setting manhole and handhole sections in place.

6. Ground all cable rack supports, manhole steps and manhole hardware to ground rod.

7. Slope soil uniformly away from each manhole and handhole in unimproved areas for a minimum distance of 3 feet. Compact surrounding soils to a minimum of 90 percent relative compaction in unpaved areas.

3.03 CLEANING

A. All new manholes and handholes shall be thoroughly cleaned of all silt, debris and foreign matter prior to final inspection.

END OF SECTION

SECTION 16660

GROUNDING SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install a complete grounding system in strict accordance with Article 250 of the National Electrical Code (NEC), as shown on the Drawings, and as specified herein.

B. All raceways, conduits, ducts and multi-conductor cables shall contain equipment grounding conductors sized in accordance with the NEC. Minimum sizes shall be No. 12 AWG.

1.02 RELATED WORK

A. Electrical Systems Testing and Settings is included in Section 16950.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, shop drawings and product data, for the following:

1. Manufacturer's name and catalog data for ground rods, exothermic welding methods, grounding clamps including installation requirements and materials.

PART 2 PRODUCTS

2.01 MATERIALS

A. Conduit shall be as specified under Section 16110.

B. Wire shall be as specified under Section 16120.

C. Ground rods shall be 3/4-in by 10-ft copper clad steel and constructed in accordance with UL 467. The minimum copper thickness shall be 0.25 mm. Ground rods shall be Copperweld; Blackburn; Erico, Inc. or equal.

D. Grounding conduit hubs shall be malleable iron type, and of the correct size for the conduit, as manufactured by Thomas & Betts Co.; Catalog No. 3940 Series, similar by Burndy; O.Z. Gedney Co. or equal.

E. Water pipe ground clamps shall be cast bronze saddle type, and of the correct size for the pipe, as manufactured by Thomas & Betts Co. Cat. No. 2 (1/2-in, 3/4-in, or 1-in size), similar by Burndy; O.Z. Gedney Co. or equal and of the correct size for the pipe.

F. Buried grounding connections shall be by Cadweld process, or equal exothermic welding system.

1. Molds, cartridge materials and accessories shall be provided in kit form and selected per the manufacturer’s written instructions for specific types, sizes and combinations of conductors and connected items. Molds and powder shall be furnished by the same manufacturer.

G. Ground Rod Test Wells

1. Ground rod test wells shall be concrete, complete with cast iron riser ring and traffic cover marked “GROUND ROD”. Boxes and covers shall be suitable for H-20 wheel loading.

2. Test wells shall be as manufactured by Erico, T416D; Christy Co., No. G5; or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Run grounding electrode conductors in rigid steel conduits. Bond the protecting conduits to the grounding electrode conductors at both ends. Do not allow water pipe connections to be painted. If the connections are painted, dis-assemble them and re-make them with new fittings.

B. Install equipment grounding conductors with all feeders and branch circuits.

C. Bond all steel building columns in new structures together with ground wire in rigid conduit and connect to the distribution equipment ground bus, as shown on the Drawings.

D. Ground wire connections to structural steel columns shall be made with exothermic welds.

E. Metal conduits stubbed into a motor control center or floor mounted electrical enclosure shall be terminated with insulated grounding bushings and connected to the motor control center or electrical enclosure ground bus. Bond boxes mounted below motor control centers to the motor control center ground bus. Size the grounding wire in accordance with NEC Table 250-122, except that a minimum No. 12 AWG shall be used.

F. Liquid tight flexible metal conduit in sizes 1-1/2-in and larger shall have bonding jumpers. Bonding jumpers shall be external, run parallel (not spiraled) and fastened with plastic tie wraps.

G. Ground transformer neutrals to the nearest available grounding electrode with a conductor sized in accordance with the Drawings or (if not shown) with NEC Article 250-66.

H. Install grounding electrodes as shown on the Drawings.

I. All equipment enclosures, motor and transformer frames, conduits systems, cable armor, exposed structural steel and all other equipment and materials required by the NEC to be grounded, shall be grounded and bonded in accordance with the NEC.

J. Seal exposed connections between different metals with No-Oxide Paint Grade A or equal.

K. Lay all underground grounding conductors slack and, where exposed to mechanical injury, protect by pipes or other substantial guards. If guards are iron pipe, or other magnetic material, electrically connect conductors to both ends of the guard. Make connections as specified herein.

L. Care shall be taken to ensure good ground continuity, in particular between the conduit system and equipment frames and enclosures. Where necessary, jumper wires shall be installed.

M. All grounding type receptacles shall be grounded to the outlet boxes with a No. 12 THW green conductor connected to the ground terminal of the receptacle and fastened to the outlet box by means of a grounding screw.

N. Molds used for welding shall be new. The number of welds made per mold shall not exceed manufacturer's recommendations.

O. Ground metal poles supporting outdoor lighting fixtures to a supplemental grounding electrode (rod) in addition to the separate equipment grounding conductor run with the supply branch circuit.

P. Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with ground clamp connectors.

Q. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters and HVAC equipment. Use braided-type bonding straps.

R. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate in accordance with NEC Paragraph 250.52 using a minimum of 20-ft of bare copper conductor not smaller than No. 4 AWG. Where base of foundation is less than 20-ft in length, coil excess conductor within base of concrete foundation. Extend grounding conductor below grade and connect to building grounding grid, ground loop, or grounding electrode external to concrete.

S. Install driven ground rods in manholes close to wall and set rod depth so 4-in will extend above finished floor. Protect ground rods with double wrapping of pressure-sensitive tape or heat shrunk insulating sleeve from 2-in above to 6-in below concrete floor. Seal floor opening with waterproof, non-shrink grout. Where ground rods are installed outside of manhole or handhole, provide a No. 4/0 AWG bare, tinned copper conductor from ground rod into manhole or handhole through a waterproof sleeve in the wall.

3.02 INSPECTION AND TESTING

A. Inspect the grounding and bonding system conductors and connections for tightness and proper installation.

B. Testing shall be performed by the independent testing firm specified in Section 16950.

C. Testing shall be performed before energizing the distribution system.

D. A separate test shall be conducted for each building or system.

END OF SECTION

SECTION 16800

FIBEROPTIC AND POWER CONDUITS ALONG PIPELINES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install a complete underground system of raceways, manholes and handholes as shown on the Drawings and as specified herein.

B. Where referred in this Section, raceways are underground conduits. Ductbanks are a collection of underground raceways. Underground system is the collection of underground raceways, manholes and handholes.

C. Set manholes and handholes at the proper elevation such that the pitch of raceways will be towards manholes and handholes and away from structures, vaults and buildings.

D. Ductbank, manhole and handhole depths vary. Coordinate with other utilities, yard piping, yard structures and field conditions to determine required depths and install raceways, manholes and handholes at that required depth at no additional cost to the OWNER.

E. Ductbank routing and manhole/handhole locations shown on the Drawings are diagrammatically depicted. Coordinate with other utilities, yard piping, yard structures and field conditions to determine required paths and depths at no additional cost to the OWNER.

F. The Pipeline Contracts shall be responsible for the following general work items:

1. Furnishing and installing all conduit, pull boxes, manholes, pull rope, detectable warning tape along the pipeline routes and other locations as shown on the Drawings. Electrical Drawings indicate only the approximate locations of manholes, underground conduits and related appurtenances. Refer to the Civil Plan and Profile Drawings for additional location details.

2. Mandreling conduits to ensure a clear unobstructed raceway.

3. Furnishing and installation of additional conduit, pull boxes, manholes and pull rope as required by this Section when installation conditions differ from the Drawings.

4. Unless noted otherwise, conduits at Pocket Pump Station wetwells, Submersible Pump Station wetwells, and valve vaults shall be extended into the wetwell or vault and sealed to make a watertight connection. Install explosion proof conduit fittings.

5. Unless noted otherwise, conduits at Standby Power Buildings shall be terminated at the site property line.

6. Prepare and submit cable pulling tensions calculations as detailed in Paragraph 3.03A. Complete pulling tension calculations shall be submitted and receive a “No Exceptions Noted” review status from the ENGINEER before any conduit installation begins.

G. The Pump Station Contract shall be responsible for the following:

1. Furnishing and installing all conduit, pull boxes, manholes, detectable warning tape at the Pump Stations, Standby Power Buildings, and other locations as shown on the Drawings.

2. Furnish, install and test all fiberoptic cable, medium voltage cable and low voltage cable as detailed in the remainder of these Specifications.

3. Furnish and install all electrical service conduit, transformer pads, pullboxes, and other equipment required by PG&E.

4. Furnish and install all conduit, pull boxes, wiring and equipment within the Pump Station wet wells and valve vaults.

1.02 RELATED WORK

A. Excavation and backfilling, including gravel and sand bedding, are included in Division 2.

B. Section 16000 – Electrical General Conditions.

C. Section 16110 – Raceways, Boxes, Fittings and Supports.

D. Section 16600 – Underground System.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300 and 16000, shop drawings and product data, for the following:

1. Manholes, handholes, and pullboxes.

2. Plastic duct spacers.

3. Manhole, handhole and pullbox, covers and extension rings.

4. Buoyancy calculations for manholes, handholes, and pullboxes.

5. Warning tape.

6. Drawings indicating the locations of all pull boxes with station numbers.

7. Fiberoptic manhole identification number schedule.

8. Pulling tension calculations.

PART 2 PRODUCTS

2.01 MATERIALS

A. Refer to Sections 16110, 16600 and detail drawings for material requirements.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Existing utilities shall be identified and excavated prior to the start of trenching for underground raceways as specified in Division 2.

B. Install raceways to drain away from buildings. Raceways between manholes or handholes shall drain toward the manholes or handholes. Raceway slopes shall not be less than 3-in per 100-ft.

C. The minimum cover for raceway (duct) banks shall be 30 inches unless otherwise permitted by the ENGINEER. Cover shall be deeper as required to cross or avoid other existing and new utilities, thrust blocks, and structures. Cover shall also be deeper where required to enter structures. CONTRACTOR shall coordinate depths between electrical, mechanical, piping, plumbing, etc. Provide 8 inches minimum separation of duct banks and other utilities.

D. Raceway terminations at manholes and handholes shall be with end bells for PVC conduit.

E. Where bends in raceways are required, use long radius elbows, sweeps and offsets.

F. Swab all raceways clean before installing cable.

G. Seal the ends of raceways and make watertight at all manholes, buildings and structures.

H. Install detectable warning tape above all ductbanks.

I. For locations containing multiple conduits, furnish and install plastic spacers to maintain conduit separation.

J. Restore paved and unpaved surfaces disturbed during the installation of duct or conduit to their original elevation and condition in accordance with Division 2.

3.02 INSTALLATION - CONDUIT

A. Conduits shall be installed on one side of the trench as detailed on the Drawings. The conduits shall not cross over the pipe unless specifically shown on the Civil Drawings.

B. Conduits shall clear concrete structures and vaults associated with the pipeline by a minimum of 1 foot.

C. The conduit shall gradually and smoothly slope up to the elevation of the pull box entrance. Use of manufactured bends shall be limited to an absolute minimum. Factory bends, if required, shall be no more than 22-1/2 degrees.

D. Conduit sections shall be joined in accordance with the manufacturers' recommendations. Joints shall be watertight.

E. Install a pull rope in all conduit.

F. Conduits entering pull boxes shall be capped or sealed watertight.

G. Bedding and backfill shall be in accordance with Section 02200 – Earthwork and as detailed on relevant Civil and Electrical Drawings.

3.03 INSTALLATION – PULL BOXES AND MANHOLES

A. The Drawings diagrammatically indicate the desired location of pull boxes, conduit runs and other items. Exact locations shall be determined by the CONTRACTOR based on physical size and arrangement of equipment, finished elevations, calculated cable pulling tensions, field obstructions, and the criteria below. Indicated locations should be followed as closely as possible; however, pull boxes shall be located according to the following criteria:

1. At no point shall the cable pulling tension exceed 600 pounds. If cable pulling tension is calculated to exceed 600 pounds, additional pull boxes shall be furnished and installed at no extra cost to the OWNER.

2. The maximum distance between any 2 pull boxes shall not exceed 1,200 feet.

3. Within the 1,200 feet distance, the CONTRACTOR shall install pull boxes at locations wherever the cumulative change of direction of the conduit exceeds 180 degrees.

4. The minimum bending radius for conduit shall be 3 feet.

5. A pull box shall be installed on one side of a tunneled or bored crossing. However, for any crossing which requires more than 180 degrees of conduit bends to account for elevation differences or route adjustments, a pull box shall be installed on both sides of the crossing.

B. Pull box covers shall be installed so that the top of the cover is flush with the restored pavement. Pull boxes in soil areas shall be installed so that the top of the cover is at least one-inch but not more than 4 inches above the final grade level of the restored surface to prevent accumulation of dirt, silt and debris on the top of the hand hole cover.

C. Perform conduit integrity tests for each section between the pull boxes after backfilling and compaction using the test and procedures described in this Section. These tests shall be performed prior to installation of the pull rope.

D. Unless otherwise detailed on the Drawings, manholes conduit entries shall be sealed with mortar to prevent the intrusion of water and debris into the pull boxes.

E. Pull boxes shall be installed on a compacted level foundation consisting of a minimum of 4 inches of granular material complying with Section 02200 - Earthwork and as detailed on relevant Civil and Electrical Drawings.

F. Backfilling around pull boxes shall not be done until mortar sealant has thoroughly set.

G. Compaction around pull boxes and associated details shall be performed in accordance with Section 02200 - Earthwork and as detailed on relevant Civil and Electrical Drawings.

3.04 CLEANING

A. All new manholes and handholes shall be thoroughly cleaned of all silt, debris and foreign matter prior to final inspection.

B. A test mandrel 3/8-inch smaller than the inside diameter shall be passed through all conduits to detect alignment and deformation problems. Mandrel shall be passed in both directions.

C. Cleaning and testing of the conduit shall be performed by the CONTRACTOR and witnessed by the ENGINEER. The cleaning and testing operation shall be conducted for each conduit section between adjacent pull boxes, a section at a time, for the entire route. The results of tests shall be documented by the CONTRACTOR and signed by the ENGINEER and the CONTRACTOR.

D. The CONTRACTOR shall provide a 5 day minimum advance notice of the schedule and location of test to the ENGINEER.

E. The CONTRACTOR shall remove and replace noncompliant conduit and shall repeat the test.

END OF SECTION

SECTION 16801

FIBER OPTIC CABLE SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. A single Network and Telecommunications Cabling Contractor (NTCC) shall furnish all services and equipment defined herein.

2. Substitutions on functions or type of equipment specified will not be acceptable. In order to insure the interchange ability of parts, the maintenance of quality, the ease of interfacing between the various subsystems and the establishment of minimums with regard to ranges and accuracy, strict compliance with the above requirements shall be maintained.

3. Equipment shall be fabricated, assembled, installed and placed in proper operating condition in full conformity with detail Drawings, specifications, engineering data, instructions and recommendations of the cable and equipment manufacturer as approved by the ENGINEER.

4. Products shall be of the same manufacturer, with devices of the same type and model to the greatest extent possible.

5. All equipment and installations shall comply with applicable Federal, State and local codes.

B. The NTCC shall be responsible for performing the specified tasks for the complete PCS (Process Control System) fiber optic data highway system.

C. Related Sections. See Related Sections for additional requirements applicable to this Section (typical).

1. Section 01780 – Operating and Maintenance Data.

2. Section 13410 – Instrumentation and Control – General Provisions.

3. Section 13421 – Process Control System – Hardware and Software.

4. Section 16800 – Fiber Optic and Power Conduits Along Pipelines.

1.02 REFERENCES

A. National Electrical Manufacturers Association (NEMA).

B. National Fire Protection Association (NFPA) - 70, National Electrical Code.

C. ANSI/TIA/EIA-568-B: Commercial Building Telecommunications Cabling Standard.

D. ANSI/TIA/EIA-569: Commercial Building Standard for Telecommunications Pathways and Spaces.

E. ANSI/TIA/EIA-606: Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.

F. ANSI/TIA/EIA-607: Commercial Building Grounding and Bonding Requirements.

G. BICSI Telecommunications Distribution Methods Manuals for Installation Practices.

H. UL-1666 Flame resistance.

I. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.03 SUBMITTALS

A. General submittal requirements:

1. Firms desiring to bid for the NTCC services and work described in these Specifications shall submit documentation demonstrating compliance with the stated NTCC qualifications of paragraph 1.04 – Quality Assurance with their bids to electrical and/or general contractors seeking to bid this Project. The OWNER will not be evaluating the qualifications of firms interested in the NTCC role prior to the Notice of Award. The CONTRACTOR shall submit documentation proving compliance of the proposed NTCC with all qualifications listed within 30 days of the Notice of Award.

2. All submittals shall be in accordance with Section 01300 and 16000.

3. Shop drawings shall fully demonstrate that the equipment and services to be furnished will comply with the provisions of these specifications and shall provide a true and complete record of the equipment as manufactured and delivered.

4. Submittals shall be bound in three-ring binder(s), with an index and sectional dividers, with all drawings reduced to a maximum size of 11-in by 17-in for inclusion within the binder.

5. Exceptions to the Specifications or Drawings shall be clearly defined by the NTCC in a separate section of each submittal package. The submittal shall contain the reason for exception, the exact nature of the exception and the proposed substitution so that a proper evaluation may be made by the ENGINEER.

6. Submittals shall include as a minimum:

    a. Conduit riser diagram.

    b. Review of the Pipeline Contract conduit system layouts.

    c. Hardware shop drawings.

    d. Testing plans.

    e. Test equipment lists.

B. Conduit Riser Diagram Submittal:

1. A complete conduit riser diagram and conduit schedule shall be prepared and submitted for the interconnection of all equipment specified in this section. The riser diagram and conduit schedule shall detail conduit identification number, size, fiber optic cable, and location.

2. The conduit riser diagrams shall utilize the same identification scheme as used on the Drawings.

C. Hardware Shop Drawing Submittal:

1. Shop Drawings shall be submitted as detailed herein. Submittals consisting of only general sales literature will not be acceptable.

2. The data sheets shall be provided with an index and proper identification and cross-referencing. All devices shall be included in a comprehensive index.

3. Submit detailed information for each device. Include as a minimum:

    a. Product (item) name as specified and indicated on the Drawings.

    b. Manufacturer's name and complete model number.

    c. Location of the device.

    d. Physical size with dimensions.

4. Deviation List: A complete list of all deviations proposed shall be included with the submittal. The list shall include a specific but brief written indication of any specific exceptions taken to the hardware as shown on the Drawings and specified herein.

D. Testing Submittal

1. Outline of Proposed Test Procedure Submittal: Prior to preparation of the detailed testing procedures, submit outlines of the specific proposed tests. Submittals shall include examples of the proposed forms and checklists.

2. Detailed Test Procedure Submittal: After the outlines for the proposed testing have been reviewed by the ENGINEER and returned stamped either “No Exceptions Noted” or “Approved as Noted”, submit the proposed detailed test procedures. The detailed test procedure submittal shall address each test as required for each test session. Testing shall begin after review and approval by the ENGINEER of the proposed detailed test procedures.

1.04 QUALITY ASSURANCE

A. The NTCC shall be a "specialty contractor" or a manufacturer regularly engaged in the design and the installation of telecommunication hardware and their associated subsystems. For the purposes of this Specification Section, a "specialty contractor" shall be interpreted to mean an organization that complies with all of the following criteria:

1. Employs a registered professional Control Systems Engineer or Electrical Engineer to supervise or perform the work required by this Specification Section.

2. Employs personnel on this project who have successfully completed BICSI or manufacturers training courses on the equipment specified in this specification section.

3. Has performed work of similar or greater complexity on at least five previous projects.

4. Has been actively engaged in the type of work specified in this Specification Section for a minimum of the last 5 consecutive years.

B. For the purposes of this Specification Section, a "manufacturer" shall be interpreted to mean an organization that complies with all of the following criteria:

1. Manufactures at least 75 percent (as measured by equipment cost) of the hardware specified in this section and which is furnished for this project.

2. Complies with the preceding criteria established for a "specialty contractor".

C. The NTCC shall maintain a permanent, fully staffed and equipped service facility with full time employees capable of designing, fabricating, installing, calibrating, and testing the systems specified herein.

D. Actual installation of the devices included in this specification section need not be performed by the NTCC's employees; however, the NTCC as a minimum shall be responsible for the technical supervision of the installation by providing on site supervision to the installers of the various components.

E. The NTCC shall be one of the following or equal:

1. Systemax

2. Point 1, Livermore, CA

3. Or equal.

G. Being listed in this specification does not relieve any potential NTCC from meeting the qualifications specified in this Section.

1.05 SYSTEM DESCRIPTION

A. The fiber optic system shall be as indicated on the Drawings.

B. The fiber optic cables will connect a system of PLCs in a star formation as shown on the Drawings. Cables shall be continuous from PLC to PLC or PLC to patch panel.

C. Most of the fiber optic cable will be installed in the underground conduit system installed under the Pipeline Contract, as described in Section 16800. The Pipeline Contracts are expected to be in construction in advance of the Pump Station Contract construction work. The NTCC shall review the proposed Pipeline Contract conduit layout submittal drawings and notify the ENGINEER if there are any pulling tension or other fiber optic installation issues that would prevent the successful fiber optic cable installation in the Pipeline conduit system. The NTCC shall provide a formal submittal review of the Pipeline Contract conduit layout before the Pipeline Contractors complete the conduit and FO manhole installation.

1.06 DELIVERY, STORAGE AND HANDLING

A. Shipping Precautions

1. After completion of shop assembly, factory test, and approval, all equipment 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 weights shall be shown on shipping tags together with instructions for unloading, transporting, storing and handling at job site.

2. Special instructions for proper field handling, storage and installation required by the manufacturer for proper protection, shall be securely attached to the packaging for each piece of equipment prior to shipment. The instructions shall be stored in resealable plastic bags or other acceptable means of protection.

B. Identification

1. Each cable shall be tagged to identify its location, tag number and function in the system. Identification shall be prominently displayed on the outside of the package.

C. Storage

1. Equipment shall not be stored out-of-doors. 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 his/her own cost and expense. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such tests as directed by the ENGINEER. This shall be at the cost and expense of the CONTRACTOR, or the apparatus shall be replaced by the CONTRACTOR at his/her own expense.

1.07 FINAL SYSTEM DOCUMENTATION

A. Prior to final acceptance of the system, operating and maintenance manuals covering instruction and maintenance on each type of equipment shall be furnished in accordance with the Section 01730.

B. The instructions shall be bound in three-ring binder(s) with Drawings reduced or folded for inclusion and shall provide at least the following as a minimum.

1. A comprehensive index.

2. A complete "As Constructed" set of approved shop Drawings.

3. A complete list of the equipment supplied.

4. Full specifications on each item.

5. System schematic drawings "As Constructed", illustrating all components and electrical connections of the systems supplied under this Section.

C. The NTCC's final documentation shall be new documentation written specifically for this project, but may include standard and modified standard documentation. All standard documentation furnished shall have all portions that apply clearly indicated. All portions that do not apply shall be lined out.

D. The manuals shall contain all illustrations, detailed drawings, wiring diagrams and instructions necessary for installing, operating and maintaining the equipment. The illustrated parts shall be numbered for identification. All information contained therein shall apply specifically to the equipment furnished and shall only include instructions that are applicable. All such illustrations shall be incorporated within the printing of the page to form a durable and permanent reference book.

E. Final documentation shall include the results of all field testing requirements of Part 3 of this specification.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. General

1. All devices and cables supplied shall be of the manufacturer's latest design.

2. All equipment and devices furnished shall be heavy-duty type, designed for continuous industrial service. All equipment provided shall be of modular construction, capable of field expansion, and shall consist of equipment models which are currently in production.

2.02 CABLING – TYPES FOC

A. FOC: Cables identified on the Drawings as FOC (Fiber Optic Cable) shall comply with the following:

1. Single mode 8.3/125 micron core/cladding, graded index glass fiber, with all dielectric material.

2. Flame-retardant, plenum rated indoor/outdoor riser cable.

3. Each cable bundled into a single 4-strand cable.

4. EIA/TIA -598 color coding for fiber optic cable.

5. Maximum bend radii 20x outside cable diameter (under installation load) and 15x outside cable diameter (long term load).

6. Armored cable with minimum crush resistance of 850 lb./in.

7. Wavelength 1310/1385/1550 nm with Max. Attn. 0.4 dB/Km (for 1310 nm wavelength) and 0.3 (for 1550 nm wavelength).

8. Gel free buffer tube, acrylate.

9. Flooded core.

10. Manufacturers:

a. Corning

b. Prysmian Group, Draka Technologies

c. Belden (Cooper Industries), Richmond, IN

d. Or equal.

2.03 LABELING

A. All cables shall be labeled at both ends. Each individual cable shall be identified by the individual color of the jack insert, matching the patch panel side.

2.04 FIBER CABLE TERMINAL CONNECTORS

A. All connectors shall be field-installable and perfectly matched to the cable used. The connectors shall provide tight fitting termination to the cladding and buffer coating. Epoxy-based or "hot melt" adhesives shall be used to bond the fiber and buffer to the connector ferrule and body prior to polishing the endface. No dry-termination or "quick crimp" connectors are allowed.

B. Connectors shall have a maximum allowable connection loss of 0.3 dB per mated pair, as measured per EIA-455-34. No index-matching gel is to be used, dry interfaces only. Single mode connectors shall be capable of field installation on 9/125 micron fibers with 900 micron buffers (OD).

C. Each connector shall be of the industry standard ST type compatible, designed for single mode tolerances, and shall meet or exceed the applicable provisions of EIA-455-5, 455-2A, and 455-34, and shall be capable of 100 repeated ratings with a maximum loss increase of 0.1 dB. Connectors shall incorporate a key-way design and shall have a zirconia ceramic ferrule. Connector bodies and couplings shall be made of corrosion-resistant and oxidation-resistant materials, such as nickel plated zinc, designed to operate in humid environments without degradation of surface finishes.

D. Manufacturers

1. 3M Telecom Systems Group, Austin, TX.

2. Corning

3. Belden

4. Or equal.

2.07 FIBER PATCH PANELS

A. Provide patch panels installed in control panels as indicated on the Drawings. The Patch Panels shall be sized to meet the capacity of the installed cable allowing all strands to be terminated at both ends.

B. Each port shall be labeled with electronic printed labels. Labeling shall be in sequential order, matching the station numbering scheme.

C. Patch Panels: Suitable for wall mounting, comprised of internal mounting plate, slack cable take up/organizer blocks, patch block with connectors and ground lugs as indicated. Patch panels shall be suitable for the cable and connectors specified.

D. Manufacturers

1. Siecor Corp., Hickory, NC.

2. 3M Telecom Systems Group, Austin, TX.

3. AT&T Network Systems, Norcross, GA.

4. Or equal.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION

A. All equipment shall be installed in accordance with the manufacturer's instructions. The locations of equipment shown on the Drawings are approximate only. Exact locations shall be as approved by the ENGINEER during construction. Obtain in the field all information relevant to the placing of process control work and in case of any interference with other work, proceed as directed by the ENGINEER and furnish all labor and materials necessary to complete the work in an approved manner as indicated.

B. Unless specifically noted, all cabling provided under this specification section shall be installed within a conduit raceway system.

3.02 CABLE INSTALLATION

A. Cable pulling tension should not exceed the manufacturer's specifications. No more than 300 pounds of tension shall be placed on any fiber cable while it is being pulled through tray or conduit. Hand-pulling is preferred; if power winches or mechanical advantage devices are used, use a tensionometer or "mechanical fuse" to insure that maximum tension is not exceeded. Published minimum bend radius for the cable shall be maintained during and after pulling.

B. The cable sheath shall be protected from sharp metal edges. Where the cable passes over sharp edge, metal conduit feed or hanger system, a bushing or grommet shall be installed to protect the cable.

C. All products used to support or attach fiber cables shall comply with the cable manufacturers' recommended minimum bend radius of the fiber optic cable being installed. The pulling tension of all fiber optic cable during installation shall also be maintained within manufacturer's specifications.

D. The only residual tension on the fiber optic cable that will be acceptable is that imposed due to its own weight.

E. The installation of the cable shall be as straight as possible. Bend radius shall not exceed manufacturer's installation specifications.

F. The method used to attach the connectors to the individual fibers shall meet the recommended installation requirements of the manufacturer. The NTCC shall visually inspect all connectors using a microscope. The finished connector end face shall be free of cracks, pits or scratches.

G. Cables shall be installed without splices unless splices are preapproved by the ENGINEER. If splices are required, submit full details of where and why a splice is proposed along with details of the splicing method and hardware.

3.03 TESTING

A. General

1. As part of the requirement of this specification section it is the responsibility of the NTCC to provide a complete and operational communications and data cabling system. Confirmation of a complete and operational system is dependent upon results derived from test procedures as specified in this Section.

2. All tests shall be conducted in accordance with prior ENGINEER-approved procedures, forms and checklist. Each specific test to be performed shall be described and a space provided after it for sign off by the appropriate party after its satisfactory completion.

3. The ENGINEER will witness all tests performed in compliance with this specification.

4. Copies of these sign off test procedures, forms and checklists will constitute the required test documentation.

5. The ENGINEER's decision shall be final regarding the acceptability and completeness of all testing.

6. The NTCC shall furnish the services of field service engineers, all special calibration and test equipment and labor to perform the field tests.

B. Fiber Optic Cable (FOC) Testing

1. Perform pre-installation and post-installation FOC tests. The ENGINEER shall be notified a minimum of 10 days in advance so that these tests are witnessed. All test equipment shall be traceable to NIST standards.

2. Test equipment: Use the Optical time domain reflectometer (OTDR) to perform pre-installation and post-installation FOC tests. The OTDR shall be as manufactured by Corning, Agilent Technologies, Fluke Networks, or equal.

3. Pre-installation Tests

a. The purpose of these tests is to perform acceptance tests on the cable prior to installation to verify that the cable conforms to the manufacturer’s specifications; is free of defects, breaks, and damages by transportation and manufacturing processes; and to provide baseline readings in dB.

b. Prior to removal of each cable from the delivery reel, all optical fibers within the cables shall be tested by the CONTRACTOR using an OTDR. The OTDR tests

shall consist of end-to-end length and fiber attenuation (dB/km) measurements to ensure proper performance of the fiber optic cable. The tests shall be performed from both ends of each fiber to ensure complete fiber continuity within the cable structure.

c. Pre-installation, "on-reel" test results shall be compared with the manufacturer's test report delivered with the cable. Gross dissimilarities shall be noted and remedied between the CONTRACTOR and manufacturer. In all cases, all fibers must meet the optical attenuation specifications prior to cable installation.

d. Perform tests on all reels of cable. The ENGINEER shall be notified a minimum of 15 days prior to any test.

e. Document each test and submit the report to the ENGINEER for review. Documentation shall consist of both hard copy and 3.5 inch electronic disk complete with all application software.

f. Cable shall not be installed until the ENGINEER has reviewed the test report.

g. Maximum allowable attenuation is 0.5 dB/km at 1310 and 1550 nm. Replace any cable in which any fiber does not meet this requirement.

4. Post-installation tests: After FOC has been installed and connectorized, the following tests shall be performed:

a. Visually inspect terminal connectors for out-of-round condition and surface defects such as micro-chips and cracks using a 200X (minimum) inspection microscope.

b. A recording OTDR shall be used to test for end-to-end continuity and attenuation of each optical fiber. The OTDR shall have an X-Y plotter to provide a hard copy record of each trace of each fiber. The OTDR shall be equipped with sufficient internal masking to allow the entire cable section to be tested. This may be achieved by using an optical fiber pigtail of 30 feet or more to display the required cable section.

c. The maximum permissible end-to-end loss shall be 0.5 dB/km. Replace any cable in which any fiber does not meet this requirement.

d. The OTDR shall be calibrated for the correct index of refraction to provide proper length measurement for the known length of reference fiber.

e. A transmission test shall be performed with the use of a 1310 and 1550 nm stabilized light sources and 1310 nm/1550 nm power meters for SMF. This test shall be conducted in both directions on each fiber of each cable.

5. Hard and electronic copies of test documentation shall be submitted to the ENGINEER. The documentation shall include:

a. The trace plot.

b. Index.

c. dB/km loss.

d. Cable length.

e. Data and time of test.

f. Wavelength.

g. Pulse width.

h. The test site.

i. Cable ID.

j. Fiber number and type.

k. Operator's initials.

6. Compare the pre-installation test results to the post-installation results. If a deviation of greater than one dB occurs, the ENGINEER shall be notified in writing, and the cable shall be removed and replaced at no additional cost.

7. Upon completion of the previous tests, all FOC coils shall be secured with ends capped to prevent intrusion of dirt and water.

8. Certification of completion of pre- and post-fiber installation testing including test results shall be submitted. Test results shall be submitted on paper in a binder, including results indicated in tables or a spreadsheet. Test results that exceed specification limits shall be noted. The electronic copy shall be included in the binder.

9. Required OTDR Trace Information

   a. All traces shall display the entire length of cable under test, highlighting any localized loss discontinuities (installation-induced losses and/or connector losses). The trace shall display fiber length (in kilofeet), fiber loss (dB), and average fiber attenuation (in dB/km), as measured between two markers placed as near to the opposite ends of the fiber under test as is possible while still allowing an accurate reading. Care shall be taken to ensure that the markers are placed in the linear region of the trace, away from the front-end response and far-end Fresnel reflection spike. Time averaging shall be used to improve the display signal to noise ratio. The pulse width of the OTDR shall be set to a sufficient width to provide adequate injected power to measure the entire length of the fiber under test.

   b. If connectors exist in the cable under test, then two traces shall be recorded. One trace shall record the fiber loss (dB) and average attenuation (dB/km) of the entire cable segment under test, including connectors. The second trace shall

display a magnified view of the connector regions, revealing the connector losses (dB). All connector losses shall be measured using the five-point splice loss measurement technique.

c. The OTDR trace shall also include the following information:

(1) The date and time of the test.

(2) The cable ID number.

(3) The cable segment ID number.

(4) The fiber color or sub-cable number.

(5) Launch point connector number.

(6) The optical wavelength used for the test.

(7) The refractive index setting of the OTDR.

(8) The pulse width setting of the OTDR.

END OF SECTION

SECTION 16950

ELECTRICAL SYSTEM TESTING AND SETTINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The CONTRACTOR shall engage the services of a recognized corporately- and financially-independent testing firm and the equipment manufactures as required for the purpose of performing inspections and tests as herein specified.

B. The testing firm shall provide all material, equipment, labor, and technical supervision to perform such tests and inspections.

C. It is the purpose of these tests to assure that all tested electrical equipment is operational and within industry and manufacturer's tolerances and is installed in accordance with design specifications.

D. The tests and inspections shall determine suitability for energizing equipment.

E. Test systems and equipment furnished under Division 16 and repair or replace all defective work and equipment. Refer to the individual equipment sections for additional specific testing requirements.

F. Field testing and commissioning shall be performed in accordance with the latest revisions of NETA Standard ATS "Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems" unless otherwise modified by these Sections.

G. A typed test report for each component tested shall be submitted to the ENGINEER for the project record files as indicated.

H. Make adjustments to the systems and instruct the OWNER's personnel in the proper operation of the systems.

I. In addition to the specific testing requirements listed in the individual Sections, perform the additional testing, inspections and adjust settings as specified herein.

J. Testing shall be scheduled and coordinated with the OWNER and ENGINEER at least 2 weeks in advance.

K. Provide qualified test personnel, instruments and test equipment.

L. Provide a test report verifying compliance with the testing requirements included under Division 16.

M. Before proceeding with the energization of equipment, notify the OWNER to schedule the start-up of the equipment.

N. The tests and inspections shall determine suitability for energizing equipment; confirm the equipment is installed per the contract documents and as a benchmark for the OWNER to use for future maintenance testing.

a. Test all electrical systems and equipment furnished under Division 16 and either repair or replace all defective work and equipment at no additional cost to the OWNER. Testing and commissioning shall be performed in accordance with the latest revision of NETA Standard ATS "Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

b. Testing shall be performed in four separate and totally independent steps as outlined below. Two typed reports shall be submitted; one after Step 3 and one after Step 4 testing are completed. The report submitted at the completion of Step 3 shall include the testing results of Steps 1, 2 and 3. The following describes the sequencing of the four testing steps to be performed:

a. Step No. 1 Testing - shall be performed by the CONTRACTOR and the manufacturer(s) of the electrical distribution and motor control equipment (medium and low voltage), before the electrical equipment is energized as specified herein. The equipment shall be completely installed and made ready for acceptance testing to be performed by a nationally recognized testing company.

b. Step No. 2 testing and the setting of all protective devices, relays, timers, etc, in accordance with the approved Protective Device Selective Coordination Study, shall be performed by CONTRACTOR, along with a nationally recognized testing company, before the electrical equipment is energized as specified herein.

c. Step No. 3 testing shall be performed as specified herein by the CONTRACTOR after the equipment manufacturers have performed their testing and the electrical distribution equipment has been energized.

d. Step No. 4 testing shall be performed when the project is substantially complete but before final acceptance by the OWNER. All electrical distribution and control system protective devices shall be re-tested and setting adjustments made as required by an independent electrical power systems testing company as specified herein.

1.02 RELATED WORK

A. Electric motors are provided with the driven equipment under Divisions 11 and 15 and are specified in the individual equipment specifications and section 16460.

B. Pump control panels are provided with the driven equipment under Division 11 and are specified in the individual equipment specifications.

C. Electrical System Analysis is included in Section 16015.

D. Testing of Fiber Optic Cable is included in Section 16801. Fiber Optic Cable testing to be performed by the Network Cabling Contractor.

1.03 SUBMITTALS

A. Test Report: Submit both proposed test report for review prior to testing and completed reports.

1. The test report shall include the following:

a. Summary of project

b. Listing of equipment tested

c. Test results

d. Recommendations

2. Furnish copies of the complete reports to the OWNER/ENGINEER's representative as directed in the contract documents.

B. The report shall include a Table of Contents and a data sheet for each component tested. Separate test reports shall be provided for each site. The Table of Contents shall identify each component by a unique number. The Number shall appear on the technical data sheet for identification. Submit cable test results, grounding test results, circuit breaker, motor circuit protector, and protective device settings, fuse type and rating for each piece of equipment. Test report shall be submitted in a three ring binder.

C. The report shall include a Table of Contents, a technical data sheet for each component (i.e. cable, circuit breaker, transformer, relay, etc.) tested. The Table of Contents shall include the name of each component, location, the major piece of equipment the component is located within, and a sheet number on which the technical information is presented. Each data sheet shall include a unique sheet number, the name of the component under test, the major piece of equipment in which the component is located and the weather conditions at the time of the test including the temperature and relative humidity at the time of the test. The firm doing the testing shall include, in the report, their opinion whether or not the equipment being tested complies with the specification and recommended measures to correct the deficiency. Any discrepancies shall be noted in the concluding summary of the report. Test report forms shall be in compliance with NETA standards. Reports shall be signed by the person in responsible charge of the field testing, an officer of the firm performing the tests and an officer of the Electrical Contracting Firm.

D. The reports shall be submitted to the ENGINEER for review, comment and record purposes. Each report shall include a Table of Contents, a technical data sheet, for each component (i.e. cable, circuit breaker, transformer, relay, etc.) tested. The Table of Contents shall include the name of each component, the major piece equipment the component is located within, and a sheet number on which the technical information is presented. Each data sheet shall include a unique sheet number, the name of the component under test, The major piece of equipment in which the component is located, the weather conditions at the time of the test (i.e. temperature, humidity, sunny, rain, etc) the tester's observation and findings, discrepancies, any remedial work performed or act to resolve problems, technical parameters obtained during the tests, as left settings of all devices, and a statement indicating the equipment is ready to be energized. The report shall contain a statement indicating the equipment was tested in accordance with the procedures outlined in the latest edition of The International Testing Association (NETA) Acceptance Testing Specifications.

1.04 APPLICABLE CODES, STANDARDS, AND REFERENCES

A. All inspections and tests shall be in accordance with the following codes and standards except as provided otherwise herein:

1. National Electrical Manufacturer's Association - NEMA

2. American Society for Testing and Materials - ASTM

3. Institute of Electrical and Electronic Engineers - IEEE

4. InterNational Electrical Testing Association - NETA Acceptance Testing Specifications (ATS) – Latest Revision

5. American National Standards Institute - ANSI C2: National Electrical Safety Code

6. State and local codes and ordinances

7. Insulated Cable Engineers Association - ICEA

8. Association of Edison Illuminating Companies - AEIC

9. Occupational Safety and Health Administration - OSHA

10. National Fire Protection Association - NFPA

    a. ANSI/NFPA 70: National Electrical Code

    b. ANSI/NFPA 70B: Electrical Equipment Maintenance

    c. NFPA 70E: Electrical Safety Requirements for Employee Workplaces

    d. ANSI/NFPA 78: Lightning Protection Code

    e. ANSI/NFPA 101: Life Safety Code

B. All inspections and tests shall utilize the following references:

1. Project design specifications

2. Project design drawings

3. Project short-circuit, coordination and arc flash study

4. Manufacturer's instruction manuals applicable to each particular apparatus

5. Project list of equipment to be inspected and tested

1.05 QUALITY ASSURANCE

A. Qualifications of testing firm

1. The testing firm shall be an independent testing organization which can function as an unbiased testing authority, professionally independent of the installers of equipment or systems evaluated by the testing firm.

2. The testing firm shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.

3. The testing firm shall meet OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907, or be a Full Member company of the InterNational Electrical Testing Association.

4. The lead, on-site, technical person shall be currently certified by the InterNational Electrical Testing Association (NETA) or National Institute for Certification in Engineering Technologies (NICET) in electrical power distribution system testing.

5. The Testing Firm shall employ a Registered professional electrical engineer in the state of California, with a minimum of five years experience performing studies of comparable project complexity.

6. The testing firm shall utilize engineers and technicians who are regularly employed by the firm for testing services. Resumes of key staff proposed for the project shall be submitted for review.

7. The testing firm shall submit proof of the above qualifications with bid documents, when requested.

8. The terms used here within, such as test agency, test firm, testing laboratory, or CONTRACTOR's test company shall be construed to mean the testing firm.

1.06 DIVISION OF RESPONSIBILITY

A. The CONTRACTOR shall perform routine insulation-resistance, continuity, and rotation tests for all distribution and utilization equipment prior to and in addition to tests performed by the testing firm specified herein.

B. The CONTRACTOR shall supply a suitable and stable source of electrical power to each test site. The testing firm shall specify the specific power requirements.

C. The CONTRACTOR shall notify the testing firm when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling.

D. The CONTRACTOR shall supply the approved short-circuit analysis and coordination study and protective device setting sheet, a complete set of electrical plans, specifications, and any pertinent change orders to the testing firm prior to commencement of testing.

E. The testing firm shall notify the OWNER/ENGINEER's representative prior to commencement of any testing.

F. Any system, material, or workmanship which is found defective on the basis of acceptance tests shall be reported to the OWNER/ENGINEER's representative.

G. The testing firm shall maintain a written record of all tests and, upon completion of project, shall assemble and certify a final test report.

H. Safety and Precautions

1. Safety practices shall include, but are not limited to, the following requirements:

a. Occupational Safety and Health Act (OSHA)

b. Accident Prevention Manual for Industrial Operations, National Safety Council (NSC)

c. Applicable state and local safety operating procedures

d. OWNER's safety practices (Lockout/Tagout)

e. National Fire Protection Association - NFPA 70E

f. National Fire Protection Association – NFPA 79

g. American National Standards for Personnel Protection

2. All tests shall be performed with apparatus de-energized. Exceptions must be thoroughly reviewed to identify safety hazards and devise adequate safeguards.

3. The testing firm shall have a designated safety representative on the project to supervise the testing operations with respect to safety.

1.07 TEST EQUIPMENT REQUIREMENTS

A. Suitability of Test Equipment

1. All test equipment shall be in good mechanical and electrical condition.

2. Selection of metering equipment should be based on a knowledge of the waveform of the variable being measured. Digital multimeters may be average or RMS sensing and may include or exclude the dc component. When the variable contains harmonics or dc offset and, in general, any deviation from a pure sine wave, average sensing and average measuring RMS scaled meters may be misleading. Use of RMS measuring meters is recommended.

3. Field test metering used to check power system meter calibration must have an accuracy higher than that of the instrument being checked.

4. Accuracy of metering in test equipment shall be appropriate for the test being performed.

5. Waveshape and frequency of test equipment output waveforms shall be appropriate for the test and tested equipment.

B. Test Instrument Standards

1. All equipment used for testing and calibration procedures shall exhibit the following characteristics:

   a. Maintained in good visual and mechanical condition

   b. Maintained in safe operating condition

2. Test equipment should have operating accuracy equal to, or better than, the following limits:

   a. Portable multimeters should be true RMS measuring.

   b. Multimeters should have the following accuracy limits, or better:

      i. AC voltage ranges: .75% +/-3 last single digits @ 60 Hz
      ii. AC current ranges: .90% +/-3 last single digits @ 60 Hz, including adapters, transducers
      iii. DC voltage ranges: .25% +/-1 last single digit
      iv. DC current ranges: .75% +/-1 last single digit
      v. Resistance ranges: .50% +/-1 last single digit
      vi. Frequency range: .10% +/-1 last single digit @ 60 Hz

   c. Clamp-on ammeters: ac current +/-3% of range +/-1 last single digit @ 60 Hz

   d. Dissipation/power factor field equipment

      i. +/-0.1% power factor for power factor values up to 2.0%
      ii. 5% of the reading for power factor values above 2.0%

   e. Low-range dc resistance equipment: 1.0% of reading, +/-2 last single digits

   f. Transformer turns-ratio test equipment: 0.5% or better @ 60 Hz

   g. Ground electrode test equipment: +/-2% of range

   h. Insulation test sets: 0-1000V dc +/-20% of reading at mid-scale

   i. Electrical load survey equipment

      i. +/-5% total error, including sensors
      ii. 1% resolution
      iii. Current transformers +/-2% of range @ 60 Hz
      iv. Voltage transformers +/-0.5% of range @ 60 Hz

   j. Liquid dielectric strength test equipment: +/-2% of scale

k. Infrared scanning equipment: sensitivity of 2Oc

l. Phase shifting equipment: +/-1.0o over entire range

m. High-current test equipment: +/-2% of range

n. DC high potential test equipment: +/-2% of full scale

o. AC high potential test equipment (60 Hz): +/-2% of full scale

C. Test Instrument Calibration

1. The testing firm shall have a calibration program which assures that all applicable test instruments are maintained within rated accuracy.

2. The accuracy shall be directly traceable to the National Institute of Standards and Technology.

3. Instruments shall be calibrated in accordance with the following frequency schedule:

a. Field instruments: 6 months maximum

b. Laboratory instruments: 12 months

c. Leased specialty equipment: 12 months (Where accuracy is guaranteed by lessor)

d. Dated calibration labels shall be visible on all test equipment.

e. Records, which show date and results of instruments calibrated or tested, must be kept up-to-date and available upon request.

f. Up-to-date instrument calibration instructions and procedures shall be maintained for each test instrument.

g. Calibrating standard shall be of higher accuracy than that of the instrument tested.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 PREPARATION

A. Testing shall be scheduled and coordinated with the OWNER and ENGINEER at least 2 weeks in advance

3.02 ACCEPTANCE TESTING - GENERAL

A. Test all electrical equipment to verify it is operational and within industry and manufacturer's tolerances and is installed in accordance with design specifications prior to energizing equipment.

B. Test systems and equipment furnished under Division 16 and repair or replace all defective work and equipment. Refer to the individual equipment sections for additional specific testing requirements.

C. Make adjustments to the systems.

D. Mechanical inspection, testing and settings of circuit breakers, protective relays, disconnect switches, motor starters, overload relays, control circuits and equipment for proper operation.

E. Check and record the full load current draw of each motor. Where power factor correction capacitors are provided the capacitor shall be in the circuit at the time of the measurement. Check ampere rating of thermal overloads for motors and submit a typed record to the ENGINEER of the same, including MCC cubicle location and driven load designation, motor service factor, horsepower, and Code letter. If incorrectly sized thermal overloads are installed replace same with the correct size overload.

F. Check power and control power fuses for the correct type and ratings. Replace fuses if they are found to be of the incorrect size.

G. Check settings of the motor circuit protectors. Adjust settings to lowest setting that will allow the motor to be started when under load conditions.

H. Check motor nameplates for correct phase and voltage.

I. Check rotation of motors prior to testing the driven load. Disconnect the driven equipment if damage could occur due to wrong rotation. If the rotation of the motor shaft is not correct, for the driven equipment, change the motor connections at the motor terminal box.

J. Check interlocking, control and instrument wiring for each system and/or part of a system to prove that the system will function properly as indicated by control schematic and wiring diagrams.

K. Inspect each piece of equipment in areas designated as HAZARDOUS to ensure that equipment of proper rating is installed. In the case where HAZARDOUS rated equipment is installed outdoors or in “WET” locations, verify that equipment furnished is also rated for use in WET locations and that conduit and equipment drains are provided. If equipment is not properly rated advise the ENGINEER.

L. Verify proper phase sequence connection at transformers, equipment, and panels. Confirm the system phase rotation and phase sequence with the Power Company.

M. Verify all circuit breaker ratings and settings are as required by the Contract Documents or as amended during shop drawing review. Advise the ENGINEER of discrepancies and make changes as directed by the ENGINEER.

N. Verify proper operation of automatic and manual transfer switches, accessories devices and associated motor interlocks provided to either delay or prevent motor starting after transfer. Verify that the upstream protective device for each automatic and manual transfer switch is of the proper type and rating to achieve the specified short-circuit withstand rating. If a specific upstream protective device is required to obtain the proper short circuit withstand rating, verify that the proper signage is installed on the upstream protective device and on the automatic/ manual transfer switch enclosures indicating the proper replacement parts. If signage is not installed on both the upstream protective device and the transfer switch advise the ENGINEER and provide the signage as specified in the transfer switch specification section.

O. Assist in the testing of the emergency/standby engine generator(s). The Electrical Contractor shall provide a journeymen electrician for the duration of the test to assist in the setup and operation of the emergency/standby engine generator(s) test(s).

P. Verify grounding of instrumentation equipment and line surge protection equipment.

Q. Test and calibrate protective relays and circuit breakers.

R. Perform over potential, high potential, insulation resistance and shield continuity test for all medium voltage cables. Megger test all low voltage power system cable.

S. Assist in performing a complete site power outage test to will demonstrate that the automatic power transfer equipment, individual equipment programming and the process control system reestablishes plant operations in the proper sequence once normal or standby power is established. The test shall be repeated until proper plant restoration is demonstrated.

3.03 ACCEPTANCE TESTING – SEQUENCE AND RESPONSIBILITIES

A. Provide acceptance testing for all equipment provided under Division 16 in accordance with the individual specification sections.

B. Provide acceptance testing for all motors provided under Divisions 11 and 15.

C. Step No. 1 Testing – In addition to the testing requirements required in the individual specification sections, the following additional tests are to be performed by the CONTRACTOR and the equipment manufacturer(s) before the equipment is energized:

1. Provide testing of each piece of equipment as specified in the individual Division 16 specification sections.

2. Perform over potential, high potential, insulation resistance and shield continuity test for all medium voltage cables. Megger test all low voltage power system cable.

3. Test transformer insulating oil, transformer turns ration (TTR), transformer bushings (bushing oil), power factor test (PFT), check connections and proper torque and tightness of cables and bushings and perform high potential testing.

4. Set motor circuit protectors per manufacturers' recommend settings for the motor installed. In no case shall the setting exceed that allowed by the NEC.

5. Verify all power and control power fuse rating are installed in accordance with the manufacturer's approved shop drawings, the Protective Device Selective Coordination Study and the NEC. Replace fuses found to be of the incorrect rating or type with fuses of the correct rating and type.

6. Visually check and record motor nameplates for correct phase and voltage.

7. Visually check and record data for each motor. The record includes motor name and number, the MCC and MCC bucket to which the motor is connected, the overload rating, and the motor circuit protector rating and setting for each motor furnished on the project. The rating and setting of the overload device and the motor circuit protector shall be compared to the ratings allowed by the NEC.

8. Inspect each piece of equipment in areas designated as HAZARDOUS to ensure that equipment of proper rating is installed. In the case where HAZARDOUS rated equipment is installed outdoors or in "WET" locations, verify that equipment furnished is also rated for use in WET locations and that conduit and equipment drains are provided. If equipment is not properly rated advise the ENGINEER.

9. Inspect all lightning and surge arrestors service entrance equipment, power distribution equipment, motors, control centers, utilization equipment, etc. Verify all lightning and surge arrestors are properly grounded and are being applied within their ratings for the type of system on which they are connected (i.e. ungrounded, solidly grounded or impedance grounded systems).

10. Verify the resistance to ground of all power distribution equipment is 5 ohms or less. If the resistance to ground is found to be greater than 5 ohms, notify the ENGINEER immediately for resolution.

11. Verify all terminations at the transformers, service entrance and distribution switchgear/ switchboards, motor control centers, panelboards, control panels, and motors, are correctly made and properly torqued.

12. Refer to the individual equipment and material specification sections for additional testing requirements.

13. Verify that the upstream protective device for each automatic and manual transfer switch is of the proper type and rating to achieve the specified short-circuit withstand rating. If a specific upstream protective device is required to obtain the proper short circuit withstand rating, verify that the proper signage is installed on the upstream protective device and automatic transfer switch enclosures indicating the proper replacement parts. If signage is not installed on both the upstream protective device and the transfer switch advise the ENGINEER and provide the signage.

14. Verify grounding of instrumentation equipment and line surge protection equipment.

15. Provide input to test report required after Step No. 3 testing as specified.

16. Inspect and operate all air interrupter switches, circuit breakers and power disconnect switches.

D. Step No. 2 - In addition to employing the nationally recognized testing company to perform the testing required in the individual specification sections, employ the services of the firm to perform the following additional testing and furnish test report as specified.

1. Test current transformers, ground sensing devices, transformer grounding resistors, fuses, interrupter switches, transfer switches, transformers and motor starters furnished to confirm they are in accordance with the approved shop drawings and the Protective Device Selective Coordination Study.

2. Set, calibrate and test all protective devices including but not limited to, circuit breakers, protective relays, timing devices, motor overload, electrical protective devices located within equipment furnished under other Sections of these specifications. Settings shall be in accordance with the approved final coordination study.

3. Inspect and test all lightning and surge arrestors service entrance equipment, power distribution equipment, motors, control centers, utilization equipment, etc. Verify all lightning and surge arrestors are properly grounded and are being applied within their ratings for the type of system on which they are connected (i.e. ungrounded, solidly grounded or impedance grounded systems).

4. Inspect and operate all air interrupter switches, circuit breakers, power disconnect switches, motor starters, and control circuits.

5. Visually verify the settings of all protective devices including but not limited to, circuit breakers, all ANSI listed protective relays, timing devices, etc. Settings shall be in accordance with the approved Protective Device Selective Coordination Study.

6. Megger test all switchgear, transformers and motor control center buses. Disconnect all devices that are susceptible to megger voltage testing before testing the buses.

7. Verify settings of all motor circuit protectors. If settings made by the CONTRACTOR/ Manufacturer(s) do not comply with the Coordination Study, advise the CONTRACTOR, make appropriate adjustments, and correct the motor data records provided by the CONTRACTOR.

8. Verify that all power and control power fuses installed are in accordance with the manufacturer's approved shop drawings, the Protective Device Selected Coordination Study and the NEC. Replace fuses found to be of the incorrect rating.

9. Verify proper operation of automatic and manual transfer switches, accessories devices and associated motor interlocks provided to either delay or prevent motor starting after transfer. Verify that the upstream protective device for each automatic and manual transfer switch is of the proper type and rating to achieve the specified short-circuit withstand rating. If a specific upstream protective device is required to obtain the proper short circuit withstand rating, verify

that the proper signage is installed on the upstream protective device and on the automatic/manual transfer switch enclosures indicating the proper replacement parts.

10. Verify CONTRACTOR's recorded data for each motor. The record includes motor name and number, the MCC and MCC bucket to which the motor is connected, the overload rating, and the motor circuit protector rating and setting for each motor furnished on the project. The rating and setting of the overload device and the motor circuit protector shall be compared to the ratings allowed by the NEC.

11. Verify the resistance to ground of all power distribution equipment is 5 ohms or less. If the resistance to ground is found to be greater than 5 ohms, notify the ENGINEER immediately for resolution.

12. Verify that all terminations at the transformers, service entrance and distribution switchgear, motor control centers, and panelboards are correctly installed and torqued.

13. Refer to the individual equipment and material specification sections for additional testing requirements.

14. Check the full load current draw of each motor. Where power factor correction capacitors are provided, the capacitor shall be in the circuit at the time of the measurement. Compare the measured value to the rating of the thermal overload devices furnished and verify compliance with the NEC.

15. Verify all circuit breaker ratings and settings are as required by the Contract Documents or as amended during shop drawing review. Advise the ENGINEER of discrepancies and make changes as directed by the ENGINEER.

16. Assist in performing a site power outage test to demonstrate that the automatic power transfer equipment, individual equipment programming and that the process control system reestablishes plant operations in the proper sequence once normal or standby power is established. The test shall be repeated until proper plant restoration is demonstrated.

E. Step No. 3 - After the electrical distribution equipment has been energized the CONTRACTOR shall perform the following tests:

1. Verify phase rotation at the service entrance and distribution switchgear, motor control centers and panelboards. The phase rotation shall be A, B, C from front to back, top to bottom and from left to right.

2. Adjust the taps on the transformers to produce a nominal voltage at the terminals of the transformers.

3. Jog all motors to verify rotation. Disconnect the driven equipment if damage could occur due to incorrect rotation. If the rotation is found to be incorrect adjust the wiring terminations at the motor terminal box.

4. Submit a typed list record for each motor. The list shall include the motor name and number, the MCC and MCC bucket to which the motor is connected, the overload rating, and the motor

circuit protector rating and setting. The rating and setting of the overload device and the motor circuit protector shall be compared to the ratings allowed by the NEC.

5. Verify proper operation of automatic and manual transfer switches, accessories devices and associated motor interlocks provided to either delay or prevent motor starting after transfer. Verify control circuits and functionality of the controls for all motors, automatic transfer systems, remote protective device (i.e. wiring for differential protection relays, alarms systems, safety interlocks, emergency stop controls, and motor, transformer and generator protective devices). The functionality shall be in accordance with the approved control schematics, wiring diagrams or functional descriptions.

6. Assist in the testing of the emergency/standby engine generator(s). The Electrical Contractor shall provide a journeymen electrician for the duration of the test to assist in the setup of the test.

7. Assist in performing a complete plant power outage test to will demonstrate that the automatic power transfer equipment, individual equipment programming and the plant's process control system reestablishes plant operations in the proper sequence once normal or standby power is established. The test shall be repeated until proper plant restoration is demonstrated.

F. Step No. 4 - Testing to be performed under Step No. 4 shall take place when the project is substantially complete but before final acceptance is granted. Employ the service of an independent recognized electrical power systems testing company, other than the manufacturers of the electrical equipment furnished under Division 16, to perform a final acceptance test of the completed electrical systems. The following work shall be provided:

1. The Testing Company shall obtain the report previously submitted along with the approved/corrected Protective Device Selective Coordination Study before starting the testing and shall become familiar with the reports and the Selective Coordination Study. All discrepancies shall be addressed before the testing begins.

2. Retest all of the protective devices in accordance with NETA Maintenance Testing Specification "MTS" and reset and refurbish equipment as required to comply with the NETA MTS requirements and the Protective Device Selective Coordination Study.

3. The equipment to be retested shall include all protective devices relays, circuit breakers, timers and liquid filled transformer insulating oil.

4. Testing shall be supervised by the Testing Company's Professional Engineer.

5. Testing shall be in accordance with Step 2 Testing above.

6. Submit a typed report as specified in the "Submittals" section above.

END OF SECTION