AGENDA

Each item on the agenda, no matter how described, shall be deemed to include any appropriate motion, whether to adopt a minute motion, resolution, payment of any bill, approval of any matter or action, or any other action. Items listed as “For Information” or “For Discussion” may also be the subject of an “action” taken by the Board or a Committee at the same meeting.

1. DETERMINATION OF A QUORUM

2. PLEDGE OF ALLEGIANCE

3. INVOCATION

4. PUBLIC COMMENT
   Pursuant to Government Code Section 54954.3

5. ADDITIONAL ITEMS TO THE AGENDA
   Determine the need to add items to the agenda. In order for the Board to add an item to the agenda it must make a determination that: (i) The item came to the attention of the Board after the posting of the agenda; (ii) That there is a need for immediate action to be taken by the Board. If these two tests are met, the Board may add the item in question to the agenda for consideration consistent with the provisions of the Brown Act.

6. CONSENT CALENDAR

   6A. AMENDMENT AND SUBSEQUENT CLOSEOUT OF THE 6-MONTH SERVICES CONTRACT WITH UNIVAR FOR SUPPLY AND DELIVERY OF CHEMICALS TO ALL WRD TREATMENT FACILITIES
       Capital Improvement Projects (CIP) Committee Recommendation: The Capital Improvement Projects (CIP) Committee recommends that the Board of Directors amend the Univar contract budget by $14,000 to satisfy all remaining invoices, whereby the interim contract would then be closed.

   6B. AUTHORIZE REPAIR WORK OF THE CHEMICAL TANK PLATFORM AT THE LEO J. VANDER LANS TREATMENT PLANT AND REQUEST TO ISSUE A PURCHASE ORDER TO CJI
       Capital Improvement Projects (CIP) Committee Recommendation: The Capital Improvements Projects (CIP) Committee recommends that the Board of Directors approve the Purchase Order with CJI Process Systems for phase 1 repairs of the LVL FRP platform for an amount not to exceed $20,000.
6C. RENEWAL OF CITYWORKS SOFTWARE LICENSE FOR ALL WRD TREATMENT PLANTS

*Capital Improvement Projects (CIP) Committee Recommendation:* The Capital Improvement Projects (CIP) Committee recommends that the Board of Directors authorize the current renewal of the Cityworks' License for an amount of $14,500, and future renewals at the rate of $20,000, plus 10% contingency.

7. CONTRACT AMENDMENT NO. 2 WITH BUTIER ENGINEERING INC. FOR CONSTRUCTION MANAGEMENT SERVICES FOR THE SAFE DRINKING WATER PROJECTS: CITY OF HUNTINGTON PARK, CALIFORNIA AMERICAN WATER AND CITY OF LYNWOOD

*Capital Improvement Projects (CIP) Committee Recommendation:* The Capital Improvement Projects (CIP) Committee recommends that the Board of Directors approve execution of Contract Amendment No. 2 with Butier Engineering Inc. for construction management services for three Safe Drinking Water approved projects for an additional amount not to exceed $170,000 subject to approval as to form by District Counsel.

8. WRD ADMINISTRATION BUILDING HVAC AUTOMATION SERVICE CONTRACTS WITH CLIMATEC LLC

*Capital Improvement Projects (CIP) Committee Recommendation:* The Capital Improvement Projects (CIP) Committee recommends that the Board of Directors enter into a Technical Support Agreement with Climatec, LLC, subject to approval of form by District Counsel, for $65,000 plus $10,000 contingency, for a total amount not to exceed $75,000 to upgrade the automation software of the current system and to provide maintenance services for the building environmental control system over a period of three years.

9. AUTHORIZE RELEASE OF A REQUEST FOR BIDS (RFB) FOR THE LEO J. VANDER LANS WATER TREATMENT FACILITY CALCIUM CHLORIDE BULK STORAGE EXPANSION PROJECT

*Capital Improvement Projects (CIP) Committee Recommendation:* The Capital Improvements Projects (CIP) Committee recommends that the Board of Directors authorize the release of a Request for Bids (RFB) for the Leo J. Vander Lans Water Treatment Facility Calcium Chloride Bulk Storage Expansion Project.
10. **RESERVE FUND POLICY**  
   *Budget Advisory Committee (BAC) Recommendation*: For discussion and possible action.

11. **5-YEAR STRATEGIC PLAN**  
   *Capital Improvement Projects (CIP) Committee Recommendation*: The Capital Improvement Projects (CIP) recommends that the Board of Directors approve the 5-Year Strategic Plan.

12. **DISTRICT COUNSEL’S REPORT**

13. **GENERAL MANAGER’S REPORT**

14. **AB 1234 COMPLIANCE REPORTS AND DIRECTOR’S REPORTS**

15. **WRD BOARD MEETING DATES**
   A. Thursday, August 1, 2019 - 11:00 a.m. - Special Board of Directors Meeting
   B. Thursday, August 15, 2019 - 11:00 a.m. - Regular Board of Directors Meeting
   C. Thursday, September 5, 2019 - 11:00 a.m. - Regular Board of Directors Meeting
   D. Thursday, September 19, 2019 - 11:00 a.m. - Regular Board of Directors Meeting

16. **CLOSED SESSION**
   A. Conference with Legal Counsel – Anticipated Litigation, pursuant to Government Code §54956.9 (b), Two (2) Matters

17. **CLOSED SESSION REPORT**

18. **ADJOURNMENT**  
   *The Board will adjourn to the next Board of Directors meeting currently scheduled for Thursday, August 1, 2019, at 11:00 a.m.*

In compliance with the Americans with Disabilities Act (ADA), if special assistance is needed to participate in the meeting, please contact Brandon Mims, Deputy Secretary at (562) 921-5521 for assistance to enable the District to make reasonable accommodations.

All public records relating to an agenda item on this agenda are available for public inspection at the time the record is distributed to all, or a majority of all, members of the Board. Such records shall be available at the District office located at 4040 Paramount Boulevard, Lakewood, California 90712.

Agendas are available at the District’s website, [www.wrd.org](http://www.wrd.org).
EXHAUSTION OF ADMINISTRATIVE REMEDIES – If you challenge a District action in court, you may be limited to raising only those issues you or someone else raised at the public hearing described in this notice, or in written correspondence delivered to the Deputy Secretary at, or prior to, the public hearing. Any written correspondence delivered to the District office before the District’s final action on a matter will become a part of the administrative record.
DATE: JULY 18, 2019
TO: BOARD OF DIRECTORS
FROM: ROBB WHITAKER, GENERAL MANAGER
SUBJECT: AMENDMENT AND SUBSEQUENT CLOSEOUT OF THE 6-MONTH SERVICES CONTRACT WITH UNIVAR FOR SUPPLY AND DELIVERY OF CHEMICALS TO ALL WRD TREATMENT FACILITIES

SUMMARY
In June 2019, the District began procuring bulk chemicals for all treatment plants under recently executed contracts with six chemical providers. Prior to this, WRD historically relied on its third-party contract operators, such as the Long Beach Water Department and the City of Torrance, to establish bulk chemical suppliers. The process of on-boarding bulk chemicals to WRD’s treatment facilities began in November 2018 with the release of a Request for Proposal (RFP). Due to a lack of bids received, the District rejected all bids and reissued the proposal in March 2019. In April 2019, bids were publically opened and the lowest responsive and responsible bidder was awarded a one-year supply contract. During this time, an interim, general services contract was executed on January 2, 2019 with Univar for $25,000. This was conducted to ensure that bulk chemicals could continue to be supplied to the WRD facilities during this period while permanent vendors were being established.

Since the time required to establish annual chemical contracts took longer than anticipated, due in-part to the need for reissuing the proposal, an additional $14,000 in chemical orders were needed to ensure continued facility operations. As a result, staff is requesting an amendment of this interim contact budget by $14,000 with Univar to allow payment of all remaining invoices. In addition, since annual contracts have now been executed with the chemical providers, staff would also like to request that this general services contract be closed.

FISCAL IMPACT
The amount of $14,000 will be drawn from the Operations budgets for the following two treatment plants: Torrance Desalter and Leo J. Vander Lans – facilities whose budgets already include the purchase of bulk chemicals. Chemical expenditures are all charged against General Ledger (GL) code 5680 within each facility budget to provide more comprehensive tracking.
CAPITAL IMPROVEMENT PROJECTS (CIP) COMMITTEE RECOMMENDATION

The Capital Improvement Projects (CIP) Committee recommends that the Board of Directors amend the Univar contract budget by $14,000 to satisfy all remaining invoices, whereby the interim contract would then be closed.
MEMORANDUM
ITEM NO. 6B

DATE: JULY 18, 2019
TO: BOARD OF DIRECTORS
FROM: ROBB WHITAKER, GENERAL MANAGER
SUBJECT: AUTHORIZE REPAIR WORK OF THE CHEMICAL TANK PLATFORM AT THE LEO J. VANDER LANS TREATMENT PLANT AND REQUEST TO ISSUE A PURCHASE ORDER TO CJI

SUMMARY

The Leo J. Vander Lans (LVL) treatment plant has numerous elevated storage tanks that require operator accessibility. The chemical tanks used for membrane cleanings have a platform and stairs constructed of fiberglass reinforced plastic (FRP) for access to the top of the tanks. Age and continued exposure to the elements warrant that repair work be conducted to ensure continued operator safety. Repair work is broken out into two phases based on the criticality of repairs needed. Phase 1 work includes the following:

- Installation of additional structural members including:
  - New beams with hardware & fasteners
  - Angle braces with hardware & fasteners
- Replacement of all handrails and
- Installation of post connections and new gate design

District staff reached out to three qualifying vendors to provide quotations. Upon completion of the site walks, quotes were received and are presented below:

Quote #1 – CJI Process Systems $16,900
Quote #2 – RK Fabrication $23,230
Quote #3 – Gates Fiberglass Installers, Inc. $27,450

The lowest responsive bidder for this project is CJI Process Systems at $16,900. The quote does not include applicable taxes, fees or permits. As this work would be undertaken to address safety, staff is proposing that these repairs be conducted during the time the facility is off-line and prior to restarting in the Fall 2019.
**FISCAL IMPACT**

The total quoted cost of this project is $16,900 with a contingency of $3,100 to cover taxes, fees or permits for a total Purchase Order amount of $20,000. Amounts have been budgeted in the J. Vander Lans Project, under Repairs and Maintenance.

**CAPITAL IMPROVEMENT PROJECTS (CIP) COMMITTEE RECOMMENDATION**

The Capital Improvements Projects (CIP) Committee recommends that the Board of Directors approve the purchase order with CJI Process Systems for phase 1 repairs of the LVL FRP platform for an amount not to exceed $20,000.
MEMORANDUM
ITEM NO. 6C

DATE: JULY 18, 2019
TO: BOARD OF DIRECTORS
FROM: ROBB WHITAKER, GENERAL MANAGER
SUBJECT: RENEWAL OF CITYWORKS SOLE-SOURCE SOFTWARE LICENSE FOR ALL WRD TREATMENT PLANTS

SUMMARY

In recent years District assets have expanded to greater than $200 million, and will continue to grow as new projects are completed, including the newest project - the Albert Robles Center (ARC) Advanced Water Treatment Facility. The Board of Directors approved the development of an enterprise asset management plan in response to the list of growing assets in 2015. A core component of this management plan is the Computerized Maintenance Management System (CMMS). This system consists of an electronic database of all District assets which is utilized to generate electronic work orders in response to maintenance-related issues, including reactionary and preventative maintenance-related work. The CMMS system tracks work performance to verify that maintenance is being performed as required to ensure proper operations and prolong asset life. The system was fully implemented at the Leo J. Vander Lans treatment plant in 2018, and staff is working to roll out the system at the Torrance Desalter and ARC.

In July 2016, the Board of Directors approved the selection of Cityworks – the CMMS software system, based on an evaluation of four software products by the District's selection committee. Selection of Cityworks also included a three-year software license agreement which has been renewed annually at a cost of $20,000. This license term is set to expire on July 21, 2019. Staff is requesting that the Capital Improvement Program (CIP) Committee recommend authorizing the renewal of this sole-source expiring software license for an amount of $20,000, which will be funded using contingency included in the existing agreement ($5,500) and $14,500 from the Operations budget. In addition, staff is requesting that future years’ annual license renewals be authorized at the rate of $20,000, plus a 10-percent contingency.
FISCAL IMPACT
The amount of $20,000 will be paid under the contingency in the current contract, while the remaining $14,500 will be drawn from the Operations budgets of the following three treatment plants: Albert Robles Center, Torrance Desalter and Leo J. Vander Lans. All future Cityworks license renewals will be budgeted and paid from the operating budgets of the three treatment plants.

CAPITAL IMPROVEMENT PROJECTS (CIP) COMMITTEE RECOMMENDATION
The Capital Improvement Projects (CIP) Committee recommends that the Board of Directors authorizes the current renewal of the Cityworks’ License for an amount of $14,500, and future renewals at the rate of $20,000, plus 10% contingency.
DATE: JULY 18, 2019

TO: BOARD OF DIRECTORS

FROM: ROBB WHITAKER, GENERAL MANAGER

SUBJECT: CONTRACT AMENDMENT NO. 2 WITH BUTIER ENGINEERING INC. FOR CONSTRUCTION MANAGEMENT SERVICES FOR THE SAFE DRINKING WATER PROJECTS: CITY OF HUNTINGTON PARK, CALIFORNIA AMERICAN WATER AND CITY OF LYNWOOD

SUMMARY

In 2016, the District approved three wellhead treatment projects through the Safe Drinking Water Program: California American Water Arlington Well, Huntington Park Well 15, and Lynwood Well 11. The wellhead treatment system at all three wells will consist of a complete granular activated filtration system built within the boundaries of the existing well sites owned and operated by the water systems. Granulated Activated Carbon filtration is a closed system that has long been recognized as an effective means for removing Volatile Organic Compounds (VOCs), including PCE and TCE, from groundwater wells. The treatment systems will have the capacity to treat the full flow of the wells.

On October 19, 2017, the Board executed an agreement with Butier Engineering Inc. $216,000 for Construction Management Services to assist with overseeing the contractors for the California American Water Arlington Well, Huntington Park Well 15, and Lynwood Well 11 projects contracted by the District.

Construction for all three projects began between July and September 2018 and since commencement, the District encountered equipment supplier manufacturing delays, storm drain capacity issues, permitting delays and issues with survey records. As a result, Amendment No. 01 with Butier Engineering was executed February 2019 for $257,232.50 to extend the resource hours needed to continue full-time inspection services and construction management. Since that time, all three projects have encountered additional unforeseen delays and change orders that have impacted the resources needed to continue construction management services. The three projects that were scheduled for completion by May or June must be extended to September due to change order work and new equipment delivery delays as well as permit design changes. Construction management/inspection services will exceed the approved resource hours needed to complete the projects. A contract amendment is needed, and Staff would like to increase the contract for an additional $170,000 to continue services through completion of the three projects.
FISCAL IMPACT
Amendment No. 2 would increase the contract for an amount not to exceed $170,000. There are sufficient funds in the District’s Capital Improvement Program for the proposed work. The amount for extended construction management services will be paid from the 2019/20 Safe Drinking Water budget.

CAPITAL IMPROVEMENT PROJECTS (CIP) COMMITTEE RECOMMENDATION
The Capital Improvement Projects (CIP) Committee recommends that the Board of Directors approve execution of Contract Amendment No. 2 with Butier Engineering Inc. for construction management services for three Safe Drinking Water approved projects for an additional amount not to exceed $170,000 subject to approval as to form by District Counsel.

ATTACHMENT:
Draft Amendment No. 2 for Professional Services with Butier Engineering, Inc.
AMENDMENT NO.2 TO CONTRACT NO. 946
AGREEMENT FOR PROFESSIONAL SERVICES
BETWEEN
WATER REPLENISHMENT DISTRICT OF SOUTHERN CALIFORNIA
AND
BUTIER ENGINEERING, INC.

This Amendment No.2 to Contract No. 946 (“Amendment No.2”), is made and entered into this 18th day of July, 2019 (“Effective Date”), by and between the Water Replenishment District of Southern California (hereinafter “District”), and Butier Engineering, Inc., (hereinafter “Consultant”). The District and Consultant are collectively referred to herein as the “Parties”.

I. RECITALS

A. WHEREAS, On October 19, 2017, a certain agreement, hereinafter referred to as Contract No. 946 (“Agreement”), was executed between the District and Consultant for Consultant to provide construction management services and oversee contractor work on three of the District’s Safe Drinking Water Program Wellhead Treatment Projects (Projects): California American Water Arlington Well, Huntington Park Well 15, and Lynwood Well 11; and

B. WHEREAS, District and Consultant desire to enter into this Amendment No.2 to the Agreement in order to increase the budgetary amount for the continuation of construction management services to oversee the completion of the three projects due to unforeseen site conditions requiring additional design and permitting delays, as set forth below.

II. AMENDMENT

NOW, THEREFORE, in consideration of the mutual covenants, promises and agreements set forth, it is agreed the aforesaid the Agreement as amended to date, a copy of which is attached hereto as Exhibit “A”, and incorporated herein by reference, shall remain in full force and effect except as otherwise hereinafter provided.

1. Fee: The budget for services as established in the Agreement shall be increased by an amount not to exceed One Hundred Seventy Thousand Dollars ($170,000.00), as provided for in Exhibit B, attached hereto and incorporated herein by this reference.

2. Remaining Portion of the Agreement: Except as otherwise expressly set forth in this Amendment No.2, all other provision of the Agreement as amended to date shall remain in full force and effect between the Parties.
IN WITNESS WHEREOF, the parties have caused this Amendment No. 2 to the Agreement to be executed as of the Effective Date.

BUTIER ENGINEERING, INC., ("CONSULTANT")

________________________________________
Signature

________________________________________
Print Name

________________________________________
Title

WATER REPLENISHMENT DISTRICT OF SOUTHERN CALIFORNIA

________________________________________
Signature

John D.S. Allen

________________________________________
Print Name

President, Board of Directors

________________________________________
Title

________________________________________
Signature

________________________________________
Print Name

Secretary, Board of Directors

________________________________________
Title

Approved As To Form

LEAL, TREJO APC

Attorneys for the Water Replenishment District of Southern California
EXHIBIT “A”
AMENDMENT NO. 1 TO CONTRACT NO. 946
AGREEMENT FOR PROFESSIONAL SERVICES
BETWEEN
WATER REPLENISHMENT DISTRICT OF SOUTHERN CALIFORNIA
AND
BUTIER ENGINEERING, INC.

This Amendment No. 1 to Contract No. 946 ("Amendment No. 1"), is made and entered into this 21st day of February, 2019 ("Effective Date"), by and between the Water Replenishment District of Southern California (hereinafter "District"), and Butier Engineering, Inc., (hereinafter "Consultant"). The District and Consultant are collectively referred to herein as the "Parties".

I.
RECATALS

A. WHEREAS, On October 19, 2017, a certain agreement, hereinafter referred to as Contract No. 946 ("Agreement"), was executed between the District and Consultant for Consultant to provide construction management services and oversee contractor work on three of the District's Safe Drinking Water Program Wellhead Treatment Projects (Projects): California American Water Arlington Well, Huntington Park Well 15, and Lynwood Well 11; and

B. WHEREAS, District and Consultant desire to enter into this Amendment No.1 to the Agreement in order to increase the budgetary amount for the continuation of construction management services to oversee the completion of the three projects, as set forth below.

II.
AMENDMENT

NOW, THEREFORE, in consideration of the mutual covenants, promises and agreements set forth, it is agreed the aforesaid the Agreement, a copy of which is attached hereto as Exhibit "A", and incorporated herein by reference, shall remain in full force and effect except as otherwise hereinafter provided.

1. Fee: The budget for services as established in the Agreement shall be increased by an amount not to exceed Two Hundred Fifty Seven Thousand Two Hundred Thirty Two Dollars and Fifty Cents ($257,232.50), as provided for in Exhibit B, attached hereto and incorporated herein by this reference.

2. Remaining Portion of the Agreement: Except as otherwise expressly set forth in this Amendment No.1, all other provision of the Agreement shall remain in full force and effect between the Parties.
IN WITNESS WHEREOF, the parties have caused this Amendment No. 1 to the Agreement to be executed as of the Effective Date.

BUTIER ENGINEERING, INC., ("CONSULTANT")

[- Signature
[- Print Name: V.P./CFO
[- Title

WATER REPLENISHMENT DISTRICT OF SOUTHERN CALIFORNIA

[- Signature
[- Print Name: John D.S. Allen
[- Title: President, Board of Directors

[- Signature
[- Print Name: Vera Robles DeWitt
[- Title: Secretary, Board of Directors

Approved As To Form

LEAL, TREJO APC

Attorneys for the Water Replenishment District of Southern California
EXHIBIT “A”
PROFESSIONAL SERVICES AGREEMENT
BUTIER ENGINEERING, INC.

This Professional Services Agreement (the “Agreement”) is made and entered into this 19th day of October 2017 by and between the Water Replenishment District of Southern California (“District”) and Butier Engineering, Inc. (“Consultant”) (collectively the “Parties” or individually as “Party”) for the furnishing of certain professional services upon the following terms and conditions.

1. **Scope of Services.** Consultant shall perform the scope of services described in Exhibit A hereto (“Services”). Tasks other than those specifically described in Exhibit A shall not be performed without a prior written amendment to this Agreement.

   1.1 **Standard of Care.** In performing the scope of services under this Agreement, Consultant shall exercise the standard of care and expertise prevailing in California for the performance of such services.

2. **Term.** The term of this Agreement shall commence on October 19, 2017 and shall end on October 19, 2019 (the “Expiration Date”). At least sixty (60) days prior to the Expiration Date, District staff shall evaluate the quality of the Services that have been provided by the Consultant, the cost of such Services relative to the benefits, and the need for any continuation of the services. The results of such evaluation shall be provided to the appropriate District Committee, which committee shall provide a report to the District’s Board of Directors (“Board”). If the Board determines that there is a demonstrated need for the continuation of such Services, the Board may renew the Agreement on terms and conditions that do not provide for a significantly longer term, increased scope of services or increased fee schedule than is provided for in Paragraphs 1 or this Paragraph 2. If the Board desires to modify the Agreement to provide for such a significantly longer term, increased scope of services or increased fee schedule, the District shall comply with the provisions of its then current Administrative Code concerning the solicitation and approval of proposals for professional services.

2.1 **Termination by District**

   2.1.1 **Termination for Convenience.** The District may terminate this Agreement for its convenience at any time upon five (5) days written notice to Consultant. Consultant’s compensation in the event of such a termination shall be exclusively limited to payment for all authorized services

Water Replenishment District of
Southern California

Prof Services Contract
Butier Engineering, Inc.
performed and for all authorized expenses incurred up to the effective date of such termination. Consultant understands and agrees that it shall not be entitled to any additional compensation or reimbursement whatsoever in the event of such termination.

2.1.2 Consultant’s Obligations Upon Termination. Following any termination of this Agreement by the District or Consultant, the Consultant shall promptly return all District property, and shall likewise provide to District all finished and unfinished data, studies, maps, reports, and other deliverables and work-product prepared by Consultant pursuant to this Agreement.

3. Consultant’s Compensation. District will compensate Consultant for services performed and for expenses incurred pursuant to this Agreement as follows:

3.1 Fee. Consultant shall be paid in accordance with the fees and Consultant Rate Schedule attached to this Agreement as Exhibit B which may not be changed except with District’s written approval.

3.2 Reimbursable Expenses. Consultant shall be reimbursed for only pre-approved expenses, subject to the provisions of this Agreement. Consultant shall obtain the District’s prior written approval before incurring an expense not specifically provided for under this Agreement.

3.2.1 Third Party Expenses. Unless specifically provided in Exhibit B, and subject to the provisions of Paragraph 3.2, the District shall not reimburse Consultant for any costs charged to Consultant by third parties unless said costs are preapproved. In the event such costs are approved, such reimbursement shall be at cost without any markup by Consultant.

3.3 Invoices. Consultant shall submit monthly invoices to District for services performed and expenses incurred during the preceding month. District shall process Consultant’s invoice upon receipt and issue any undisputed payment in a timely manner. Consultant’s invoices shall separately identify all personnel for whose services payment is sought, the services performed, and all expenses for which reimbursement is requested. As a condition precedent to payment, District may require Consultant to furnish supporting information and documentation for all charges for which payment is sought. District shall have the right to withhold from payments to Consultant reasonably disputed amounts including, without limitation, amounts for services not performed in accordance with this Agreement and costs, expenses or damages incurred by District as a result of Consultant’s breach of this Agreement or Consultant’s negligence.

4. Consultant’s Obligation to Provide Notice of Changes. Consultant shall provide written notice to the District no later than twenty (20) days after the occurrence of any event (including any direction by the District) which Consultant believes requires a change in its compensation or the time for performance of its obligations under this Agreement. Said
notice shall describe the event and the basis for any change in compensation or time for performance requested by Consultant. The Parties shall thereafter meet and confer to determine whether such a change is appropriate. However, no such change to this Agreement may be made except by written amendment to this Agreement executed by the Parties. Consultant’s failure to provide the notice required under this Paragraph shall constitute a waiver of its right to seek a change in its compensation or the time for performance of its obligations under this Agreement.

5. **Ownership and Use of Documents.** All proprietary information developed by Consultant in connection with, or resulting from, this Agreement, including but not limited to inventions, discoveries, improvements, copyrights, patents, maps, reports, textual material or software programs, shall be the sole and exclusive property of the District. Consultant agrees that the compensation to be paid pursuant to this Agreement includes adequate and sufficient compensation for any proprietary information developed in connection with or resulting from this Agreement. Consultant further understands and agrees that full disclosure of all proprietary information developed in connection with, or resulting from, this Agreement shall be made to the District, and that Consultant shall do all things necessary and proper to perfect and maintain District’s ownership of such proprietary information. All documents, reports, surveys, renderings, photographs, data and other materials furnished by the District to Consultant shall remain the exclusive property of the District and shall not be distributed or provided to third parties without the express written authorization of the District.

6. **Publication of Project Information.** Consultant shall notify and obtain written approval from the District before presenting verbal or written information to outside individuals or entities about the services or project for which Consultant was retained.

7. **Patents and Copyrights.** The Consultant shall assume all costs arising from the use of patented or copyrighted materials, including but not limited to, equipment, devices, processes, and software programs used or incorporated in the work performed under this Agreement. Consultant shall defend, indemnify hold the District, its officers, directors agents, employees, representatives and assigns harmless from any and all claims, demands, suits at law, and actions of every nature for or on account of the use of any patented or copyrighted materials.

8. **Consultant’s Status.** Consultant is an independent contractor and neither Consultant nor any employee of Consultant is or will be treated as an employee of the District under this Agreement. District controls the result to be accomplished under this Agreement, but not the means by which Consultant achieves such results.

8.1 Payments made to Consultant pursuant to this Agreement shall be the sole and complete compensation to which Consultant is entitled. Consultant is solely responsible for any taxes levied by local, state or federal authorities on such sums. Consultant shall defend and indemnify the District for any taxes, fines, penalties and attorneys’ fees assessed or threatened to be assessed against District for failure to properly withhold taxes as a result of any determination that Consultant, or any
of Consultant's employees, is an employee rather than an independent contractor of District.

8.2 District will not make any contribution to any retirement plan or Social Security on behalf of Consultant or any of Consultant's employees. Consultant shall defend and indemnify the District for any contribution, fines, penalties and attorneys' fees assessed or threatened to be assessed against District for failure to contribute to any retirement plan or Social Security as a result of any determination that Consultant, or any of Consultant's employees, is an employee rather than an independent contractor of District.

8.3 District will not make any payments to Consultant, or Consultant's employees, which rely upon employee status, including, but not limited to, FLSA and other overtime and minimum wage requirements, prevailing wage laws, worker's compensation benefits, FMLA, CFRA, Paid Leave, and unemployment benefits. Consultant shall defend and indemnify the District for any payment, fines, penalties and attorneys' fees assessed or threatened to be assessed against District for failure to make any such payment or otherwise provide the benefits of such laws as a result of any determination that Consultant, or any of Consultant's employees, is an employee rather than an independent contractor of District.

8.4 Consultant shall comply with the Political Reform Act of 1974, as amended including, but not limited to, disclosure of all conflicts of interest and other financial disclosure requirements required thereunder.

9. Instructions to Consultant. In the performance of the services set forth in this Agreement, Consultant shall report to and receive instructions from the following person on behalf of the District: Charlene King or Ken Ortega.

10. Subconsultant Services. Any subconsultants to be used by Consultant in the performance of the scope of services shall be identified in Exhibit A hereto. Consultant shall obtain the District's prior written approval before retaining a subconsultant to perform any portion of the scope of services of this Agreement. Notwithstanding Consultant's use of any subconsultants, Consultant shall be responsible to the District for the performance of its subconsultants as it would be if Consultant had performed those services itself. Nothing in this Agreement shall be deemed or construed to create a contractual relationship between the District and any subconsultant employed by Consultant. Consultant shall be solely responsible for payments to any subconsultants. Consultant shall defend and indemnify the District for any payment, fines or penalties assessed or threatened to be assessed against District as a result of any claim brought by any subconsultant of Consultant for any matter arising from, or related to, the services performed by subconsultant under this Agreement.

11. Compliance With Laws and Regulations: Licensing. Consultant shall perform its services under this Agreement in compliance with all applicable provisions of Federal, State and local laws, statutes, codes, rules, regulations, ordinances and professional standards
("Applicable Laws"). By entering into this Agreement, Consultant represents and warrants that it possesses and will keep current all license and registrations required by Applicable Laws to enter into this Agreement and to perform the scope of services hereunder.

12. **Insurance.** Consultant, at its sole cost and expense, shall obtain, keep in force, and maintain the following policies of insurance at all times while this Agreement is in effect, and shall not commence any work under this Agreement until proof of such insurance has been provided to the District. The coverages provided by such insurance shall not be construed as limitations of liability.

12.1 **Required Policies.**

12.1.1 **Commercial General Liability Insurance** (contractual, products, and completed operations coverages included) with a combined single limit of no less than $2,000,000 per occurrence or the full per occurrence limits of the policies available, whichever is greater for bodily injury, personal injury and property damage.

12.1.2 **Business or Comprehensive Automobile Liability Insurance** for owned, scheduled, non-owned, or hired automobiles, with a combined single limit of no less than $1,000,000 per accident.

12.1.3 **Professional Liability Insurance** with limits of $1,000,000 per claim and $1,000,000 in the aggregate.

12.1.4 **Employers’ Liability Insurance** with limits of $1,000,000 per claim and $1,000,000 in the aggregate.

12.1.5 **Workers’ Compensation Insurance** as required under the Workers’ Compensation Insurance and Safety Act of the State of California.

12.2 **Required Terms.**

12.2.1 All policies except workers’ compensation and professional liability, shall name as additional insureds the Water Replenishment District of Southern California, its directors, officers, employees, agents authorized volunteers and representatives. The coverage shall contain no special limitations on the scope of protection afforded the District, its directors, officers, employees, or authorized volunteers.

12.2.2 All policies (with the exception of Professional Liability) shall be written on an occurrence basis. If a policy may only be obtained on a claims made basis, the policy shall be maintained continuously for a period of no less than three (3) years after the date of final completion of the scope of services under this Agreement.
12.2.3 All policies shall provide that coverage cannot be cancelled without thirty (30) days prior written notice to the District.

12.2.4 All insurance required under this Agreement shall be considered primary to any insurance maintained by the District. All policies except Professional Liability shall include waivers of subrogation in favor of the District and its insurers.

12.2.5 Any failure to comply with reporting or other provisions of the policies including breaches of warranties shall not affect coverage provided to District, its directors, officers, employees, or authorized volunteers.

12.2.6 The Consultant’s insurance shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer’s liability.

12.2.7 Liability insurance shall indemnify the Consultant and his/her sub-contractors against loss from liability imposed by law upon, or assumed under contract by, the Consultant his/her sub-contractors for damages on account of such bodily injury (including death), property damage, personal injury, completed operations, and products liability.

12.2.8 Deductibles and Self-Insured Retentions – Any deductible or self-insured retention must be declared to and approved by District. At the option of District, the insurer shall either reduce or eliminate such deductibles or self-insured retentions. Policies containing any self-insured retention (SIR) provision shall provide or be endorsed to provide that the SIR may be satisfied by either the named or additional insureds, co-insurers, and/or insureds other than the first named insured.

12.2.9 Evidence of Insurance – Prior to execution of the agreement, the Consultant shall file with District a certificate of insurance signed by the insurer’s representative evidencing the coverage required by this agreement. Such evidence shall include an additional insured endorsement signed by the insurer’s representative. Such evidence shall also comply with the Evidence and Required Forms of Insurance attached hereto as Exhibit “C”. In the event that the Consultant employs other contractors (sub-contractors) as part of the work covered by this agreement, it shall be the Consultant’s responsibility to require and confirm that each sub-contractor meets the minimum insurance requirements specified above. Failure to continually satisfy the Insurance requirements is a material breach of contract.

12.2.10 All policies required under this Agreement shall be issued by companies authorized to transact insurance business in the State of California acceptable to the District and having a Best rating of A- or equivalent or as otherwise approved by District.
13. **Indemnification.** Consultant shall indemnify, defend and hold harmless the District and its directors, officers, employees, agents and representatives (collectively “District”), from and against any and all claims, liabilities, costs, damages, suits, proceedings, injuries (including injuries to real and personal property, and injuries to persons, including death) incurred by District (“Losses”), as a result of Consultant’s breach of any provision of this Agreement, Consultant’s failure to comply with applicable laws, Consultant’s negligent acts or omissions, or Consultant’s willful misconduct. However, Consultant’s obligation to defend shall arise regardless of any claim or assertion that the District caused or contributed to the Losses. Nothing in this paragraph shall constitute a waiver or limitation of any legal rights which the District may have including, without limitation, the right to implied indemnity.

14. **Arbitration and Attorneys’ Fees.** Any dispute arising from or relating to this Agreement shall be submitted to final and binding arbitration before an arbitrator who is a member of the National Academy of Arbitrators. The parties will obtain a list of five names of potential arbitrators from the National Academy of Arbitrators, or the American Arbitration Association, and will take turns striking the names of arbitrators until one arbitrator remains, who shall preside over the arbitration. The arbitrator will have no power to rewrite any of the terms of this Agreement. The parties shall split the cost of the arbitrator’s fee and any court reporter required by the arbitrator or if both parties agree to having the proceedings taken down by a court reporter. The prevailing Party in any action arising from or relating to this Agreement shall be entitled to recover its reasonable attorneys’ fees, expert witness fees and arbitration fees and costs in addition to any other relief and recovery ordered by the arbitrator or other tribunal hearing any matter related to this Agreement.

15. **Conflict of Interest.** No official of the District who is authorized in such capacity and on behalf of the District to negotiate, make, accept or approve, or to take part in negotiating, making, accepting or approving this Agreement, or any contract or subcontract relating to work to be performed pursuant to this Agreement, shall become directly or indirectly personally interested in this Agreement or in any part thereof. Consultant shall not accept employment or contract during the term of this Agreement with any firm or individual for the provision of services if such employment or contract would conflict directly with the Services provided to the District under this Agreement.

16. **Equal Opportunity.** During the performance of this Agreement, Consultant shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, age, marital status or national origin.

17. **Successors and Assigns.** This Agreement shall inure to the benefit of, and be binding upon, the District, Consultant, and their respective successors and assigns provided, however, that no assignment of the duties or benefits under this Agreement shall be made without the written consent of the Consultant and the District.

18. **Choice of Law and Venue.** This Agreement shall be governed by and interpreted in accordance with the laws of the State of California. The Parties agree that the exclusive
venue for any action or proceeding arising from or relating to this Agreement shall be in the County of Los Angeles, State of California.

19. **Notices.** All notices provided by this agreement shall be in writing and shall be sent by first-class mail and facsimile transmission as follows:

If to the District:

- **Water Replenishment District of Southern California**
  - 4040 Paramount Blvd.
  - Lakewood, CA 90712
  - **Phone:** (562) 921-5521
  - **Fax:** (562) 921-6101

If to Consultant:

- **Mark M. Butier, Jr.**
  - Butier Engineering, Inc.
  - 17822 E. 17th Street, Suite 404
  - Tustin, CA 92780
  - **Phone:** 714-832-7222
  - **Fax:** 714-832-7211
  - **Email:** jrbutier@butier.com

20. **Amendments.** This Agreement may be modified only by a writing signed by the Parties hereto.

21. **Integration; Construction.** This Agreement (inclusive of exhibits incorporated herein by this reference) sets forth the final, complete and exclusive expression of the Parties’ agreement with respect to the subject matter hereof, and supersedes any and all other agreements, representations, and promises, whether made orally or in writing. Notwithstanding anything in Exhibit A to the contrary (or any invoice or other unilateral terms or conditions provided by Consultant), in the event of any conflict or inconsistency between this Agreement and Exhibit A (or any invoice or other unilateral terms or conditions provided by Consultant), this Agreement shall control. The Parties represent and warrant that they are not entering into this Agreement based upon any representation or understanding that is not expressly set forth in this Agreement. This Agreement shall be construed as the product of a joint effort between the Parties and shall not be construed against either Party as its drafter.

22. **Effective Date.** This Agreement is effective as of the date first set forth above.
23. **Authority.** Each person signing this Agreement represents that he or she has the authority to do so on behalf of the Party for whom he or she is signing.

IN WITNESS WHEREOF, the Parties have caused this AGREEMENT to be executed the day and year first above written.

**WATER REPLENISHMENT DISTRICT OF SOUTHERN CALIFORNIA**

<table>
<thead>
<tr>
<th>Signature</th>
<th>Signature</th>
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<tbody>
<tr>
<td>Robert Katherman</td>
<td>Sergio Calderon</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Print Name</th>
<th>Print Name</th>
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<tr>
<td>President, Board of Directors</td>
<td>Secretary, Board of Directors</td>
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**BUTIER ENGINEERING, INC. ("CONSULTANT")**

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<tr>
<th>Signature</th>
<th>Print Name</th>
<th>Title</th>
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<tbody>
<tr>
<td>F.</td>
<td>Mohan Bhat, Jr.</td>
<td>VP/CEO</td>
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Approved As To Form
LEAL, TREJO LLP

Attorneys for the Water Replenishment District of Southern California
EXHIBIT A
SCOPE OF WORK

1. Consultant shall perform the detailed scope of work described in the Request for Proposal (RFP) for Construction Management Services for Construction of Multiple Safe Drinking Water Wellhead Treatment Projects, attached hereto as Exhibit A-1, and as provided by Consultant's Scope of Work, attached hereto as Exhibit A-2. Should there be any discrepancy between the scope of work detailed in Exhibit A-1 and the proposal for services in Exhibit A-2, the scope of work in Exhibit A-1 shall prevail.

2. Consultant shall perform the scope of services in accordance with the approach documented in Exhibit A-2.
EXHIBIT A-1

REQUEST FOR PROPOSAL (RFP-17-004) FOR CONSTRUCTION MANAGEMENT SERVICES FOR CONSTRUCTION OF MULTIPLE SAFE DRINKING WATER WELLHEAD TREATMENT PROJECTS
REQUEST FOR PROPOSAL
(RFP-17-004)

FOR CONSTRUCTION MANAGEMENT SERVICES
FOR CONSTRUCTION OF MULTIPLE SAFE
DRINKING WATER WELLHEAD TREATMENT
PROJECTS

Issued: August 10, 2017

Pre-Proposal Meeting:
Tuesday, August 22, 2017 at 10:00 a.m.
WRD Board Room
4040 Paramount Blvd
Lakewood, CA 90712

Questions Regarding this RFP Due:
Friday, August 25, 2017, at 12:00 p.m.
Melody Wu, Project Administrator
E-mail: mwu@wrdrd.org

PROPOSAL DUE:
Thursday, August 31, 2017 at 3:00 p.m. Local Time

Submit Sealed Proposal To:
Attn: Melody Wu, Project Administrator
Water Replenishment District of Southern California
4040 Paramount Boulevard
Lakewood, CA 90712
Phone: (562) 921-5521
www.wrd.org
NOTICE TO PROPOSERS

Request For Proposals

For Construction Management Services for Construction of Multiple Safe Drinking Water Wellhead Treatment Projects

SCOPE OF SERVICES: The Water Replenishment District of Southern California (WRD) is seeking proposals from qualified firms to provide professional Construction Management (CM) for WRD’s Safe Drinking Water Program Wellhead Treatment Projects. This will be a multiple project contract for Treatment Projects located in City of Huntington Park, City of Lynwood, and City of Los Angeles. WRD intends to retain a CM Consultant to undertake various tasks to manage the construction of treatment systems through start-up.

A pre-proposal meeting will be held in the WRD Board Room at 4040 Paramount Boulevard, Lakewood, California 90712, on Tuesday, August 22, 2017 at 10:00 a.m. Firms interested in submitting proposals are encouraged to attend.

QUESTIONS REGARDING THIS RFP: All questions regarding the technical aspects or general requirements/provisions of this Request for Proposal (RFP) must be directed in writing to Melody Wu, Project Administrator, via e-mail: mwu@wrdo.org, with the subject heading “Question – RFP for SDW CM Services” by no later than Friday, August 25, 2017, at 12:00 p.m. Questions received from prospective proposers and responses from WRD will be formally documented in a Question and Answer (Q&A) table that will be posted on the WRD website: http://www.wrd.org/business/water-replenishment-business.php. The Q&A table will be updated regularly as questions are received from prospective proposers.

DEADLINE FOR PROPOSALS: Five (5) hard copies and one (1) electronic copy of the proposal must be received in a sealed envelope by WRD no later than Thursday, August 31, 2017 at 3:00 p.m., or such later time that WRD may announce by addendum to proposers at any time prior to the submittal deadline. The envelope shall be plainly marked on the exterior “PROPOSAL FOR PROFESSIONAL CONSTRUCTION MANAGEMENT” and with the name and address of the Proposer. Envelopes containing proposals will be time stamped upon receipt by WRD.

Proposals must be mailed or delivered in person or via courier services to:

Attn: Melody Wu, Project Administrator
Water Replenishment District of Southern California
4040 Paramount Blvd.
Lakewood, CA 90712

Proposals received after the deadline will not be considered under any circumstances. Faxed or e-mailed proposals will not be accepted. There will be no formal opening of the received proposals. WRD reserves the right to reject any and/or all proposals received.
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LIST OF ATTACHMENTS

Attachment A – Form for Key Personnel Participation on the Project

Attachment B – Form for Consultant and Subconsultant Status as LBE, SBE, and VBE

Attachment C – WRD Standard Agreement for Professional Services
REQUEST FOR PROPOSAL

For Construction Management Services for Construction of Multiple Safe Drinking Water Wellhead Treatment Projects

The Water Replenishment District of Southern California (WRD or District) is seeking proposals from experienced and qualified firms (also referred to as “Consultant” or “Proposer” herein) to provide professional Construction Management services for multiple WRD Safe Drinking Water Wellhead Treatment Projects located within the WRD boundaries at various sites in Los Angeles County. WRD intends to evaluate the proposals received and enter into a Professional Services Agreement (Contract) with the qualified Consultant.

This Request for Proposal (RFP) describes the required scope of services, the information that must be included in the proposal, and the Consultant selection process. Proposers are encouraged to carefully review this RFP in its entirety prior to submitting their proposals. Failure to submit information in accordance with these requirements and procedures may be cause for disqualification. This RFP is available for downloading from the WRD website: http://www.wrd.org/business/water-replenishment-business.php.

2.0 INTRODUCTION

The WRD is a State Special District that was established in 1959 under the California Water Code (Division 18, §60000 through §60622) to manage the groundwater resources within the Central Basin and West Coast Basin in southern Los Angeles County. WRD’s mission is to provide, protect and preserve high-quality groundwater through innovative, cost-effective and environmentally sensitive basin management practices for the benefit of residents and businesses of these groundwater basins. The aquifers in the Central Basin and West Coast Basin provide for about 40 percent of the total water needs for the people and businesses in the 43 cities covering WRD’s 420-square mile service area.

To accomplish its mission, WRD conducts managed aquifer recharge using imported water, recycled water, and storm water, prevents seawater intrusion through injection of imported water and recycled water into coastal barrier wells, protects and preserves groundwater quality through monitoring, testing, data analysis, and treatment, and ensures a future supply of reliable groundwater through planning, conjunctive use, and development of new projects. More information regarding the WRD can be found at www.wrd.org.
3.0 BACKGROUND

Years of improper disposal of industrial solvents allowed volatile organic compounds (VOCs) to seep into Southern Los Angeles county groundwater aquifers. As a result, wells within the area served by WRD have been adversely affected by these contaminants. To mitigate this problem, WRD established a Safe Drinking Water Program as part of its Clean Water Program in 1991. Since that time seventeen projects have been constructed, thirteen of which are VOC removal projects.

The WRD Safe Drinking Water Program provides funding for and is responsible for the design, construction, and purchase of the wellhead treatment equipment. WRD processes the necessary environmental documentation. However, the water producer (groundwater pumper) is responsible for obtaining any health department, discharge, and air quality permits. The pumper is also responsible for operating and maintaining the facilities. Three wells have recently been selected for inclusion in the program. They are the City of Huntington Park Well 15, City of Lynwood Well 11, and California American Water Company Arlington Well. WRD has retained the design consultants to plan, design, and provide engineering assistance during the construction of treatment systems through start-up. WRD intends to retain a construction management team to provide inspection and construction management services of treatment systems through start-up for all four locations.

4.0 SCOPE OF WORK

The Consultant shall provide the following services, including but not limited to those described below, and may propose additional tasks or phases which they feel is necessary based on the information provided and to their experience on projects of similar size and scope.

The overall goals of are:

1. Provide a constructability review of the three project plans & specifications prior to bidding.

2. Assist WRD and the well owners in the issuance and advertisement of bids, and recommendation of contractors to supply and install the systems.

3. Manage the complete construction, inspection, installation, and operation verification of the three wellhead treatment systems at the identified locations. Each project will be bid separately.

The construction of these project are to be achieved in the shortest time period and at the most economical cost. The Consultant shall develop a construction management plan to ensure construction can be accomplished within the proposed project budget and schedule. It is the District’s goal to construct the project concurrently if possible.
PROJECT LOCATIONS & MAP

<table>
<thead>
<tr>
<th>Item</th>
<th>City of Huntington Park</th>
<th>City of Lynwood</th>
<th>California American Water Company</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Well No. 15</td>
<td>Well No. 11</td>
<td>Arlington Well</td>
</tr>
<tr>
<td>Address</td>
<td>6720 Cottage Street,</td>
<td>11645 Esther</td>
<td>5109 Arlington Avenue,</td>
</tr>
<tr>
<td></td>
<td>Huntington Park, CA</td>
<td>Street Lynwood, CA</td>
<td>Los Angeles, CA</td>
</tr>
<tr>
<td>Well Capacity (gpm)</td>
<td>1100</td>
<td>650</td>
<td>800</td>
</tr>
<tr>
<td>Contaminant(s)</td>
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<td>Trichloroethylene</td>
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<tr>
<td></td>
<td>(TCE)</td>
<td>(TCE)</td>
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</tr>
<tr>
<td>Proposed Treatment</td>
<td>Granular Activated</td>
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<tr>
<td>System</td>
<td>Carbon (GAC) System</td>
<td>Activated</td>
<td>Activated Carbon (GAC) System</td>
</tr>
</tbody>
</table>

August 10, 2017
RFP for Professional Construction Management Services
RFP-17-004
TASK 1 – Meetings

TASK 1.1 – Kick-Off Meeting

1. **WRD**
   Consultant shall meet with WRD personnel to discuss scope of work, project team, and project schedule, and to receive any additional background information.

2. **Others**
   Consultant shall meet with each of the pumpers, other stakeholders and WRD staff to discuss project locations, site constraints, access restrictions, any prior treatment that may have been performed, and unique features of sites, practical restrictions, and pumper preferences.

TASK 1.2 – Monthly Progress Meetings

Consultant shall meet monthly with WRD staff and purveyor representatives to discuss project progress.

Deliverable: Meeting minutes

TASK 2 – Constructability Review of Plans and Specifications

It is the overall goal of the District to save time and money by uncovering problems or potential problems that may be encountered during construction such as errors, omissions, ambiguities and conflicts. The consultant shall review each project’s plans & specifications prior to bidding to ensure a clear and complete set of bid documents and reduce impacts to the project. The consultant will review the plans, specifications, and bid schedule to make sure the work requirements are clear, conflicts are identified & corrected and reduce the need for clarifications.

Deliverable: Constructability Report. The Consultant will mark up the plans and specifications to identify the areas of needed corrections. The Consultant will also provide the review comments in spreadsheet format where comments can be quickly sorted.

TASK 3 – Construction Management

Consultant shall assign manpower, delegate responsibilities, review work progress, and otherwise direct the progress of the work so as to ensure satisfactory completion of work, on schedule and within budget. Consultant shall prepare and submit monthly progress reports and invoices, and all other applicable project documentation to the District for review and approval.
Task 3.1 – Project Management

The consultant shall oversee construction management of the projects. The responsibilities shall include:

1. Bid Advertisement and Award - During the advertisement period, the consultant shall be available to answer questions that any potential bidder may have and shall conduct Pre-Bid meetings for each facility. Consultant shall assist WRD in evaluation and verification of the accuracy of the bids received to ensure responsiveness, and recommend award.

2. Preconstruction meeting—This shall be held with the contractor of each facility to go over the schedule and various responsibilities.

3. Progress meetings. The consultant shall develop the progress meeting schedule to ensure that proper progress is being achieved on the projects. Based on the scope of work described herein, the Consultant shall propose the frequency of meetings needed to successfully complete each project.

4. Submittals—Consultant shall review shop drawings and other submittals produced by contractor for conformance with design specifications and recommend approval, rejection, or modification.

5. Inspection—The consultant shall be present to inspect and recommend the acceptance, rejection, or modification of equipment delivered or work performed.

6. Progress Payments—Consultant shall recommend review monthly contractor invoices and recommend payment or rejection.

7. Change Orders – Consultant shall review and coordinate change order requests.

Deliverable: Meeting notes and activity summaries, and recommendation memoranda

Task 3.2 – Progress Reports and Invoicing

Each month, the Consultant shall submit a progress report along with an invoice for the work accomplished during the reporting period. The report shall describe in detail the progress made during the previous month and the hours spent on each task. Percentage completed and anticipated date of completion for each task shall be included. Invoices submitted shall be consistent with the monthly progress report format. The approved total budget, along with the budget for any task, shall not be exceeded unless previously authorized in writing by WRD. The Consultant shall notify WRD’s Project Manager immediately upon reaching 50 and 75 percent of the project’s budget.
The monthly invoice shall be in a format approved by the District. Each project will be invoiced separately. At a minimum, each invoice shall contain the purchase order or contract number and shall be itemized by task. A subtotal cost for each task shall be included. Names of persons, their job titles, hourly billing rates, actual hours worked during the billing period, and subtotal labor costs must be summarized in a table. Attach to each invoice all documentation for other direct costs in the form of receipts or vendor invoices, with the applicable costs identified for items such as equipment costs. WRD will provide reporting requirements to Consultant, and Consultant shall prepare invoices that comply with the requirements. Failure to satisfy the reporting requirements may result in rejection or short pay of the invoices submitted to WRD for payment.

5.0 DESIRED QUALIFICATIONS

WRD will evaluate all responsive proposals based on the qualifications listed below.

1. Demonstrate at least 5 years of experience working on similar water treatment projects.

2. The Consultant firm must be located within 60 miles of WRD’s District boundaries.

3. Commitment to providing a single Project Manager/Program Manager as WRD’s primary point of contact. This Project Manager must have at least 5 years (total, with or without current firm) of professional construction management experience working on similar projects of similar size and scope or larger.

4. Professional Construction Management certifications/licenses or Engineering with a specialization in Construction Management.

6.0 PROPOSAL CONTENTS

To provide a degree of consistency in review of the written proposals, firms are requested to include the following content in their proposals. The information requested below will be used to evaluate each proposal based on the evaluation criteria outlined in this RFP. Proposals may be deemed nonresponsive if they do not respond to all areas specified below.

Proposals shall be prepared simply and economically, providing a straightforward and concise description of how the proposal has satisfied all the requirements of this RFP. Emphasis shall be on completeness and clarity of content with sufficient detail to allow for accurate evaluation and comparative analysis. Excessive or irrelevant materials will not be favorably received.

The following subsections describe the contents required in the proposal. The proposal shall be of such scope and depth to sufficiently describe and demonstrate the Proposer’s understanding of and approach to the projects.
6.1 Title Page

Proposer should identify the RFP title, name and title of the firm’s contact person, address, telephone number, fax number, email address, and date of proposal submission.

6.2 Cover Letter

A principal of the firm authorized to commit the firm to the requirements of the RFP must sign the cover letter. The letter shall discuss the Proposer’s commitment to providing high quality services as described in the RFP. Additionally, the letter shall briefly describe the firm’s understanding and approach to the services. The letter should identify a contact person (name, e-mail address, and phone number) for future communication during the selection process.

6.3 Table of Contents

The table of contents should include a clear and complete identification by section and page number of the submitted materials.

6.4 Company Background

Provide a brief background of the firm including history, types of services provided, organization structure, number of employees, annual revenues, number of offices and locations with staff size and disciplines, and any other relevant information that may be useful in determining the firm’s qualifications to provide the services described in this RFP. Include a brief summary of the firm’s philosophy related to the planning and design of Project(s).

6.5 Project Overview and Approach

Present a narrative overview of the Proposer’s understanding of the RFP requirements and the overall approach and technical plan for accomplishing the work assignments. Provide a narrative demonstrating your firm’s or team’s ability to accomplish the scope of services in a comprehensive and thorough manner with an aggressive schedule in order to meet the District’s goal of moving the projects through construction within the earliest possible timeframe. Also discuss at a minimum the following:

(i) Ability to successfully complete work assignments within the District’s required time frame and, as necessary, on short notice,

(ii) Approach to assignment of work within the firm and how team members will conduct tasks and prepare anticipated deliverables,
(iii) Describe the Proposer’s project management approach and communications protocol,

(iv) Describe the Proposer’s approach to quality assurance and control, as well as any performance guarantees,

(v) Technical approach to assigned tasks on how the projects will be implemented from construction to completion and,

(vi) Identify current and reasonably foreseeable actual and possible constraints, problems, and/or issues that could hinder the execution of services under the contract, and suggest approaches to resolving or managing these constraints, problems, and/or issues.

6.6 Additional Services

Include any comments, suggestions, or additions the Proposer may have regarding the scope of work or any other aspects of the work that the Proposer feels would be helpful to WRD in selecting a firm for the services described in the RFP. Identify the potential impact(s) or benefit(s) that these recommendations would have if accepted by WRD. Tasks above the minimum to complete the work described herein shall be clearly identified as “optional” in the proposal.

6.7 Experience and Record of Past Performance

Describe Proposer’s experience in completing similar assignments, preferably using the same project team proposed for the services described in this RFP. Using the form provided as Attachment A, list at least five (5) water treatment related construction management projects successfully completed within the last five (5) years of similar nature that demonstrate the firm’s and its subconsultants’ (if needed) competence to perform the work described in this RFP. Ongoing projects currently being performed by the Proposer also may be submitted for consideration.

Clearly identify the role of all team members in each of the projects referenced. For each of the reference projects listed, provide the following information:

1 Name and location of project;

2 Name and address of project owner/sponsor;

3 Name and current phone number and e-mail address of owner’s representative intimately familiar with the project, to contact for reference. Verify the reference person that can be contacted at the phone number provided;

4 A description of type and extent of services provided for the project;
5 Project budget (both projected and "as completed");

6 Project schedule milestones (both projected and "as completed"). Include dates of project initiation, key milestones and deliverables, and completion date or status of the project;

7 Special problems or difficulties encountered, such as project budget and schedule control issues, and how they were resolved by the Consultant; and

8 Applicability and relevance of the referenced project to the services described in this RFP.

In addition, the Consultant shall provide a minimum of five (5) client references from similar projects completed in the last five (5) years. The District at its discretion may contact other firms or agencies for additional information. Failure to provide accurate contact information, adequate information or project reference summaries may be cause for rejection of the proposal as being nonresponsive.

6.8 Project Team and Qualifications

Provide an organizational chart that describes the structure of the project team, including subconsultants/subcontractors. The project team description shall identify the following:

- The Project Manager,
- The names of readily-available key personnel that will be deployed for each task and their contact information, and the primary office locations of each project team member (preferably within the southern Los Angeles County area),
- The role each team member will play in providing services under the Contract, and
- A written assurance that the key individuals listed and identified will be performing the work and will not be substituted with other personnel or reassigned to another project without the District's prior approval. The proposal shall clearly identify who will lead the execution of assigned tasks and the respective personnel that will be assigned to them.

Provide a description of the experience, qualifications including required licenses and certifications, area of expertise or specialization, and availability (including current workload) of the project team members, including subconsultants/subcontractors, if any. Describe other project commitments by project team members and the anticipated level of involvement of each team member based on the abilities and expertise required for the type of work desired.

Provide the resumes of all members of the project team, including subconsultants/subcontractors, as an appendix. Each resume shall not exceed three (3) pages and shall include name and title, education, years with the company, licenses and certifications (issue and
expiration dates), home office location, relevant experience within at least the last five (5) years, and other required qualifications discussed in this RFP.

The identified Project Manager will be WRD’s main point of contact for all assigned projects for the duration of the Contract. The proposal shall include the Project Manager’s contact information, including phone and e-mail address.

Once a Contract has been executed, the Consultant must request approval of the District in advance of any new personnel being assigned to the project. The District reserves the right to reject or remove personnel performing services at any time for the duration of the Contract. Complete a table (an example is provided in Attachment B) that summarizes the percentage of work (based on fees) to be performed by the Consultant and each Subconsultant. Specify the certification status of the Consultant and its subconsultants with respect to Local Business Enterprise (LBE), Small Business Enterprise (SBE), and Veteran Business Enterprise (VBE). The status of business enterprise is requested information in this proposal and will be used as criteria for proposal evaluation. Failure to include the completed form may be grounds for considering the proposal to be nonresponsive. Please refer to Section 10.6 for definitions of LBE, SBE, and VBE.

6.9 Conflict of Interest

Provide a statement that the Proposer, individuals employed by the Proposer, or firms employed by or associated with the Proposer, including subconsultants/subcontractors, do not have a conflict of interest with the Project. The Proposer shall exercise reasonable efforts to prevent any actions or conditions that could result in a conflict of interest and shall include, but is not limited to, establishing precautions to prevent its employees or agents from making, receiving, providing in, or offering gifts, entertainment, payments, loans, or other considerations which could be deemed to appear to influence individuals to act contrary to the best interest of the District. If a potential conflict of interest is identified in any form, the Proposer shall inform the District immediately. Proposers are subject to disqualification on the basis of a conflict of interest as determined by WRD.

6.10 Other Information

The proposal shall include a statement that the Proposer will meet the insurance requirements per Section 12.1 of the District’s standard Professional Services Agreement, which is attached to this RFP as Attachment C. Present a statement or description regarding any litigation to which the firm is a party, any bankruptcy settlements, or unpaid judgments against the firm or its principals. Provide a statement as to whether the firm has defaulted on previous professional contracts.

6.11 WRD Standard Contract

The selected Consultant shall be expected to execute a Contract using the District’s standard
Professional Services Agreement, which is provided as Attachment C. Proposers shall provide a statement in their proposals clearly stating acceptance of all the terms and conditions specified in the standard Professional Services Agreement (i.e. no exceptions can be made to WRD’s standard Professional Services Agreement).

6.12 Project Costs and Labor Hours

The proposal shall include a table showing the following information:

- Labor hour breakdowns by the project tasks and subtasks identified in Section 3.0 (including other subtasks that the Proposer sees fit) and associated personnel, including any subconsultants, as well as total hours. Names and titles/categories of individuals proposed to work on the project tasks/subtasks, including names of subconsultants/subcontractors shall be indicated.

- Fully loaded hourly billing rates – All direct, capital, and reimbursable expenses, including but not limited to travel and transportation costs, meals, lodging, office equipment and supplies, administrative and communications fees, etc., must be built into the hourly rates. Therefore, the District shall not pay Consultant nor its subconsultants/subcontractors for any direct or reimbursable expenses incurred for implementation of the scope of services described herein.

- The labor hours and fees for proposed optional tasks, if any, shall be presented in a separate table to differentiate from the baseline Scope of Work.

It is expected that the indicated hourly rates will remain in effect for the duration of the Contract unless otherwise specified and approved by WRD. The rate sheet shall also include any other rates or fees, such as markups for subconsultants/subcontractors not identified as part of the project team, equipment markups, or other direct costs that may be incurred.

The proposal shall also include a description of the anticipated method of billing for services performed, with provisions for monthly billing that will include itemized accounting of hours of personnel, hourly rates, and percent completion for each task identified.

7.0 PROPOSAL SUBMISSION REQUIREMENTS

7.1 Proposal Format

The proposal shall be limited to no more than 25 pages in length. This does not include the title page, table of contents, cover letter, appendices, dividers, or résumés. All sections of the proposal shall be printed on 8.5” x 11” size recycled paper or recyclable white bond paper,
paginated, and bound. Any oversized documents, such as charts or tables, must be folded to size and secured in the envelope.

All files shall be in a text searchable PDF format (i.e., not scanned images) compatible with Adobe Acrobat Version 8.0 (at a minimum). The main directory of the CD/flash drive shall contain the entire proposal as a single PDF file. All sections of the PDF file shall be bookmarked.

7.2 Proposal Signing

The proposal shall be signed by an officer, or officers, authorized to execute legal documents on behalf of the Proposer. The submission and signing of the proposal shall indicate the intention of the Proposer to adhere to the provisions described in this RFP and certifies that the proposal was prepared independently and was submitted without any collusion designed to limit competition or bidding.

7.3 Proposal Submittal Procedures

Five (5) hard copies of the proposal shall be submitted in a sealed envelope to WRD no later than the proposal due date and time indicated in this RFP. The envelope shall be plainly marked on the exterior “PROPOSAL FOR PROFESSIONAL CONSTRUCTION MANAGEMENT-INSPECTION SERVICES” and with the name and address of the Proposer. In addition, an electronic copy of the proposal on a CD or flash drive shall be submitted. Envelopes containing proposals will be time stamped upon receipt by WRD.

Proposals must be mailed or delivered in person or via courier services to:

Attn: Melody Wu, Project Administrator
Water Replenishment District of Southern California
4040 Paramount Blvd.
Lakewood, CA 90712

It is the Proposer’s responsibility to ensure that proposals are received prior to the submittal deadline. Proposal packages should also include all signed Acknowledgment of Addendum forms that may be issued by WRD as part of this RFP process, as further described below.

The WRD will not be responsible for the proper identification and handling of any proposals submitted incorrectly. Late proposals, late modification, or late withdrawals will not be considered under any circumstances. Faxed or emailed proposals will not be accepted. There will be no formal opening of the received proposals.

7.4 Questions Regarding the RFP

Questions concerning the technical aspects or general requirements/provisions of the RFP must be received no later than the due date indicated in this RFP and must be directed in writing to
Melody Wu, WRD Project Administrator, via email only to: mwu@wrd.org with the subject heading “Question – RFP for SDW CONSTRUCTION MANAGEMENT Services”.

Questions received from prospective proposers and responses from WRD will be formally documented in a Question and Answer (Q&A) table that will be posted on the WRD website: http://www.wrd.org/business/water-replenishment-business.php. The Q&A table will be updated regularly as questions are received from prospective proposers. As a result, all proposers are recommended to visit the above-mentioned WRD website on a regular basis. Responses to questions may result in the issuance of an Addendum to the RFP, as further described in Section 10.4.

7.5 Proposal Preparation Costs

This solicitation does not commit the District to award any work nor to pay any costs incurred from the preparation of proposals. Firms responding to this RFP will be solely responsible for all costs and expenses incurred during the selection process.

8.0 PRE-PROPOSAL MEETING

A pre-proposal meeting is scheduled for Tuesday, August 22, 2017 at 10:00 a.m., at WRD’s Board Room located at 4040 Paramount Boulevard in Lakewood, California 90712. Prospective proposers are encouraged to attend and present questions regarding all requirements and provisions specified within the RFP and the Consultant selection process. Responses to questions will be formally documented and distributed. Meeting participants are required to sign in and provide a business card upon arrival at the meeting room. A copy of the sign-in sheet will be posted on the WRD website: http://www.wrd.org/business/water-replenishment-business.php.

9.0 PROCUREMENT SCHEDULE AND PROCESS

9.1 Solicitation Schedule

Milestones for the RFP process are summarized in the table below. The District reserves the right to modify the schedule below at its discretion. Proper notification changes will be made to interested proposers.

<table>
<thead>
<tr>
<th>Event</th>
<th>Date/Time</th>
</tr>
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<tbody>
<tr>
<td>RFP Issued by WRD</td>
<td>August 10, 2017</td>
</tr>
<tr>
<td>Pre-Proposal Meeting</td>
<td>Tuesday, August 22, 2017 at 10:00 a.m.</td>
</tr>
<tr>
<td>Deadline for Questions Regarding this RFP</td>
<td>Friday, August 25, 2017, at 12:00 p.m.</td>
</tr>
<tr>
<td>Proposals Due</td>
<td>Thursday, August 31, 2017 at 3:00 p.m.</td>
</tr>
<tr>
<td>WRD Board Awards Contract</td>
<td>Thursday, September 21, 2017</td>
</tr>
</tbody>
</table>

9.2 Selection Process
This solicitation is being conducted by WRD through a fair and open process in accordance with procurement policies established for water replenishment districts in the State of California, those policies established by WRD, and applicable State laws.

All responsive proposals will be evaluated by a selection committee formed by the District. The proposal shall be of such scope and depth to sufficiently describe and demonstrate the Proposer’s understanding, approach, and qualifications to successfully complete the scope of services described herein. Submittal of incomplete or vague responses to any section or subsection of this RFP may result in rejection of the proposal. Proposals will be evaluated, scored, and ranked based on the criteria specified in Section 10 of this RFP.

Once the proposers are ranked, WRD will initiate negotiation with the top-rated proposer. If WRD is unable to reach an agreement with the top-rated proposer, negotiations will be formally terminated. WRD will then negotiate with the next highest-ranked proposer and so on until an agreement is reached. Once negotiations with a proposer are terminated, WRD will not renegotiate with that proposer.

The firm that is recommended to the WRD Board of Directors for award of contract will be the one whose proposal is determined to be the most advantageous to the District in consideration of price and all other evaluation factors that are set forth in this RFP. No other factors or criteria not listed in this RFP shall be used in the evaluation.

10.0 EVALUATION CRITERIA

Selection will be made on the basis of WRD’s judgment as to which proposal best serves WRD’s interest. The proposal will be evaluated on the basis of the criteria listed below in this section. Proposals also will be evaluated based on the clarity, completeness, and professional quality of the documents submitted, as well as conformance to the RFP instructions and responsiveness to the RFP requirements in a straightforward and concise manner.

10.1 Project Team and Qualifications

Project team’s technical and management competence to perform the work specified herein will be evaluated. Considerations include, but are not limited to the following:

- Professional qualifications and education of the project team.
- Expertise and the appropriate mix of skills and disciplines of the project team and percentage of work to be self-performed.
- The accessibility and commitment of the Proposer’s key personnel and subconsultants/subcontractors to successfully complete assigned projects, including the geographic proximity of each team member’s primary office location with respect to the District’s service area.
• Ability to perform work on short notice and anticipated response times.

• Capacity and flexibility to complete high quality work in a timely manner that meets the established schedule.

• Familiarity with the policies and procedures of the District, County, and other local agencies.

10.2 Project Understanding and Approach

The following will be considered in the evaluation of proposals:

• Understanding of the nature of professional services contracts and expected tasks to be performed.

• Work schedule and methodology to completing assigned tasks, specifically with regards to budget sensitivity, efficiency, adherence to District standards and applicable regulatory codes, and pertinence of the assigned tasks.

• Demonstration on how the Proposer will organize the execution of assigned projects, including the make-up of the team, the leadership of the team, the accountability of the Project Manager, and the lines of authority.

• A strong project management structure that includes clearly defined communications protocols (including how the Proposer’s staff will interact with the District’s team and project manager), procedures for coordination throughout the assigned project, and subconsultant/subcontractor integration.

• A solid quality assurance and control program that demonstrates a clear understanding of the need and process of ensuring WRD receives the highest quality product required for assigned projects.

• Overall clarity, creativity, and logic, and completeness of the approach. The proposal should demonstrate interest and insight to the specific details of WRD’s desired services.

• Other services or considerations not addressed in the RFP, but were deemed to be pertinent to the scope of services by the Proposer.

10.3 Performance on Similar or Related Projects

WRD reserves the right to conduct an independent verification of the Proposer’s experience qualifications by contacting project references, accessing public information, or contacting independent parties. Prospective proposers shall respond and provide additional information that may be requested during the evaluation of proposals. Factors to be considered will include, but may not be limited to, experience with similar projects, project coordination, cost control, quality of work, technical capability, and adherence to project schedules and standards.
10.4 Billing Rates

Hourly billing rates, including markup rates, will be evaluated with respect to the anticipated overall value for services proposed.

10.5 Organizational and Support Resources

The following will be considered in the evaluation of proposals:

1. Capability under current workload to perform the work specified herein. Factors to be considered include, but may not be limited to, number of qualified staff allocated to assigned projects, availability of key personnel and support staff, knowledge of local conditions, and demonstrated ability to meet proposed project schedules.

2. Anticipated response times after notification of work assignments by WRD.

10.6 Local Business Enterprise (LBE) and Small Business Enterprise (SBE) and Veteran Business Enterprise (VBE) Preference

The District may give preference in the evaluation of proposals to proposers based on the extent of participation demonstrated through compliance with LBE, SBE, and VBE participation. For purposes of this evaluation, the District may provide preference of up to 5% of the total evaluation points for consultants with at least 20% participations of LBE or at least 20% participations of SBE/VBE.

A Local Business Enterprise (LBE) is defined as a vendor, contractor, or consultant who has a valid physical business address and an established place of business: (1) located within five miles of the District’s service boundary or (2) located within a city that is situated within five miles of the District’s service boundary.

A Small Business Enterprise (SBE) shall mean a small business enterprise certified as such by any branch of the Federal Government, the State of California, or by any other Public Entity within the State of California as defined by California Public Contract Code Section 1100. To qualify for the SBE Preference, SBEs must be certified as such at the time the proposal is submitted to the District. Proof of certification should be submitted to the District along with the proposal, and not later than two (2) business days after the deadline for submitting proposals. Proof shall include a copy of each SBE’s certification or other appropriate documentary evidence by the certifying public entity. Proof of certification may be subject to verification by the District. The District shall not, however, be required to verify the accuracy of any such certifications, and shall have the sole discretion to determine if a respondent is a SBE. Companies having certifications for Veteran Business Enterprise (VBE) may submit such certifications, which may be used by the District in partial fulfillment of the 20% SBE participation.
For companies with multiple offices, the office affiliation of the proposed individuals working on the project will be used as a means to estimate the company’s LBE participation.

For Local Business Enterprise (LBE), Small Business Enterprise (SBE), and Veteran Business Enterprise (VBE) preference consideration, the Consultant and Subconsultant Status as LBE, SBE, and VBE form, which is attached to this RFP as Attachment B, must be completed.

11.0 GENERAL PROVISIONS

The Proposer should specify if any of the requirements included in this section or any other section of the RFP pose a specific problem, and if so, identify the problem and its impact within the proposal.

11.1 Entire Agreement

The services described in this RFP, the successful proposal (with any proposed optional tasks) approved by WRD, the purchase order, and any written changes or amendments to the scope of services shall represent the entire Agreement between the parties and shall supersede all prior written or oral representations, discussions, and agreements. Furthermore, this RFP is not only meant to aid in the preparation of proposals, but it is also intended to serve as a binding technical guidance document for the Consultant. The consulting firm awarded a contract to provide services described in this RFP shall be deemed bound to execute all requirements as listed and prescribed in this RFP, unless WRD modifies aspects of the scope of work or any conditions in the RFP in writing. Thus, the executed Contract will incorporate the terms and conditions specified in this RFP, as well as the final scope of work and fee schedule submitted by the Consultant as part of its proposal.

11.2 Contract Amendments

Changes that affect the scope of work, period of performance or time schedule, and costs will be effected by written notices of amendment. No payments will be made for work performed outside the original scope of work unless prior written approval was granted by WRD. The Consultant may be required to provide additional services under a negotiated change order approved in writing by WRD.

11.3 Term of Contract

Upon approval by the WRD Board of Directors, the District shall enter into a contract with a maximum term of two years with selected firm.
11.4 Ownership and Use of Documents

Consultant will be required to treat WRD’s documents in confidence and shall indemnify WRD in case of alteration, loss, or damage thereto. Consultant shall not release to the general public, public agencies, or private businesses in any manner, any information, data, or documents developed pursuant to the performance of services specified herein without the expressed written consent of WRD.

Any preliminary or working drafts, notes, and inter-agency or intra-agency memoranda that are not expected to be retained by the Consultant or WRD in the ordinary course of business shall be exempt from disclosure to any public entity under provisions of the Public Records Act.

11.5 Business Records Access and Retention

All records pertaining to this Project, which are retained by the Consultant, shall be accessible to WRD while work is ongoing and for at least five years thereafter.

11.6 Termination

WRD may terminate the project at any time at its sole discretion. Notice of termination will be provided in writing. Upon termination of the project, WRD shall make payment to the Consultant only for services provided up to the date of termination.

12.0 TERMS AND CONDITIONS

12.1 Proposal Rejection

WRD reserves the right to accept or reject any or all proposals received in response to this RFP or cancel in whole or part the selection process if it is in the best interest of the District to do so. Alternatively, the District reserves the right to waive any minor defect or technicality in any proposal received.

12.2 Proposal Clarification and Requests for Additional Information

All proposals shall be afforded fair and equal treatment with respect to any opportunity for clarification. WRD reserves the right to request clarification of information submitted and to request additional information from any or all proposers. The District may require any evidence it deems necessary, such as documentation regarding the Proposer’s financial stability, before any contract is awarded. In conducting discussions with proposers, there shall be no disclosure of information derived from proposals submitted by competing firms.

12.3 Proposal Validity Period
Proposers may withdraw their proposals at any time prior to the due date and time by submitting a written notification of withdrawal signed by the firm’s authorized agent. Proposers who withdraw their proposals prior to the designated date and time may still submit another proposal if done in accordance within the proper time frame. A proposal cannot be changed or modified after it has been submitted by the designed due date and time and shall constitute an irrevocable offer, for a period of ninety (90) days, to WRD for the services set forth in the proposal.

12.4 RFP Revisions and Addenda

WRD reserves the right to issue a written Addendum or Addenda to provide further clarification or make revisions/corrections to the RFP. All Addenda will be issued via e-mail to prospective proposers who were initially forwarded the RFP via e-mail as well as other prospective proposers who have subsequently provided WRD with their contact information (i.e. e-mail address and telephone number). All Addenda will also be posted on the WRD website (http://www.wrd.org/business/water-replenishment-business.php) within a reasonable timeframe prior to the proposal due date. If an Addendum is necessary within 72 hours of the proposal submittal deadline, the District, at its discretion, can extend the proposal submittal deadline. Any Addendum issued must be acknowledged by the Proposer by signing and submitting the “Acknowledgment of Addendum” form that will be provided with each Addendum. All Acknowledgment of Addendum forms must be submitted to WRD as part of the proposal package that is submitted by the proposal due date. Failure to acknowledge any Addenda may result in the proposal being considered nonresponsive and subject to rejection.

The Proposer shall be responsible for ensuring that its proposal reflects any and all addenda issued by the District prior to the submittal due date. Therefore, the District recommends that prospective proposers check the WRD website prior to making their submission.

12.5 Confidentiality

The content of proposals will be kept confidential until the award of contract by the WRD’s Board of Directors. All materials submitted in response to this RFP will become the property of the WRD and will become public record after award of contract to the successful Consultant. The WRD will not return any proposals to proposers.

If a Proposer believes any portion of its proposal contains confidential or proprietary information, exempt from public disclosures under the California Public Records Act, the Proposer must label that information within its proposal as “CONFIDENTIAL”, “TRADE SECRET”, or “PROPRIETARY.” The above restrictions may not include cost or price information, which shall be open to the public upon award of contract. Notwithstanding the foregoing, the District will not be responsible or liable in any way for losses that the Proposer may incur from the disclosure of information or material to third parties.
13.0 LEGAL POLICIES

13.1 Compliance

The Consultant shall abide by and obey all applicable federal, state, and local laws, rules, regulations, and ordinances.

13.2 Governing Laws and Requirements

Performance of services herein shall be governed and construed in accordance with the laws of the State of California. The selected Consultant hereby agrees that in any action relative to the performance of said services, venue shall be in the County of Los Angeles, State of California.

13.3 Public Releases

The Consultant agrees not to use or otherwise make public in any manner, either for profit or nonprofit, any of the information, data, procedures, systems, or documentation developed pursuant to the performance of services specified herein without the expressed written permission of WRD.

13.4 Business License

The Consultant will be required to show evidence of all valid and applicable business license(s), which must be in effect during the period of the performance of services specified herein.

13.5 WRD’s Property

All deliverables submitted pursuant to the performance of services specified herein shall become the sole property of WRD and they may be used in any manner and for any purpose WRD deems in its best interest.
ATTACHMENTS
Attachment A

Key Personnel Participation in Example Projects
### KEY PERSONNEL PARTICIPATION IN EXAMPLE PROJECTS

<table>
<thead>
<tr>
<th>NAMES OF KEY PERSONNEL</th>
<th>ROLE IN THIS PROPOSAL</th>
<th>EXAMPLE PROJECTS LISTED IN SECTION 4.2.1</th>
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<tr>
<td>John D.</td>
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<td>Const. Manager</td>
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<td>Peter L.</td>
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#### EXAMPLE PROJECTS KEY

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# ATTACHMENT A

## KEY PERSONNEL PARTICIPATION IN EXAMPLE PROJECTS

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<th>NAMES OF KEY PERSONNEL</th>
<th>ROLE IN THIS PROPOSAL</th>
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## EXAMPLE PROJECTS KEY

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Attachment B

Consultant and Subconsultant Status as LBE, SBE and VBE
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<th>Status of SBE and VBE</th>
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Attachment C

WRD Standard Agreement for Professional Services
PROFESSIONAL SERVICES AGREEMENT
[INSERT CONTRACTOR NAME]

This Professional Services Agreement (the “Agreement”) is made and entered into this [day of __________, _______] by and between the Water Replenishment District of Southern California (“District”) and [Insert Contractor Name] (“Consultant”) (collectively the “Parties” or individually as “Party”) for the furnishing of certain professional services upon the following terms and conditions.

1. Scope of Services. Consultant shall perform the scope of services described in Exhibit A hereto (“Services”). Tasks other than those specifically described in Exhibit A shall not be performed without a prior written amendment to this Agreement.

1.1 Standard of Care. In performing the scope of services under this Agreement, Consultant shall exercise the standard of care and expertise prevailing in California for the performance of such services.

2. Term. The term of this Agreement shall commence on [Month, Day, Year] and shall end on [Month, Day, Year] (the “Expiration Date”). At least sixty (60) days prior to the Expiration Date, District staff shall evaluate the quality of the Services that have been provided by the Consultant, the cost of such Services relative to the benefits, and the need for any continuation of the services. The results of such evaluation shall be provided to the appropriate District Committee, which committee shall provide a report to the District’s Board of Directors (“Board”). If the Board determines that there is a demonstrated need for the continuation of such Services, the Board may renew the Agreement on terms and conditions that do not provide for a significantly longer term, increased scope of services or increased fee schedule than is provided for in Paragraphs 1 or this Paragraph 2. If the Board desires to modify the Agreement to provide for such a significantly longer term, increased scope of services or increased fee schedule, the District shall comply with the provisions of its then current Administrative Code concerning the solicitation and approval of proposals for professional services.

2.1 Termination by District

2.1.1 Termination for Convenience. The District may terminate this Agreement for its convenience at any time upon five (5) days written notice to Consultant. Consultant’s compensation in the event of such a termination shall be exclusively limited to payment for all authorized services performed and for all authorized expenses incurred up to the effective date.
of such termination. Consultant understands and agrees that it shall not be entitled to any additional compensation or reimbursement whatsoever in the event of such termination.

2.1.2 Consultant’s Obligations Upon Termination. Following any termination of this Agreement by the District or Consultant, the Consultant shall promptly return all District property, and shall likewise provide to District all finished and unfinished data, studies, maps, reports, and other deliverables and work-product prepared by Consultant pursuant to this Agreement.

3. Consultant’s Compensation. District will compensate Consultant for services performed and for expenses incurred pursuant to this Agreement as follows:

3.1 Fee. Consultant shall be paid in accordance with the fees and Consultant Rate Schedule attached to this Agreement as Exhibit B which may not be changed except with District’s written approval.

3.2 Reimbursable Expenses. Consultant shall be reimbursed for only pre-approved expenses, subject to the provisions of this Agreement. Consultant shall obtain the District’s prior written approval before incurring an expense not specifically provided for under this Agreement.

3.2.1 Third Party Expenses. Unless specifically provided in Exhibit B, and subject to the provisions of Paragraph 3.2, the District shall not reimburse Consultant for any costs charged to Consultant by third parties unless said costs are preapproved. In the event such costs are approved, such reimbursement shall be at cost without any markup by Consultant.

3.3 Invoices. Within thirty (30) days of Agreement execution, the Consultant shall include a Form W-9 as a prerequisite for payment. Consultant is to include the District’s purchase order number when submitting monthly invoices to District for services performed and expenses incurred during the preceding month. District shall process Consultant’s invoice upon receipt and issue any undisputed payment in a timely manner. Consultant’s invoices shall separately identify all personnel for whose services payment is sought, the services performed, and all expenses for which reimbursement is requested. As a condition precedent to payment, District may require Consultant to furnish supporting information and documentation for all charges for which payment is sought. District shall have the right to withhold from payments to Consultant reasonably disputed amounts including, without limitation, amounts for services not performed in accordance with this Agreement and costs, expenses or damages incurred by District as a result of Consultant’s breach of this Agreement or Consultant’s negligence.

4. Consultant’s Obligation to Provide Notice of Changes. Consultant shall provide written notice to the District no later than twenty (20) days after the occurrence of any event (including any direction by the District) which Consultant believes requires a change in its
compensation or the time for performance of its obligations under this Agreement. Said notice shall describe the event and the basis for any change in compensation or time for performance requested by Consultant. The Parties shall thereafter meet and confer to determine whether such a change is appropriate. However, no such change to this Agreement may be made except by written amendment to this Agreement executed by the Parties. Consultant’s failure to provide the notice required under this Paragraph shall constitute a waiver of its right to seek a change in its compensation or the time for performance of its obligations under this Agreement.

5. **Ownership and Use of Documents.** All proprietary information developed by Consultant in connection with, or resulting from, this Agreement, including but not limited to inventions, discoveries, improvements, copyrights, patents, maps, reports, textual material or software programs, shall be the sole and exclusive property of the District. Consultant agrees that the compensation to be paid pursuant to this Agreement includes adequate and sufficient compensation for any proprietary information developed in connection with or resulting from this Agreement. Consultant further understands and agrees that full disclosure of all proprietary information developed in connection with, or resulting from, this Agreement shall be made to the District, and that Consultant shall do all things necessary and proper to perfect and maintain District’s ownership of such proprietary information. All documents, reports, surveys, renderings, photographs, data and other materials furnished by the District to Consultant shall remain the exclusive property of the District and shall not be distributed or provided to third parties without the express written authorization of the District.

6. **Publication of Project Information.** Consultant shall notify and obtain written approval from the District before presenting verbal or written information to outside individuals or entities about the services or project for which Consultant was retained.

7. **Patents and Copyrights.** The Consultant shall assume all costs arising from the use of patented or copyrighted materials, including but not limited to, equipment, devices, processes, and software programs used or incorporated in the work performed under this Agreement. Consultant shall defend, indemnify hold the District, its officers, directors agents, employees, representatives and assigns harmless from any and all claims, demands, suits at law, and actions of every nature for or on account of the use of any patented or copyrighted materials.

8. **Consultant’s Status.** Consultant is an independent contractor and neither Consultant nor any employee of Consultant is or will be treated as an employee of the District under this Agreement. District controls the result to be accomplished under this Agreement, but not the means by which Consultant achieves such results.

8.1 Payments made to Consultant pursuant to this Agreement shall be the sole and complete compensation to which Consultant is entitled. Consultant is solely responsible for any taxes levied by local, state or federal authorities on such sums. Consultant shall defend and indemnify the District for any taxes, fines, penalties and attorneys’ fees assessed or threatened to be assessed against District for failure
to properly withhold taxes as a result of any determination that Consultant, or any of Consultant’s employees, is an employee rather than an independent contractor of District.

8.2 District will not make any contribution to any retirement plan or Social Security on behalf of Consultant or any of Consultant’s employees. Consultant shall defend and indemnify the District for any contribution, fines, penalties and attorneys’ fees assessed or threatened to be assessed against District for failure to contribute to any retirement plan or Social Security as a result of any determination that Consultant, or any of Consultant’s employees, is an employee rather than an independent contractor of District.

8.3 District will not make any payments to Consultant, or Consultant’s employees, which rely upon employee status, including, but not limited to, FLSA and other overtime and minimum wage requirements, prevailing wage laws, worker’s compensation benefits, FMLA, CFRA, Paid Leave, and unemployment benefits. Consultant shall defend and indemnify the District for any payment, fines, penalties and attorneys’ fees assessed or threatened to be assessed against District for failure to make any such payment or otherwise provide the benefits of such laws as a result of any determination that Consultant, or any of Consultant’s employees, is an employee rather than an independent contractor of District.

8.4 Consultant shall comply with the Political Reform Act of 1974, as amended including, but not limited to, disclosure of all conflicts of interest and other financial disclosure requirements required thereunder.

9. **Instructions to Consultant.** In the performance of the services set forth in this Agreement, Consultant shall report to and receive instructions from the following person(s) on behalf of the District: [Insert Name]

10. **Subconsultant Services.** Any subconsultants to be used by Consultant in the performance of the scope of services shall be identified in Exhibit A hereto. Consultant shall obtain the District’s prior written approval before retaining a subconsultant to perform any portion of the scope of services of this Agreement. Notwithstanding Consultant’s use of any subconsultants, Consultant shall be responsible to the District for the performance of its subconsultants as it would be if Consultant had performed those services itself. Nothing in this Agreement shall be deemed or construed to create a contractual relationship between the District and any subconsultant employed by Consultant. Consultant shall be solely responsible for payments to any subconsultants. Consultant shall defend and indemnify the District for any payment, fines or penalties assessed or threatened to be assessed against District as a result of any claim brought by any subconsultant of Consultant for any matter arising from, or related to, the services performed by subconsultant under this Agreement.

11. **Compliance With Laws and Regulations; Licensing.** Consultant shall perform its services under this Agreement in compliance with all applicable provisions of Federal, State and
local laws, statutes, codes, rules, regulations, ordinances and professional standards ("Applicable Laws"). By entering into this Agreement, Consultant represents and warrants that it possesses and will keep current all license and registrations required by Applicable Laws to enter into this Agreement and to perform the scope of services hereunder.

12. **Insurance.** Consultant, at its sole cost and expense, shall obtain, keep in force, and maintain the following policies of insurance at all times while this Agreement is in effect, and shall not commence any work under this Agreement until proof of such insurance has been provided to the District. The coverages provided by such insurance shall not be construed as limitations of liability.

12.1 **Required Policies.**

12.1.1 **Commercial General Liability Insurance** (contractual, products, and completed operations coverages included) with a combined single limit of no less than $2,000,000 per occurrence or the full per occurrence limits of the policies available, whichever is greater for bodily injury, personal injury and property damage.

12.1.2 **Business or Comprehensive Automobile Liability Insurance** for owned, scheduled, non-owned, or hired automobiles, with a combined single limit of no less than $1,000,000 per accident.

12.1.3 **Professional Liability Insurance** with limits of $1,000,000 per claim and $1,000,000 in the aggregate.

12.1.4 **Employers’ Liability Insurance** with limits of $1,000,000 per claim and $1,000,000 in the aggregate.

12.1.5 **Workers’ Compensation Insurance** as required under the Workers’ Compensation Insurance and Safety Act of the State of California.

12.2 **Required Terms.**

12.2.1 All polices except workers’ compensation and professional liability, shall name as additional insureds the Water Replenishment District of Southern California, its directors, officers, employees, agents authorized volunteers and representatives. The coverage shall contain no special limitations on the scope of protection afforded the District, its directors, officers, employees, or authorized volunteers.

12.2.2 All policies shall be written on an occurrence basis. If a policy may only be obtained on a claims made basis, the policy shall be maintained continuously for a period of no less than three (3) years after the date of final completion of the scope of services under this Agreement.
12.2.3 All policies shall provide that coverage cannot be cancelled without thirty (30) days prior written notice to the District.

12.2.4 All insurance required under this Agreement shall be considered primary to any insurance maintained by the District. All policies except Professional Liability shall include waivers of subrogation in favor of the District and its insurers.

12.2.5 Any failure to comply with reporting or other provisions of the policies including breaches of warranties shall not affect coverage provided to District, its directors, officers, employees, or authorized volunteers.

12.2.6 The Consultant’s insurance shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer’s liability.

12.2.7 Liability insurance shall indemnify the Consultant and his/her sub-contractors against loss from liability imposed by law upon, or assumed under contract by, the Consultant his/her sub-contractors for damages on account of such bodily injury (including death), property damage, personal injury, completed operations, and products liability.

12.2.8 Deductibles and Self-Insured Retentions – Any deductible or self-insured retention must be declared to and approved by District. At the option of District, the insurer shall either reduce or eliminate such deductibles or self-insured retentions. Policies containing any self-insured retention (SIR) provision shall provide or be endorsed to provide that the SIR may be satisfied by either the named or additional insureds, co-insurers, and/or insureds other than the first named insured.

12.2.9 Evidence of Insurance – Prior to execution of the agreement, the Consultant shall file with District a certificate of insurance signed by the insurer’s representative evidencing the coverage required by this agreement. Such evidence shall include an additional insured endorsement signed by the insurer’s representative. Such evidence shall also comply with the Evidence and Required Forms of Insurance attached hereto as Exhibit C. In the event that the Consultant employs other contractors (sub-contractors) as part of the work covered by this agreement, it shall be the Consultant’s responsibility to require and confirm that each sub-contractor meets the minimum insurance requirements specified above. Failure to continually satisfy the Insurance requirements is a material breach of contract.

12.2.10 All polices required under this Agreement shall be issued by companies authorized to transact insurance business in the State of California acceptable to the District and having a Best rating of A- or equivalent or as otherwise approved by District.
13. **Indemnification.** Consultant shall indemnify, defend and hold harmless the District and its directors, officers, employees, agents and representatives (collectively “District”), from and against any and all claims, liabilities, costs, damages, suits, proceedings, injuries (including injuries to real and personal property, and injuries to persons, including death) incurred by District (“Losses”), as a result of Consultant’s breach of any provision of this Agreement, Consultant’s failure to comply with applicable laws, Consultant’s negligent acts or omissions, or Consultant’s willful misconduct. However, Consultant’s obligation to defend shall arise regardless of any claim or assertion that the District caused or contributed to the Losses. Nothing in this paragraph shall constitute a waiver or limitation of any legal rights which the District may have including, without limitation, the right to implied indemnity.

14. **Arbitration and Attorneys’ Fees.** Any dispute arising from or relating to this Agreement shall be submitted to final and binding arbitration before an arbitrator who is a member of the National Academy of Arbitrators. The parties will obtain a list of five names of potential arbitrators from the National Academy of Arbitrators, or the American Arbitration Association, and will take turns striking the names of arbitrators until one arbitrator remains, who shall preside over the arbitration. The arbitrator will have no power to rewrite any of the terms of this Agreement. The parties shall split the cost of the arbitrator’s fee and any court reporter required by the arbitrator or if both parties agree to having the proceedings taken down by a court reporter. The prevailing Party in any action arising from or relating to this Agreement shall be entitled to recover its reasonable attorneys’ fees, expert witness fees and arbitration fees and costs in addition to any other relief and recovery ordered by the arbitrator or other tribunal hearing any matter related to this Agreement.

15. **Conflict of Interest.** No official of the District who is authorized in such capacity and on behalf of the District to negotiate, make, accept or approve, or to take part in negotiating, making, accepting or approving this Agreement, or any contract or subcontract relating to work to be performed pursuant to this Agreement, shall become directly or indirectly personally interested in this Agreement or in any part thereof. Consultant shall not accept employment or contract during the term of this Agreement with any firm or individual for the provision of services if such employment or contract would conflict directly with the Services provided to the District under this Agreement.

16. **Equal Opportunity.** During the performance of this Agreement, Consultant shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, age, marital status or national origin.

17. **Successors and Assigns.** This Agreement shall inure to the benefit of, and be binding upon, the District, Consultant, and their respective successors and assigns provided, however, that no assignment of the duties or benefits under this Agreement shall be made without the written consent of the Consultant and the District.

18. **Choice of Law and Venue.** This Agreement shall be governed by and interpreted in accordance with the laws of the State of California. The Parties agree that the exclusive
venue for any action or proceeding arising from or relating to this Agreement shall be in the County of Los Angeles, State of California.

19. **Notices.** All notices provided by this agreement shall be in writing and shall be sent by first-class mail and facsimile transmission as follows:

If to the District:

Water Replenishment District of
Southern California
Attn: WRD Project Manager
WRD Contract Administrator
4040 Paramount Blvd.
Lakewood, CA 90712
Phone: (562) 921-5521
Fax: (562) 921-6101

If to Consultant:

Contact Name: __________________________
Address: ______________________________
Address: ______________________________
City, State ZIP: _________________________
Phone: ________________________________
Fax: _________________________________
Email: ________________________________

20. **Amendments.** This Agreement may be modified only by a writing signed by the Parties hereto.

21. **Integration; Construction.** This Agreement (inclusive of exhibits incorporated herein by this reference) sets forth the final, complete and exclusive expression of the Parties’ agreement with respect to the subject matter hereof, and supersedes any and all other agreements, representations, and promises, whether made orally or in writing. Notwithstanding anything in Exhibit A to the contrary (or any invoice or other unilateral terms or conditions provided by Consultant), in the event of any conflict or inconsistency between this Agreement and Exhibit A (or any invoice or other unilateral terms or conditions provided by Consultant), this Agreement shall control. The Parties represent and warrant that they are not entering into this Agreement based upon any representation or understanding that is not expressly set forth in this Agreement. This Agreement shall

Water Replenishment District of
Southern California

[insert contractor name]
be construed as the product of a joint effort between the Parties and shall not be construed against either Party as its drafter.

22. **Effective Date.** This Agreement is effective as of the date first set forth above.

23. **Authority.** Each person signing this Agreement represents that he or she has the authority to do so on behalf of the Party for whom he or she is signing.

IN WITNESS WHEREOF, the Parties have caused this AGREEMENT to be executed the day and year first above written.

**WATER REPLENISHMENT DISTRICT OF SOUTHERN CALIFORNIA**

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<table>
<thead>
<tr>
<th>Signature</th>
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<tbody>
<tr>
<td>Robert Katherman</td>
<td>Sergio Calderon</td>
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<tr>
<td>Print Name</td>
<td>Print Name</td>
</tr>
<tr>
<td>President, Board of Directors</td>
<td>Secretary, Board of Directors</td>
</tr>
<tr>
<td>Title</td>
<td>Title</td>
</tr>
</tbody>
</table>

[INSERT CONTRACTOR NAME], ("CONSULTANT")

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<table>
<thead>
<tr>
<th>Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Print Name</td>
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<tr>
<td>Title</td>
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</tbody>
</table>

**Approved As To Form**

**LEAL, TREJO LLP**

Attorneys for the Water Replenishment District of Southern California

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Water Replenishment District of Southern California 9

Professional Services Contract

[insert contractor name]
EXHIBIT A
SCOPE OF WORK

[Insert detailed description of scope of work.]
EXHIBIT B
CONSULTANT RATE SCHEDULE

Attach provided Rate Schedule Here.

If Rate Schedule/Budget is not included in proposal, complete the following:

1.0 Consultant shall be compensated for actual services performed in accordance with this Agreement [insert appropriate language: at the hourly rates, monthly sum or the lump sum amount.]

2.0 A budgetary amount of $[_________] (which amount applies to Consultant’s fee and reimbursable expenses) is established for this Agreement. Notwithstanding any other provision of this Agreement, the District shall not be obligated to pay Consultant any amount in excess of said budgetary amount absent prior written approval from the District. Likewise, Consultant shall not be obligated to perform services or incur expenses in excess of the budgetary amount absent prior written approval from the District.

[Insert additional terms as needed after consultation with counsel.]
EXHIBIT C
EVIDENCE AND REQUIRED FORMS OF INSURANCE

Checklist for Additional Insured Endorsement

Contractor Name: ____________________________

Project Name: ____________________________

Refer to the Additional Insured Endorsements forms E1-5 following:

☐ Additional Insured (AI) Status – GENERAL LIABILITY - Member Water District, its directors, officers, employees, or authorized volunteers are named as additional insureds – as broad as following forms:
  o Form CG 20 10 11 85 (E1) or
  o BOTH CG 20 10 (E2) and CG 20 37 (E3) if forms with later edition dates provided (usually 10 01 or 07 04 editions). Also acceptable CG 20 10 04 13 (or older editions E2) specifically naming the District parties or using language that states "as required by contract"
  o “Blanket” Endorsement - (no specific policy number) (E4) covering one or more of the above endorsements required with words "as required by written contract/agreement"
  o If large number of Subcontractors - Additional Insured endorsement CG 20 38 04 13 recommended. (E5)
    o Policy numbers - matches policy number shown on Certificate of Insurance. (see Optional Dec. Page/Endorsement pages below)
    o Primary Coverage – The primary/non-contributory language is included.
      "The insurance provided by this policy shall be primary as respects any claims related to the ___________ Project. Any insurance, self-insurance, or other coverage maintained by the district, its directors, officers, employees, or volunteers shall not contribute to it." e.g. Form CG 20 01 (E6)

☐ Auto liability (Optional (E7)) AI - most standard forms have automatic AI but some carriers provide endorsement

☐ Waiver of Subrogation (Workers Compensation and Property (Course of Construction, if required in contract) (E8)

☐ Optional - For extra confidence in verifying coverage require Declaration Page and Endorsement Schedule pages - compare the endorsement numbers. Look out for Amendment of contractual liability and or prior works exclusions - refer to Legal Counsel.
EXHIBIT A-2

SCOPE OF WORK
3. Project Overview & Approach

PROJECT UNDERSTANDING

The Butier Team understands that the District is seeking a qualified consulting firm to perform professional construction management and inspection services of treatment systems through start-up for three wellhead locations. The purpose of the project is to install wellhead treatment equipment on wells that have been identified under the Safe Drinking Water Program as contaminated with volatile organic compounds (VOCs). The contaminant for all of the wells is Trichloroethylene (TCE) and the proposed treatment system for each is the Granular Activated Carbon (GAC) System. The three wells that have recently been selected for inclusion in the project include the following:

<table>
<thead>
<tr>
<th>Well / Location</th>
<th>Capacity</th>
<th>Design Stage</th>
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</thead>
<tbody>
<tr>
<td>City of Huntington Park Well No. 15</td>
<td>1100 gpm</td>
<td>65% Tetra Tech</td>
</tr>
<tr>
<td>City of Lynwood Well No. 11</td>
<td>650 gpm</td>
<td>85% KEH &amp; Associates</td>
</tr>
<tr>
<td>California American Water Company</td>
<td>800 gpm</td>
<td>90% Valentine Environmental Engineers</td>
</tr>
</tbody>
</table>

The estimated cost of construction for each well is $1 million - $1.5 million. The projects will be staggered and are expected to overlap. It is anticipated that the combined project duration will be less than two years with each well taking six (6) to eight (8) months from NTP to start-up. The actual labor hours spent on site isn’t expected to take the full 6 - 8 months.

Most of the project duration will consist of procuring the wellhead treatment equipment, which has a long lead time. Each separate bidding will include the purchase and installation of the treatment equipment. It will not be pre-purchased by the District. The site work is minimal and will consist mostly of pipe work and concrete foundations.

SCOPE OF WORK

1. Meetings

A. Kick-off Meeting

The Butier Team will schedule and facilitate a kick-off meeting with WRD personnel to discuss the scope of work, project team, and project schedule and to receive any additional background information. In addition, the Butier Team will schedule and facilitate kick-off meetings with each of the pumpers, project stakeholders and WRD staff to discuss the following: any prior treatment that may have been performed; contract administration guidelines; contractual roles; and reinforcement of specific requirements for safety, access, and coordination issues for the work. The CM/Lead Inspector will provide a meeting agenda three (3) days in advance of the meeting and transmit meeting minutes to all attendees within three (3) business days.

B. Monthly Progress Meetings

The Project Manager and CM/Lead Inspector will schedule and conduct construction progress meetings with WRD staff and purveyor representatives and provide meeting agendas. Topics discussed at the meetings will include the project schedule; near-term activities; clarifications and problems that need resolution; coordination with other Contractors; status of change orders, submittals, and RFIs; safety issues; OSHA visits and citations; and other topics. The PM and CM/Lead Inspector will identify action items and assign responsibility for the action and date action is to be completed; prepare minutes of the meetings and include identified action items; review the meeting minutes with the Contractors and obtain the Contractors’ concurrence with the content; and distribute the minutes to the attendees within five (5) calendar days of the meeting.

C. Pre-Construction Scheduling Meeting

Butier’s Project Manager / Senior Scheduler and CM/Lead Inspector will facilitate a pre-construction scheduling meeting with the District and the Contractors to discuss the scheduling specification requirements and format. The meetings will facilitate timely submittal, review, and approval of the Baseline Schedules and help to reduce the number of resubmittals. The CM/Lead Inspector will prepare an agenda 5 business days prior to the meetings and submit to the District for approval. The CM/Lead Inspector will distribute meeting minutes to all attendees within 3 business days of the meetings.
2. Constructability Review

Prior to bid of each project, the Butler Team will review the plans and specifications (including the bid schedule). Written comments will be provided related solely to the completeness and adequacy of the documents for bidding and construction purposes. Particular emphasis will be placed on the adequacy of the documents for constructability, promotion of site safety, avoidance of construction contractor claims and construction cost overruns, meeting environmental compliance, and meeting overall project schedules. The Team will identify ambiguities, conflicts, lack of clarity, and use of unnecessarily restrictive requirements.

The CM team—consisting of professional civil, mechanical, and electrical engineers—will implement a checklist for thorough constructability reviews through final design completion of the project plans, technical specifications, and estimates provided by the design consultants (KEH & Associates, Tetra Tech, and Valentine Environmental Engineers). The CM Team will prepare a report for each project for review, comment, and approval by the District prior to submitting comments to the design consultants. The constructability reviews will include, but not be limited to, the following: technical elements of the design; completeness and compatibility of the plans and technical specifications; compatibility of the design packages; and feasibility of the construction staging/phasing.

Review comments will address the minimization of interference between all construction contractors working at the various sites. The Team will provide review comments to the District in a written report, consistent with the design review schedule. The review comments will be provided electronically in a spreadsheet format specified by the Design Engineers and the WRD Project Manager.

3. Construction Management

A. Bid Advertisement and Award

Our Team can assist the District in conducting contractor outreach to help publicize the projects and ensure an adequate number of bidders. Effective bidder outreach will help to ensure that large bidding pools are created. Our Team can also assist the District by conducting effective pre-bid meetings including site tours, if necessary. These serve to inform bidders about key project issues and requirements resulting in more responsive bids and better bid prices. The CM Team will assist District staff with the advertisement for bids, conduct pre-bid meetings, be available to answer questions that any potential bidder may have, receive and evaluate all bids submitted, prepare a bid summary sheet of all bids, conduct a reference check on the apparent low bidders, and provide recommendations to the District for bid award. The PM will assist the District with any bid protests and contract negotiations.

B. Pre-Construction Meeting

The Project Manager and CM/Lead Inspector will schedule and facilitate pre-construction meetings for each project with the Contractors and the District. The project team will outline the following to the Contractors: contract administration guidelines, contractual roles, reinforcement of specific requirements for safety, access, and coordination issues for the work. The CM will provide a meeting agenda 3 days in advance of the meeting and transmit meeting minutes to all attendees within 2 business days.

C. Weekly Project Progress Meetings

The Project Manager and CM/Lead Inspector will facilitate weekly construction progress meetings for each project with the Contractors, the District and other necessary stakeholders. The CM/Lead Inspector will prepare an agenda prior to the meeting and distribute meeting minutes within 3 business days. The meetings will cover site safety, progress, job problems, and any actions requiring clarification of design intent, ambiguities in contract documents, and other key issues. Action monitoring will be implemented to ensure compliance and timely response by all parties.

D. Document Control System

Butler utilizes cloud-based construction project management software. The program affords the project team with 24/7 visibility into project status and a centralized, comprehensive platform to manage all vital project data. The program will allow us to create "dashboards" specific to the user. This will allow District staff and vital stakeholders to quickly access project records for key metrics and provide near real-time updates of project progress.

E. Shop Drawings and Submittal Reviews

The Butler Team will be responsible for processing and monitoring the status of submittals for each project. Using a systematic tracking procedure established by the CM/Lead Inspector for timely submittal review and processing of shop drawings with means for acceleration of review possible for significant critical controlling shop drawings. In meeting the District’s internal timeframes, submittals will be processed on a one-week turnaround basis or sooner. Submittal tracking will be introduced into the electronic document control system and status of submittals will
be known at all times. This system will be coordinated with each Contractor per contract document requirements. The CM/Lead Inspector will provide limited reviews as shop drawings are received during the construction phase and provide recommendations and review comments supplemented by District staff.

F. On-Site Field Inspection
Butier will provide a CM/Lead Inspector who is qualified to oversee all of the work at each project site, including project start-up performed by the Contractors to ensure it is in compliance with the contract documents, industry standards and applicable codes, local regulations, and construction permits. Additional CM/Lead Inspector responsibilities include the following:

- **Pre-Construction Survey**: Perform a pre-construction site video survey with the Contractors prior to the NTP. Document the existing condition of all areas that will be impacted by construction. The CM/Lead Inspector will also take digital photographs to document the existing conditions. The survey documentation will be provided to the project team via a cloud based link. A permanent record will be downloaded at the end of the project.

- **Daily Inspection Reports**: For each project, the CM/Lead Inspector will maintain daily inspection reports, which will be submitted to the District on a weekly basis. The reports will document construction activities for each well, including the date, day of week, and weather conditions; hours of work; personnel on site; equipment being used; idle or inoperable equipment; details of each activity; controversial matters/disputes; deficiencies and violations; instructions issued to the construction contractor; safety concerns; description of accidents; major material and equipment deliveries to the site; names of visitors to the site; and delays and extra work.

- **Photographic Records**: Provide weekly photographic/digital records of each project during construction. Log construction digital photographs on a daily basis. A digital photographic library will be maintained of significant construction activities. The photographs will be labeled with the date, location, and narrative information. Additional digital photographs will be taken of change order and claim items, and any special or unique conditions as they arise. The photographic library will be turned over to the District at the completion of the construction contract.

- **Schedule Review**: Reviewing the Contractors’ two week “look ahead” schedules and coordinate staffing needs with Butier’s Project Manager.

- **Record Drawings**: The CM/Lead Inspector will review each Contractor’s record drawings on a monthly basis to ensure that timely recording is being accomplished. The CM/Lead Inspector will ensure that District record drawings identify RFIs, shop drawing revisions, change order modifications, etc. and that they are updated weekly. The record drawings will be submitted to the Design Engineers at the completion of each project. The CM/Lead Inspector will coordinate the submittal of completed record drawings to the District’s Records Manager. The CM/Lead Inspector will hold monthly record drawing review meetings with the District’s PM and the Contractors prior to submittal of monthly progress payments. Construction contract documents should provide the District with the ability to withhold a percentage of the monthly pay request to ensure timely completion of as-built drawings. Butier will be utilizing Blue Beam.

- **RFIs**: Discuss responses to RFIs with Butier’s Project Manager as required and coordinate the replies to the Contractors; review of the submittals; provide non-conformance reports; and provide documentation of construction activities, duration of activities, manpower and equipment allocation.

G. Review Monthly Progress Payments
The CM/Lead Inspector will receive, check, and verify all Contractor monthly progress payment requests and other project-related invoices based upon the cost-loaded schedule. The progress payment worksheet will be based on an approved schedule of values. Progress pay requests will be checked against the approved schedule of assigned values and actual in-place quantities verified at the end of the pay period. The pay request format will be established by the project team to expedite checking, processing, and subsequent updating of project budgets and cost projections and forwarded to the District’s Project Manager for approval and payment to the Contractors.

H. Contractor Claims & Change Orders
The Project Manager and CM/Lead Inspector will have no authority to issue changes or modifications to the contract documents. The CM/Lead Inspector will track, document, and negotiate all changes for added costs or credits with the Contractor and evaluate all schedule impacts of changes. The Project Manager and CM/Lead Inspector will advise the District’s Project Manager of equitable cost and time adjustments for proposed or authorized changes including credits, if any that are due.
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Butler’s Project Manager and the CM/Lead Inspector will evaluate all claims by the Contractor seeking additional costs or additional time for contract modifications. The documentation of claims issues are included in the Document Control System and provide the Team with detailed data for determining the validity of all requests. Butler’s Project Manager and the CM/Lead Inspector will assess whether the claim is merited and make recommendations on resolution or denial of claimed costs. The CM/Lead Inspector will identify, prepare, log and monitor all Contractor claims or changes and will prepare a position paper setting forth the contractual basis of the change order entitlement, background leading to the request for potential change order, possible resolution to change requests, and recommendations for the District’s decision.

### 1. Review Contractor’s CPM Schedule

Butler’s Project Manager / Senior Scheduler will evaluate and monitor the Contractors’ Baseline Schedules, weekly look-ahead schedules, monthly schedule updates, Time Impact Analyses (TIAs), schedule revisions, and as-built schedule submittals. The Project Manager / Senior Scheduler will also update the overall project schedules to reflect actual progress and changes. Slippage of any contract activities on the critical path, as well as time sequence problems, will be identified early so that the Team may take corrective action, if possible. The Contractors should be required to re-evaluate the logic of their original schedules and resubmit revised planning should the original plan be ineffective or not followed. Contractor time extensions must be supported by critical path impacts on the approved baseline schedules. The Butler Team will utilize Primavera Project Planner (P6) to perform schedule reviews.

### 2. Project Reports and Invoicing

Each month, the CM/Lead Inspector will submit a progress report along with an invoice for the work accomplished during the reporting period. The report will describe in detail the progress made during the previous month and the hours spent on each task. Percentage completed and anticipated date of completion for each task will be included. Invoices submitted will be consistent with the monthly progress report format. The approved budget, along with the budget for any task, will not be exceeded unless previously authorized in writing by the District. The Project Manager and CM/Lead Inspector will notify the District’s Project Manager immediately upon reaching 50 and 75 percent of the project’s budget.

The monthly invoice will be in a format approved by the District. Each project will be invoiced separately. At a minimum, each invoice will contain the purchase order or contract number and will be itemized by task. A subtotal for each task will be included. Names of persons, their job titles, hourly billing rates, actual hours worked during the billing period, and subtotal labor costs will be summarized in a table. The Butler Team will adhere to the reporting requirements provided by the District and will prepare invoices that comply with the requirements.

### 4. Closeout and Acceptance

#### A. Testing

The CM/Lead Inspector will observe and coordinate that testing for each well has been successfully completed and verify and confirm that proper operation for all systems is satisfactory. After successful testing, a written report will be provided to the District.

#### B. Final Punch List

The CM/Lead Inspector will prepare a project punch list at substantial completion of each project and coordinate the correction of deficiencies and schedule. Upon correction of deficiencies by the Contractors, the CM/Lead Inspector will coordinate and conduct a final walk-through prior to the acceptance of work with the Design Engineers, District’s Project Manager, District’s Operations and Maintenance Department, and other staff as directed by the District’s Project Manager.

#### C. Final Payment Requests

The CM/Lead Inspector will verify that the Contractors have made all payments to the subcontractors and vendors and that any stop notices or liens have been released.

#### D. Contractor’s Project Record Drawings

The Butler Team will review the Contractor’s final red-line drawings for completeness and accuracy before final payment is approved and drawings are given to the Design Engineers for incorporation into AutoCAD. The Project Manager will submit the final red-line drawings (hard copies and electronic PDF copies) to the District and the Design Engineers.

#### E. Final Progress Documentation Report

The CM/Lead Inspector will prepare and submit a final progress report to the District no later than 60 calendar days following the filing of the Notice of Completion.

#### F. Project Documents and Files

The CM/Lead Inspector will furnish all original project documents and final reports—including daily logs and photographs—to the District’s PM within 60 calendar days following filing of the Notice of Completion.
Project Management Approach

The Buiter Team will use a project control system consisting of four elements that provide quality assurance/quality control procedures and guidelines in the execution of all construction management projects. The four elements are:

- Technical Quality Control Procedures
- Cost and Schedule Control (For CM Team and Construction Contracts)
- Quality Assurance/Quality Control
- Construction Management Communications Manual

A. Technical Quality Control Procedures

Technical quality control on each project is accomplished by three primary means:

1) Assigning experienced, qualified project personnel
2) Implementing regular checking procedures
3) Conducting technical reviews.

It is our policy to assign to every project one or more senior staff members to serve as technical advisors. For larger projects, we request the owner allow us to form a technical review committee (TRC) whose responsibilities include: infusing innovative technical concepts at the beginning of a project; providing technical guidance to the Project Manager and team members throughout the course of the work; resolving technical issues; reviewing the work at key milestones to see that the work product meets and exceeds the high standards for technical excellence that Buiter sets for itself; and assuring the technical adequacy of the project prior to the submittal of the product to the District.

B. Cost and Schedule Control

While the CM Team’s ability to meet schedule milestones will be important for meeting the overall goals of the project, their ability to monitor and manage the Contractor’s performance will be critical to minimizing problems during construction. Contractor schedule requirements will be specified in the contract documents based on the needs of the project. Such requirements include substantial completion deadlines and interim and final completion dates. The Buiter Team will use two primary tools to track construction schedule performance. First, resource-loaded schedules (Primavera) are the basis for evaluating performance and identifying if potential problems will occur. Second, variance identification/analysis initiates recovery when problems do occur.

The construction progress will be evaluated based on data contained in approved, resource-loaded critical path method schedules. The Contractor will be required to submit detailed resource-loaded schedules for acceptance by the District. The Contractor is then required to provide timely, detailed status information as the work progresses. The Buiter Team will project future performance through trend analysis and evaluate the Contractor’s actual performance by comparing actual quantities completed versus planned. The primary resource loading for these evaluations include: 1) Cost (dollars); 2) Man-hours (by craft); 3) Quantity of work (cubic yards, linear feet, etc.); and 4) Construction equipment listing.

An initial baseline schedule submittal from the Contractor must be reviewed for compliance with the contract documents and established procedures to determine that the schedule logic is accurate, durations are reasonable, float is managed properly, adequate reserves are established, pending and approved changed orders are included, and most important, that the schedule is a reliable tool for measuring progress.

Every measurement of schedule performance must be compared with the approved or baseline contract schedule. While all deviations from the baseline schedule are variances, not all variances are significant or schedule threatening.

The CM Team must be aware of the activity start date, regardless of float. Schedule variances must be addressed with the Contractor at weekly progress meetings and whenever the CM Team deems appropriate. The importance of schedule management and “staying ahead of the Contractor” is critical for managing an inexperienced Contractor or managing a Contractor that is prone to submitting claims, in order to minimize costs to the District. The Buiter Team has managed both types of Contractors on similar projects.

The CM Team will evaluate each variance, its cause and possible corrective actions, and require the Contractor to provide an action plan to correct unsatisfactory variances. If a satisfactory resolution is not achieved, the CM Team must take action. Control of schedule performance must be addressed at the weekly progress meetings with the Contractor. Anticipated work to be accomplished should be reviewed based on a three-week “look ahead” schedule updated weekly by the Contractor. Available information must be evaluated for schedule exceptions, available contractual options, and corrective actions required by the Contractor.
Recovery plans are required whenever the Contractor falls significantly behind schedule. These plans should address mitigation efforts such as additional crews and shifts, or developing work-around schedules that move the delayed activity off the critical path so that its completion will not affect critical milestones. The Butler Team will prepare monthly project reports that track project status and budget as a means of documenting the project history. A cost analysis will be performed that analyzes earned value and includes projections of expenditures. Critical issues will be identified, and an analysis will include action items and recommendations for resolution.

C. Quality Assurance and Quality Control Plan
The Butler Team will develop a QA/QC Plan for the assigned projects. The plan will reflect a set of objectives defined by District staff, assigned CM and inspection personnel. The purpose will be to provide District staff with a disciplined format for measuring management policy objectives. In the future, the information derived should serve as a template for how the District can best utilize consultant staff to meet its short-term construction needs.

The plan will include the overall project QC procedures, as well as a comprehensive plan for testing, inspection, and documenting contractor compliance with the construction contract documents. The QA/QC Plan shall include provisions for the review of drawings, specifications, technical reports, memoranda, meeting summaries, calculations, and estimates, and may be developed from standards currently implemented by the District.

Procedures will be incorporated to ensure reviews by the District of all project documents, including both print and electronic, are addressed. The QA/QC Plan shall be organized into the following sections: 1) Organization and Responsibility; 2) Execution and Schedule; 3) Procedural Requirements; and 4) Project Quality Management Audits.

These sections define requirements and procedures for checking, reviewing, distributing, tracking, and controlling documents for QA/QC. The project specific QA/QC Plan shall be submitted and reviewed by the District prior to submittal of other project deliverables. The individuals performing QA/QC reviews shall be clearly indicated in the project organization chart. Deliverables shall contain a statement that the information contained in the submittal has been quality control checked in accordance with the QA/QC Plan.

D. Construction Management Manual
The Project Manager will prepare a Construction Management Communications Manual for each project to be approved by the District. The manual will include project correspondence and other forms of communication in accordance with the District's document formatting standards. The Project Manager will prepare a written communications manual that accurately describes the CM organization, roles and responsibilities, reporting relationships, communication requirements, and construction management procedures.

The manual integrates the interdependent roles of the District, Construction Manager, Designer, and Construction Contractor through pre-construction, mobilization, construction, and acceptance of the phases of the work. The manual will include the project delivery plan for construction contracts master program (CPM) schedule, budgets, and cash flow. It will provide for the methodology of monitoring progress in pre-construction, mobilization, and construction phases for comparison of as-planned to base line planning, including milestone updating. The Communication Manual will include as a minimum, the following items:

- **Project Organization**: Individual assignments, responsibilities, phone numbers, lines of communication, and methods for interfacing with the District, local agencies, subcontractors, other contractors under contract to the District, and Contractor. Organization chart showing relationships between the parties involved at the sites.

- **Communication Management**: Document control systems and procedures; distribution lists for each type of project documentation; and examples of all required Contractor forms to transmit and formalize all RFIs, RFCs, submittals, and substitution requests.

- **Meeting and Notice Procedures**: Schedules, notices, agendas, reporting procedures, documentation requirements, and timely acceptance processes.

- **QA/QC**: Procedures, testing, factory inspection, coordination checks, and construction inspection activities for all project features, equipment and materials; and separate sections for each specification section.

- **Contract Administration**: Description of control systems and procedures utilizing Box.com for performing and documenting submittal reviews, clarifications, RFIs, change orders, claims management, contract closeout activities, and other contract administration procedures.
EXHIBIT B
CONSULTANT RATE SCHEDULE AND FEES

1.0 Consultant shall be compensated for actual services performed in accordance with this Agreement, per the project cost and labor hours attached hereto as Exhibit B-1.

2.0 A budgetary amount of $216,000.00 (which amount applies to Consultant’s fee and reimbursable expenses) is established for this Agreement. Notwithstanding any other provision of this Agreement, the District shall not be obligated to pay Consultant any amount in excess of said budgetary amount absent prior written approval from the District. Likewise, Consultant shall not be obligated to perform services or incur expenses in excess of the budgetary amount absent prior written approval from the District.
EXHIBIT B-1

PROJECT COST AND LABOR HOURS

Water Replenishment District of Southern California
Exhibit B
Consultant Rate Schedule
Professional Services Contract
Butler Engineering, Inc.

364170.3
7. Project Costs & Labor Hours

Proposed Fee

The proposed level of effort is based on the preliminary project schedule provided in the RFP. The final staffing plan will be based on schedules approved for each project. Staffing efficiencies will be realized based on overlapping construction schedules. It is our intent to oversee all three projects concurrently.

In-Plant Fabrication Inspection Scope

We would like to strongly suggest the budget include a contingency to provide in-plant fabrication/testing and inspection services authorized at the discretion of District staff. Upon determining the location of the fabrication shop, a specific risk assessment will be made and presented to the WRD management.

Rates for the Construction Management Team

Vehicle mileage, computers, computer software, printers, reproduction, prints, cell phone service, broadband service, delivery service, mail, telephone charges, office supplies, technical reference materials, training, and personal protective equipment (PPE) including hard hats, safety boots, work gloves, safety glasses and other PPE as required shall be billed at the attached rates per labor hour charged to the project.

Excluded from Rates

Trailer rental costs, installation of utilities, cost of utilities, cost of sanitary services, broadband / high speed connections, janitorial, furniture, travel and per diem outside the District’s service area.
Water Replenishment District of Southern California  
CM Services for Construction of Multiple Safe Drinking Water Wellhead Treatment Projects  

Preliminary Staff Resource Plan and Level of Effort (Hours per month)  
Based on RFP: Preliminary Schedule  

<table>
<thead>
<tr>
<th>Project Description/Resource Plan</th>
<th>Personnel</th>
<th>Jan-17</th>
<th>Feb-18</th>
<th>Mar-18</th>
<th>Apr-18</th>
<th>May-18</th>
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<tr>
<td>Field CM Services</td>
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<tr>
<td>Principal-In-Charge</td>
<td>C. Harris</td>
<td>24</td>
<td>24</td>
<td>24</td>
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<td>168</td>
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<tr>
<td>CM Inspector</td>
<td>F. Johnson</td>
<td>360</td>
<td>160</td>
<td>160</td>
<td>160</td>
<td>90</td>
<td>540</td>
</tr>
<tr>
<td>Start-Up Engineer (Mechanical)</td>
<td>K. Kreeger</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>40</td>
<td>40</td>
</tr>
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</table>

| Constructability                 |           |        |        |        |        |        |       |
| Principal-in-Charge (Civil Revie) | C. Harris | 40     | 40     | 40     | 40     | 40     | 160   | $195.00 | $7,800  |
| Electrical Review                | J. Rodgers| 40     |        |        |        |        | 40    | $195.00 | $7,800  |
| Mechanical Review                | K. Kreeger| 40     |        |        |        |        | 40    | $195.00 | $7,800  |

|                      | Total     | 34     | 184    | 154    | 184    | 154    | 104   | $215,520 |

Additional Services (TBD) $0

Total Proposed Fee $215,520
EXHIBIT C
EVIDENCE AND REQUIRED FORMS OF INSURANCE

Checklist for Additional Insured Endorsement

Contractor Name: ________________________________
Project Name: __________________________________

Refer to the Additional Insured Endorsements forms □ following:

Endorsement(s)

☐ Additional Insured (AI) Status – GENERAL LIABILITY - Member Water District, its directors, officers, employees, or authorized volunteers are named as additional insureds - as broad as following forms:
  o Form CG 20 10 11 85 (□) or
  o BOTH CG 20 10 □□ and CG 20 37 □□ if forms with later edition dates provided (usually 10 01 or 07 04 editions). Also acceptable CG 20 10 04 13 (or older editions □□) specifically naming the District parties or using language that states "as required by contract"
  o "Blanket" Endorsement - (no specific policy number) □□ covering one or more of the above endorsements required with words "as required by written contract/agreement".
  o If large number of Subcontractors - Additional Insured endorsement CG 20 38 04 13 recommended. □□
  o Policy numbers - matches policy number shown on Certificate of Insurance. (see Optional Dec. Page/Endorsement pages below)
  o Primary Coverage – The primary/non-contributory language is included. "The insurance provided by this policy shall be primary as respects any claims related to the _________ Project. Any insurance, self-insurance, or other coverage maintained by the district, its directors, officers, employees, or volunteers shall not contribute to it." e.g. Form CG 20 01 □□

☐ Auto liability (Optional □□) AI - most standard forms have automatic AI but some carriers provide endorsement

☐ Waiver of Subrogation (Workers Compensation and Property (Course of Construction, if required in contract) □□

☐ Optional - For extra confidence in verifying coverage require Declaration Page and Endorsement Schedule pages - compare the endorsement numbers. Look out for Amendment of contractual liability and or prior works exclusions - refer to Legal Counsel.
EXHIBIT “B”
November 18, 2018

Ms. Charlene King, P.E.
Associate Engineer, Construction and Operations
Water Replenishment District of Southern California
4040 Paramount Blvd.
Lakewood, CA 0712

Subject: Butier Engineering, Inc.: Construction Management Services Contract Amendment for the Wellhead Treatment Projects

1. Huntington Park Well 15 Treatment Project: Project #0122612

2. California American Water Arlington Wellhead Treatment Project:
   Project #0122412

3. Lynwood Well 11 Treatment Project:
   Project #0122512

Dear Ms. King,

Butier Engineering respectfully requests a Construction Management Services Contract Amendment in the amount of $257,232.50 to continue to perform our contract scope of services on the subject projects. The original budget anticipated no City Permits, a GAC Supplier unable to deliver on time, unknown storm drain capacity for well flushing and startup discharges and problems with Survey Records.

The City of Huntington Park has also assumed a major role in the engineering, management and permitting requiring much more effort in coordinating their special requests, independent reviews and permits.

We intend to provide full-time inspection services through June of 2019 and on an as-needed basis for project close-out. This staffing approach will be updated monthly and commensurate with field activity.

If you have any questions regarding our request, please direct them to me for clarification at (714) 832-7222.

Respectfully Yours,

Butier Engineering, Inc.
Construction Managers, Consulting Engineers

Mark M. Butier, Jr.
Vice President/CFO

17822 E. 17th St.
Suite 404
Tustin, CA 92780
Tel (714) 832-7222
Fax (714) 832-7211

BUTIER
| Project Name          | Project Number | Year | State | Objective | Description | Phase 1 | Phase 2 | Phase 3 | Phase 4 | Phase 5 | Phase 6 | Phase 7 | Phase 8 | Phase 9 | Phase 10 | Phase 11 | Phase 12 | Phase 13 | Phase 14 | Phase 15 | Phase 16 | Phase 17 | Phase 18 | Phase 19 | Phase 20 | Phase 21 | Phase 22 | Phase 23 | Phase 24 | Phase 25 | Phase 26 | Phase 27 | Phase 28 | Phase 29 | Phase 30 | Phase 31 | Phase 32 | Phase 33 | Phase 34 | Phase 35 | Phase 36 | Phase 37 | Phase 38 | Phase 39 | Phase 40 | Phase 41 | Phase 42 | Phase 43 | Phase 44 | Phase 45 | Phase 46 | Phase 47 | Phase 48 | Phase 49 | Phase 50 | Phase 51 | Phase 52 | Phase 53 | Phase 54 | Phase 55 | Phase 56 | Phase 57 | Phase 58 | Phase 59 | Phase 60 | Phase 61 | Phase 62 | Phase 63 | Phase 64 | Phase 65 | Phase 66 | Phase 67 | Phase 68 | Phase 69 | Phase 70 | Phase 71 | Phase 72 | Phase 73 | Phase 74 | Phase 75 | Phase 76 | Phase 77 | Phase 78 | Phase 79 | Phase 80 | Phase 81 | Phase 82 | Phase 83 | Phase 84 | Phase 85 | Phase 86 | Phase 87 | Phase 88 | Phase 89 | Phase 90 | Phase 91 | Phase 92 | Phase 93 | Phase 94 | Phase 95 | Phase 96 | Phase 97 | Phase 98 | Phase 99 | Phase 100 | Phase 101 | Phase 102 | Phase 103 | Phase 104 | Phase 105 | Phase 106 | Phase 107 | Phase 108 | Phase 109 | Phase 110 | Phase 111 | Phase 112 | Phase 113 | Phase 114 | Phase 115 | Phase 116 | Phase 117 | Phase 118 | Phase 119 | Phase 120 |
EXHIBIT “B”
June 19, 2019

Ms. Charlene King
Associate Engineer, Construction and Operations
Water Replenishment District of Southern California
4040 Paramount Blvd.
Lakewood, CA 90712

Subject: Butier Engineering, Inc.: Construction Management Services Contract Amendment 2 for the Wellhead Treatment Projects

Huntington Park Well 15 Treatment Project:
Project #0122612

California American Water Arlington Wellhead Treatment Project:
Project #0122412

Lynwood Well 11 Treatment Project:
Project #0122512

Dear Ms. King,

Butier Engineering respectfully requests a Construction Management Services Contract Amendment in the amount of $165,244.00 to continue to perform our contract scope of services on the subject projects.

The following chronology of delay along with anticipated delay that follows supports our request.

ARLINGTON

Delay 1. GAC delivery time by manufacturer is 14-16 weeks additional 18 calendar days was needed for project performance. Extend the contract completion date from April 3, 2019 to April 21, 2019.

Delay 2. City of Los Angeles permit process resulted in revised drawings and additional work scope adding 106 calendar days to the project completion time. Extend the contract from April 21, 2019 to August 16, 2019.

- Additional Permit Fees
- Vault Orientation Modifications
- 106-day Time Extension + overhead
- Added 12” Cross and Gate Valve
• Storage & Delivery costs from our valve supplier, GAC vessel supplier and PHC
• Addition of Drain and Nitrate Lines
• Addition of Static Mixers + installation
• Addition of Brooks Variable Flow Meter 2520
• Splitting of spool and adding two flanges surrounding static mixer Westfall 2800
• Extra work on demolition of concrete pad to over-excavate and pour new
• Extra work on grading

Potential Delay 3. Cal American has requested additional concrete encasement for electrical duct banks. Estimate 10 calendar days extend to August 26, 2019 price for this COR is $ 9,395.26.

Potential Delay 4. Extra pipe, appurtenances, and work needed to connect to the existing 48th street well pipe per RFI 46. The pipe has a week lead time and is keeping the contractor from finishing work in that area. Estimate 10 calendar days extend to September 5, 2019 price for this COR is $ 13,072.76.

HUNTINGTON PARK

Delay 1. Emerson Programming 10 cd April 24, 2019 to May 4, 2019

Delay 2. Replace Sand Separator 75 cd May 4, 2019 to July 18, 2019

Delay 3. Modify piping to retain NSF 61 rating 10 CD July 18, 2019 to July 28, 2019

Potential Delay 4. 6/12/19 New piping for the sand separator inlet and outlet drawing and review may result in a delay. Anticipate 14 cd July 28, 2019 to August 11, 2019

Potential Delay 5. 6/12/19 Emerson contract for programming is still not resolved as they are not able to sign a subcontract because of insurance requirements for the Project. Christina related we should plan on providing another vendor. Heath is currently working with another Company to provide programming services. Anticipate 14 cd from August 11, 2019 to August 28, 2019.

Possible Delay 6. 6/12/19 Contractor related there is an issue with seismic calculations as the existing pad will need to be modified. Contractor is working with his structural engineer on this. Contractor has released the sand separator for manufacturing and delivery by 7/4/19. City of Huntington Park also requested revised plans be provided to his Building & Safety Department after approval by TetraTech. Anticipate 20 day delay from August 28, 2019 to September 17, 2019.

LYNWOOD

Delay 1. Sand separator procurement and installation including additional repairs to discharge screen/system and start up may require baker tanks or pumper truck anticipate 103 cd May 20, 2019 to Aug 31, 2019.
We intend to provide full-time inspection services through October of 2019 and on an as-needed basis for project close-out. This staffing approach will be updated monthly and commensurate with field activity.

If you have any questions regarding our request, please direct them to me for clarification at (714) 832-7222.

Respectfully Yours,

BUTIER

Construction Managers, Consulting Engineers

Mark M. Butier, Jr.
Vice President/CFO
<table>
<thead>
<tr>
<th>Date</th>
<th>Item No.</th>
<th>Description</th>
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<td>7/18/2019</td>
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<td>Meeting Date: 7/18/2019 Item No. 7</td>
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DATE: JULY 18, 2019
TO: BOARD OF DIRECTORS
FROM: ROBB WHITAKER, GENERAL MANAGER
SUBJECT: WRD ADMINISTRATION BUILDING HVAC AUTOMATION SERVICE CONTRACTS WITH CLIMATEC LLC

SUMMARY
To manage the heating and cooling needs for the District Administration building, an automated building environmental control system was installed. This automation provides the ability to monitor the entire system, improve the efficiency and reduce the electrical consumption for the building.

The District is currently experiencing issues with the user interface. The existing user interface is obsolete and further patches to address security or other enhancements are not available. Software upgrades are required from the existing Alerton and Envision to Compass Ascent along with a new control module.

The automated environmental control system is a proprietary system that requires servicing by factory authorized maintenance vendors. Each vendor is assigned a territorial service area and becomes the sole service entity for that given area. Climatec is the authorized maintenance vendor for the Lakewood area and the District has worked with Climatec under an earlier service agreement that has expired. Staff would like to implement the necessary upgrades and enter into a new technical support agreement with Climatec for a three-year contract. The agreement will include the system upgrades, quarterly maintenance, and technical labor for current known issues identified by staff. The total cost for the three-year contract will be $75,000. This includes a contingency of $10,000 for unforeseen work during the three-year period.

FISCAL IMPACT
The total cost of this three-year contract is $65,000 with a contingency of $10,000 for a total of $75,000. The amount will be paid from the 2019/20 Administrative Department budget.
CAPITAL IMPROVEMENT PROJECTS (CIP) COMMITTEE RECOMMENDATION

The Board of Directors enter into a Technical Support Agreement with Climatec, LLC, subject to approval of form by District Counsel, for $65,000 plus $10,000 contingency, for a total amount not to exceed $75,000 to upgrade the automation software of the current system and to provide maintenance services for the building environmental control system over a period of three years.

ATTACHMENT:
Draft General Services Contract with Climatec LLC
This General Services Agreement (the “Agreement”) is made and entered into this 18th day of July, 2019 by and between the Water Replenishment District of Southern California (“District”) and Climatec LLC, (“Contractor”) (collectively the “Parties” or individually as “Party”) for the furnishing of certain professional services upon the following terms and conditions.

1. **Scope of Services.** Contractor shall perform the scope of services described in Exhibit A (hereinafter referred to as “Services”), attached hereto and incorporated herein by this reference. Tasks other than those specifically described in Exhibit A shall not be performed without a prior written amendment to this Agreement. In the event of a conflict in or inconsistency between the terms of this Agreement and Exhibit A, this Agreement shall prevail.

   1.1 **Standard of Performance.** In performing the scope of services under this Agreement, Contractor shall diligently perform all services required in connection with this Agreement in the manner and according to the standards observed by a competent practitioner of the profession in which Contractor is engaged in the geographical area in which Contractor practices its profession.

   1.2 **Assignmnet of Personnel.** Contractor shall assign only competent personnel to perform services in connection with this Agreement.

2. **Term.** The term of this Agreement shall commence on July 18, 2019 and shall end on June 30, 2022 (the “Expiration Date”). At least ninety (90) days prior to the Expiration Date, District staff shall evaluate the quality of the Services that have been provided by the Contractor, the cost of such Services relative to the benefits, and the need for any continuation of the services.

   2.1 **Termination by District**

      2.1.1 **Termination for Convenience.** The District may terminate this Agreement for its convenience at any time within thirty (30) day written notice to Contractor. Contractor's compensation in the event of such a termination shall be exclusively limited to payment for all authorized services performed and for all authorized expenses incurred up to the effective date of such termination. Contractor understands and agrees that it shall not be entitled to any additional compensation or reimbursement whatsoever in the event of such termination.
3. **Contractor’s Compensation.** District will compensate Contractor for services performed and for expenses incurred pursuant to this Agreement as follows:

3.1 **Fee.** District hereby agrees to pay Contractor for the Scope of Services, whether by fixed price, hourly rates subject to fixed rate schedule, pursuant to the fee schedule attached as Exhibit B and incorporated herein by this reference, which may not be changed except with District’s written approval. Total compensation for work performed under this Agreement shall not exceed Sixty Five Thousand Dollars ($65,000.00).

3.2 **Reimbursable Expenses.** No expenses, costs, or liabilities of Contractor shall be reimbursable unless the obligation and manner of reimbursement is expressly set forth in the scope of services and in the fee schedule (Exhibit A).

4. **Project Site.** Contractor shall perform the Services in such a manner as to cause a minimum of interference with District’s operations and the operations of other contractors at each Project site and to protect all persons and property thereon from damage or injury. Upon completion of the Services at a Project site, Contractor shall leave such Project site clean and free of all tools, equipment, waste materials and rubbish. Each Project site may include all buildings, offices, and other locations where Services are to be performed, including any access roads. Contractor shall be solely responsible for the safe transportation and packing in proper containers and storage of any equipment required for performing the Services, whether owned, leased or rented. District will not be responsible for any such equipment which is lost, stolen or damaged or for any additional rental charges for such equipment. Equipment left or stored at a Project site, with or without permission, is at Contractor’s sole risk. District may assume that anything left on the work site an unreasonable length of time after said work is completed has been abandoned. Any transportation furnished by District shall be solely as an accommodation and District shall have no liability therefore. Contractor acknowledges and agrees that it shall assume the risk and is solely responsible for its use of any District owned equipment and property provided by District for the performance of Services. District shall have no liability to Contractor therefore. In addition, Contractor further acknowledges and agrees that it shall assume the risk and is solely responsible for its owned, non-owned and hired automobiles, trucks or other motorized vehicles as well as any equipment, tolls, or other property which is utilized by Contractor on each Project site.

5. **Contractor Status.** Contractor is an independent contractor and neither Contractor nor any employee of Contractor is or will be treated as an employee of the District under this Agreement. District controls the result to be accomplished under this Agreement, but not the means by which Contractor achieves such results.

5.1 **Payments made to Contractor pursuant to this Agreement shall be the sole and complete compensation to which Contractor is entitled.** Contractor is solely responsible for any taxes levied by local, state or federal authorities on such sums. Contractor shall defend and indemnify the District for any taxes, fines, penalties...
and attorneys’ fees assessed or threatened to be assessed against District for failure to properly withhold taxes as a result of any determination that Contractor, or any of Contractor’s employees, is an employee rather than an independent contractor of District.

5.2 District will not make any contribution to any retirement plan or Social Security on behalf of Contractor or any of Contractor’s employees. Contractor shall defend and indemnify the District for any contribution, fines, penalties and attorneys’ fees assessed or threatened to be assessed against District for failure to contribute to any retirement plan or Social Security as a result of any determination that Contractor, or any of Contractor’s employees, is an employee rather than an independent contractor of District.

5.3 District will not make any payments to Contractor, or Contractor’s employees, which rely upon employee status, including, but not limited to, FLSA and other overtime and minimum wage requirements, prevailing wage laws, worker’s compensation benefits, FMLA, CFRA, Paid Leave, and unemployment benefits. Contractor shall defend and indemnify the District for any payment, fines, penalties and attorneys’ fees assessed or threatened to be assessed against District for failure to make any such payment or otherwise provide the benefits of such laws as a result of any determination that Contractor, or any of Contractor’s employees, is an employee rather than an independent contractor of District.

5.4 Contractor shall comply with the Political Reform Act of 1974, as amended including, but not limited to, disclosure of all conflicts of interest and other financial disclosure requirements required thereunder.

6. Instructions to Contractor. In the performance of the services set forth in this Agreement, Contractor shall report to and receive instructions from the following person on behalf of the District: Charlene King.

7. Subcontractor Services. Any subcontractors to be used by Contractor in the performance of the scope of services shall be identified in Exhibit A hereto. Contractor shall obtain the District’s prior written approval before retaining a subcontractor to perform any portion of the scope of services of this Agreement. Notwithstanding Contractor’s use of any subcontractors, Contractor shall be responsible to the District for the performance of its subcontractors as it would be if Contractor had performed those services itself. Nothing in this Agreement shall be deemed or construed to create a contractual relationship between the District and any subcontractor employed by Contractor. Contractor shall be solely responsible for payments to any subcontractors. Contractor shall defend and indemnify the District for any payment, fines or penalties assessed or threatened to be assessed against District as a result of any claim brought by any subcontractor of Contractor for any matter arising from, or related to, the services performed by subcontractor under this Agreement.
8. **Compliance With Laws and Regulations; Licensing.** Contractor shall perform its services under this Agreement in compliance with all applicable provisions of Federal, State and local laws, statutes, codes, rules, regulations, ordinances and professional standards (“Applicable Laws”). By entering into this Agreement, Contractor represents and warrants that it possesses and will keep current all license and registrations required by Applicable Laws to enter into this Agreement and to perform the scope of services hereunder.

9. **Insurance.** Contractor, at its sole cost and expense, shall obtain, keep in force, and maintain the following policies of insurance at all times while this Agreement is in effect, and shall not commence any work under this Agreement until proof of such insurance has been provided to the District. The coverages provided by such insurance shall not be construed as limitations of liability.

9.1 **Required Policies.**

9.1.1 **Commercial General Liability Insurance** (contractual, products, and completed operations coverages included) with a combined single limit of no less than $1,000,000 and a general aggregate limit of no less than $1,000,000.

9.1.2 **Business or Comprehensive Automobile Liability Insurance** for owned, scheduled, non-owned, or hired automobiles, with a combined single limit of no less than $1,000,000 per accident.

9.1.3 **Employers’ Liability Insurance** with limits of $1,000,000 per claim and $1,000,000 in the aggregate.

9.1.4 **Workers’ Compensation Insurance** as required under the Workers’ Compensation Insurance and Safety Act of the State of California.

9.2 **Required Terms.**

9.2.1 All policies except workers’ compensation shall name as additional insureds the Water Replenishment District of Southern California, its directors, officers, employees, agents and representatives.

9.2.2 All policies shall be written on an occurrence basis. If a policy may only be obtained on a claims made basis, the policy shall be maintained continuously for a period of no less than three (3) years after the date of final completion of the scope of services under this Agreement.

9.2.3 All policies shall provide that coverage cannot be cancelled without twenty (20) days prior written notice to the District.

9.2.4 All insurance required under this Agreement shall be considered primary to any insurance maintained by the District. All policies except
Professional Liability shall include waivers of subrogation in favor of the District and its insurers.

9.2.5 All polices required under this Agreement shall be issued by companies authorized to transact insurance business in the State of California acceptable to the District and having a Best rating of A- or better.

10. **Indemnification.** Contractor shall indemnify, defend and hold harmless the District and its directors, officers, employees, agents and representatives (collectively “District”), from and against any and all claims, liabilities, costs, damages, suits, proceedings, injuries (including injuries to real and personal property, and injuries to persons, including death) incurred by District (“Losses”), as a result of Contractor’s breach of any provision of this Agreement, Contractor’s failure to comply with applicable laws, Contractor’s negligent acts or omissions, or Contractor’s willful misconduct. However, Contractor’s obligation to defend shall arise regardless of any claim or assertion that the District caused or contributed to the Losses. Nothing in this paragraph shall constitute a waiver or limitation of any legal rights which the District may have including, without limitation, the right to implied indemnity.

11. **Warranty.**

11.1 In addition to any and all warranties provided or implied by law or public policy, Contractor warrants that all Services (including but not limited to all equipment and materials supplied in connection therewith) shall be free from defects in design and workmanship, and that Contractor shall perform all Services in accordance with all applicable engineering, construction and other codes and standards, and with the degree of high professional skill normally exercised by or expected from recognized professional firms engaged in the practice of supplying services of a nature similar to the Services in question. Contractor further warrants that, in addition to furnishing all tools, equipment and supplies customarily required for performance of work, Contractor shall furnish personnel with the training, experience and physical ability, as well as adequate supervision, required to perform the Services in accordance with the preceding standards and the other requirements of this Agreement. In addition to all other rights and remedies which District may have, District shall have the right to require, and Contractor shall be obligated at its own expense to perform, all further services which may be required to correct any deficiencies which result from Contractor’s failure to perform any Services in accordance with the standards required by this Agreement. Moreover, if, during the term of this Agreement (or during the one (1) year period following the term hereof), any equipment, goods or other materials or Services used or provided by Contractor under this Agreement fail due to defects in material and/or workmanship or other breach of this Agreement, Contractor shall, upon any reasonable notice from District, replace or repair the same to District's satisfaction. Unless otherwise expressly permitted, all materials and supplies to be used by Contractor in the performance of the Services shall be new and of best kind.
11.2 Contractor hereby assigns to District all additional warranties, extended warranties, or benefits like warranties, such as insurance, provided by or reasonably obtainable from suppliers of equipment and material used in the Services.

12. **Health and Safety Programs.** The Contractor shall establish, maintain, and enforce safe work practices, and implement an accident/incident prevention program intended to ensure safe and healthful operations under their direction. The program shall include all requisite components of such a program under Federal, State and local regulations and shall comply with all District site programs.

12.1 Contractor will be responsible for acquiring job hazard assessments as necessary to safely perform all duties of each Project and provide a copy to District upon request.

12.2 Contractor will be responsible for providing all employee health and safety training and personal protective equipment in accordance with potential hazards that may be encountered in performance of Project and provide copies of the certified training records upon request by District. Contractor shall be responsible for proper maintenance and/or disposal of their personal protective equipment and material handling equipment.

12.3 Contractor is responsible for ensuring that its lower-tier subcontractors are aware of and will comply with the requirements set forth herein.

12.4 Contractor shall immediately report any injuries to the District site safety representative. Additionally, the Contractor shall investigate and submit to the District site safety representative copies of all written accident reports, and coordinate with District if further investigation is requested.

12.5 Contractor shall develop a plan to properly handle and dispose of all hazardous wastes they generate within the Scope of Services.

12.6 Contractor shall advise its employees and subcontractors that any employee, who jeopardizes his/her safety and health, or the safety and health of others, may be subject to actions including removal from Project.

13. **Arbitration and Attorneys’ Fees.** Any dispute arising from or relating to this Agreement shall be submitted to final and binding arbitration before an arbitrator who is a member of the National Academy of Arbitrators. The parties will obtain a list of five names of potential arbitrators from the National Academy of Arbitrators, or the American Arbitration Association, and will take turns striking the names of arbitrators until one arbitrator remains, who shall preside over the arbitration. The arbitrator will have no power to rewrite any of the terms of this Agreement. The parties shall split the cost of the arbitrator’s fee and any court reporter required by the arbitrator or if both parties agree to having the proceedings taken down by a court reporter. The prevailing Party in
any action arising from or relating to this Agreement shall be entitled to recover its reasonable attorneys fees, expert witness fees and arbitration fees and costs in addition to any other relief and recovery ordered by the arbitrator or other tribunal hearing any matter related to this Agreement.

14. **Conflict of Interest.** No official of the District who is authorized in such capacity and on behalf of the District to negotiate, make, accept or approve, or to take part in negotiating, making, accepting or approving this Agreement, or any contract or subcontract relating to work to be performed pursuant to this Agreement, shall become directly or indirectly personally interested in this Agreement or in any part thereof. Contractor shall not accept employment or contract during the term of this Agreement with any firm or individual for the provision of services if such employment or contract would conflict directly with the Services provided to the District under this Agreement.

15. **Equal Opportunity.** During the performance of this Agreement, Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, age, marital status or national origin.

16. **Successors and Assigns.** This Agreement shall inure to the benefit of, and be binding upon, the District, Contractor, and their respective successors and assigns provided, however, that no assignment of the duties or benefits under this Agreement shall be made without the written consent of the Contractor and the District.

17. **Choice of Law and Venue.** This Agreement shall be governed by and interpreted in accordance with the laws of the State of California. The Parties agree that the exclusive venue for any action or proceeding arising from or relating to this Agreement shall be in the County of Los Angeles, State of California.

18. **Notices.** All notices provided by this agreement shall be in writing and shall be sent by first-class mail and facsimile transmission as follows:

If to the District:

Water Replenishment District of
Southern California
4040 Paramount Blvd.
Lakewood, CA 90712
Phone: (562) 921-5521
Fax: (562) 921-6101
Remit all invoices to:

Accounts Payable
Water Replenishment District of
Southern California
4040 Paramount Blvd.
Lakewood, CA 90712
(562) 921-5521

If to Contractor:

Climatec LLC
Kris Moder, Account Manager
2150 Towne Center Place, Suite 200
Anaheim, CA 92806
Phone: 949-241-1778

19. Amendments. This Agreement may be modified only by a writing signed by the Parties hereto.

20. Integration; Construction. This Agreement sets forth the final, complete and exclusive expression of the Parties’ agreement with respect to the subject matter hereof, and supersedes any and all other agreements, representations, and promises, whether made orally or in writing. The Parties represent and warrant that they are not entering into this Agreement based upon any representation or understanding that is not expressly set forth in this Agreement. This Agreement shall be construed as the product of a joint effort between the Parties and shall not be construed against either Party as its drafter.

21. Effective Date. This Agreement is effective as of the date first set forth above.

22. Authority. Each person signing this Agreement represents that he or she has the authority to do so on behalf of the Party for whom he or she is signing.

[SIGNATURES ON THE NEXT PAGE]
IN WITNESS WHEREOF, the Parties have caused this AGREEMENT to be executed the day and year first above written.

WATER REPLENISHMENT DISTRICT OF SOUTHERN CALIFORNIA

Signature
John D. S. Allen
Print Name
President, Board of Directors
Title

Signature
Print Name
Secretary, Board of Directors
Title

CLIMATEC LLC, ("CONTRACTOR")

Signature
Print Name
Title

Approved As To Form
LEAL, TREJO APC

H. Francisco Leal
Attorneys for the Water Replenishment District of Southern California
EXHIBIT A
SCOPE OF WORK

Contractor shall perform the scope of services as described in Contractor’s proposal.
Water Replenishment District
Technical Support Agreement & Embedded Upgrade

Attention: Charlene King
Associate Engineer, Construction & Operations
June 10, 2019

Attention: Charlene King
Associate Engineer, Construction & Operations
Water Replenishment District of Southern California
4040 Paramount Blvd
Lakewood, CA 90712

Re: Technical Support Agreement with Embedded Upgrade

Dear Ms. King,

Here at Climatec LLC, we distinguish ourselves as a leading provider of advanced building technologies and energy solutions with our highly customized, tailored service and upgrade offerings.

We feel that we provide the best value as a partner to collaborate with the Water Replenishment District of Southern California by:

- Upgrading your user interface to improve security, reliability and provide a current platform (existing global controller is obsolete).
- Including software updates and patches to keep system up-to-date.
- Performing a one-time facility performance evaluation report which establishes a base-line for current operations and identifies specific areas for improvement.
- Scheduling quarterly maintenance on your Alerton building control system to keep the system tuned and running optimally.
- Providing remote support during normal work hours.
- Including additional services & value with a designated primary service technician, performing backups/data restoration, running global controller diagnostics, informally training and coaching the system operators, preferred response times, and discounted service/material rates for additional work not in contract.

In addition to this proposal, budgeting for additional repairs or service is prudent. Actual expenditure may amount annually, but carrying $5,000/year would be appropriate for a system of this size and age.

The following proposal provides additional details on our proposed approach to the Service Agreement. I welcome continued dialogue and look forward to helping you and your staff members support the Long Beach WRD facility together.

Respectfully,

Kris Moder

Kris Moder
Account Manager
(949) 241-1778
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A. STANDARD OFFERINGS

Facility Performance Evaluation Report
Climatec LLC assesses and evaluates the existing energy management system of all potential clients in efforts to identify current system deficiencies and to establish a service baseline.

FPER – are to be presented to client within 3 months of commencement. Client will receive an energy management system rating with explanations and system improvement details. Utilizing’s trends and offsite analytics, Climatec LLC will include a potential, monetized energy savings metric in this one time report. Client to receive a hard copy of this report when presented in person and have a copy available via shared web portal.

System and Service Review
Climatec LLC TSA manager and Business Development Engineer will hold an annual formal review with your staff to discuss on going services, identified services needed, enhancement options for improving overall performance, resolve operational problems, and to review your changing needs and objectives.

Software Maintenance
Climatec LLC will furnish and install manufacturer’s software updates to maintain or improve system performance within the functional capabilities of your existing system. System upgrades are to be addressed separately.

Database Protection: Climatec LLC as a standard will protect your database manual backups completed at each scheduled TSA visit.

Master Hardware Maintenance
Climatec LLC will review and document server performance on a yearly basis. PC specifications, including windows system, PC performance, memory consumption, and limited hard drive space are to be noted during inspection. Climatec LLC to test network integrity and document network speeds. Climatec LLC is to inspect and document all global controller’s battery life, capacity, and physical conditions. All global programs are to be uploaded to server and time syncs are to be sent. Inspect onboard LED diagnostics and document all findings.
**Alerton BMS Preventive Maintenance**

Climatec LLC will perform preventive maintenance (PM) on the Alerton Building Management System during scheduled visits. Typical tasks performed are detailed in a later section. This agreement is structured such that these services will be performed as time allows. If there is a priority list of items to be addressed formulated by the Water Replenishment District of Southern California staff, these will typically be addressed in advance of the PM tasks.

**Informal Operator Coaching (during visits)**

Climatec LLC recognizes that staff may transition. Our technicians may provide informal operator coaching during scheduled visits. As a general rule of thumb, we suggest limiting this to a small portion of the visit (approximately 30-60 minutes), so that there is time to address issues or perform PM tasking.

**Customer Portal (in development)/Correspondence**

Climatec, LLC is in the process of developing an online customer portal as a place to store all prudent TSA records between the Client, Business Development Engineer and Service team. In detail the portal is to store a summary of the Technical Service Report, Field Evaluation Report, all executed scheduled and unscheduled Field Service Reports, and current year Tasking progress. Correspondence shall be via email, phone or hard copy until the final portal is completed.

**Documentation**

All aforementioned tasks are to be clearly tracked and documented via the Field Service Reports. Tasking of each visit aimed at maintaining this commitment to the Client will be clearly noted before each visit however note, that the client always reserves the right to redirect our technician to other purposes.
B. TECHNICAL SERVICES

☐ ANALYTICAL MAINTENANCE AGREEMENT (Not in Scope)

Climatec LLC will utilize advanced energy, comfort, and operational dynamic analytical software along with our vast experience in building automation to preemptively determine inevitable failures, identify energy wasters, minimize building drift, improve comfort and increase productivity. In addition to Climatec LLC’s Standard offerings listed above, Climatec LLC will compile detailed preemptive findings, to be prioritized and submitted for client approval prior to each field visit. Climatec LLC and Client to predetermine a set allocation of onsite labor to be used to maintain system at the highest performing levels throughout the year.

Climatec LLC will continually review building data, adjust analytics, and create new analytics. Regularly scheduled Client meetings will determine implementation of new analytics aimed at continual building enhancement.

It is the intent of Climatec LLC to utilize the data extracted to its fullest potential. Coverage includes detailed review of 100% of Clients heavy equipment (Air Handlers, Chiller Plant) and 100% of Clients non-heavy equipment (VAV, Fan Coils, Heat Pumps, AC units) every year. (Equipment list in tab C). Climatec LLC is to identify and rectify, faulty sensors, overridden systems, set points not achieved, failed scheduled, and a lot more.

Climatec LLC’s Certified Energy Engineers shall include energy surveys, resulting in detailed Energy Efficiency measures to be presented to Clients.

The client does have the option to divert allocated labor to other assignments however must be noted so on Field Service Report (FSR).

☒ CORRECTIVE MAINTENANCE AGREEMENT

In addition to Climatec LLC’s Standard offerings listed above, corrective maintenance shall be performed to optimize the system effectiveness by reviewing controlled equipment, documenting system anomalies, then correcting the findings. Customers building consist of critical equipment listed in TAB C. In efforts to maintain the facility in optimum condition, Climatec LLC will perform the detailed tasks listed in TAB E. Abnormal findings such as controllers’ off-line, overridden systems, failed points, failed sequences of operation, and critical alarms on aforementioned systems are to be corrected.

The client does have the option to divert assigned technician however must note so on Field Service Report (FSR) and understand that original scheduled tasks will require additional time to meet the corrective maintenance commitment.
☐ CENTRAL PLANT OPTIMIZATION MAINTENANCE AGREEMENT (Not in Scope)

Climatec LLC will continuously make monthly remote modifications via an encrypted connection to the central plant in efforts to keep it running at maximum efficiency. Climatec LLC’s energy engineers and Clients are to have seasonally onsite assessment debriefings in person. Reports on efficiency measures are to be delivered via email to Client on a scheduled basis and stored in the newly established portal. Software will be maintained and updated with all newly released patches available as released. Climatec LLC local plant operator training included on a scheduled basis. Client will have access to predetermined hours of support at no additional cost and with no additional paperwork authorization needed.

☐ MECHANICAL MAINTENANCE AGREEMENT (Not in Scope)

Climatec LLC will dispatch mechanical technician on a scheduled basis to preventatively maintain mechanical systems as listed TAB E. All work is to be documented in detailed via Field Service reports.

Client will also have access to predetermined hours of support at no additional cost and with no additional paperwork authorization needed (reference Tab F).

The client does have the option to divert assigned technician however must note so on Field Service Report (FSR) and understand that original scheduled tasks will require additional time to meet the preventative maintenance commitment.

☒ EMBEDDED PROJECT

Climatec LLC will finance 50% or less of client’s capital project over 3 years maximum of the selected technical agreement above.

Note that contract must remain in place for the duration of the three years or Client agrees to pay the remaining project balance off upon calculation of service agreement.
C. BMS EQUIPMENT & UPGRADE

Currently your Climatec system is running Envision Web. This proposal includes an upgrade of the obsolete Alerton BCM to a Bosch Global JACE with Web License. Controls listed below are associated with independently controlled HVAC equipment.

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Equipment Type</th>
<th>Model</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Global Controllers</td>
<td>ACM (post upgrade)</td>
<td>Alerton</td>
</tr>
<tr>
<td>31</td>
<td>Controllers</td>
<td>VAVIH-SD</td>
<td>Alerton</td>
</tr>
<tr>
<td>1</td>
<td>Controllers</td>
<td>VLC-1188</td>
<td>Alerton</td>
</tr>
<tr>
<td>2</td>
<td>BACnet Integration</td>
<td>xxx</td>
<td>Trane</td>
</tr>
<tr>
<td>1</td>
<td>Web Software</td>
<td>Compass Ascent-SM</td>
<td>Alerton</td>
</tr>
</tbody>
</table>

Upgrade Project - performed during year 1 of contract

Rationale

The existing user interface is obsolete and further patches to address security or other enhancements are not available. WRD is currently experiencing issues with the user interface. This proposal seeks to address these challenges while providing a new, secure user interface. The devices and integrations downstream from the existing global controller will remain in place.

This proposal includes a project at the commencement of the agreement and hence a down payment. As a result, if there is a cancellation of the agreement prior the full 3-year term, the remaining balance of the upgrade will be due in full.

Project Scope of Work

Climatec proposes to:

- Upgrade the existing Alerton BCM to an ACM and upgrade Envision to Compass Ascent:
  - provides fast, reliable DDC programming and global automation routines
  - design allows multiple DDC program instances to run within a single controller providing the ability to logically group sub-systems and improve uptime

Graphics connection will be via Ethernet or wireless LAN, or remotely over the internet.
Project Inclusions & Clarifications

Inclusions:

- New workstation computer
- Software Upgrade from existing Envision to Alerton Ascent Compass
- Prior to upgrade, Climatec backs up existing configuration to avoid database issues.
- Includes latest Compass software features, but existing graphics, alarms, trends are to remain (no refresh/modifications or revisions to nav tree).
- Climatec will check out and confirm the new software upgrade has successfully transferred all data including devices, schedules, trends and alarms. The Facility Performance and Evaluation Report will provide a more detailed baseline approximately 2 months post upgrade.
- Includes Four (4) hours of on-site training performed in one visit.
- Removal of existing BCM global controller (to be property of Climatec for rebate processing – credit included in pricing.)
- Install new Ascent Control Module global controller including:
  - Controller
  - Battery pack
  - 64 device license
- Design, programming, installation and checkout labor.
- One year warranty material and labor for new devices only.
- Taxes.
- Includes technician labor for the following additional scope associated with known issues:
  - Replace outside air temperature sensor – includes new sensor installed same location, programming/checkout (extra fee if relocation is required).
  - 1st floor communication (especially work space area), troubleshoot and reprogram as required issues with max air/heater commands (excludes any mechanical or other repairs).
  - 1st floor private office control system investigation and programming modifications/tuning (excludes any mechanical or other repairs).

Exclusions:

- Overtime: work to be performed during normal business hours
- Repair: assumes all mechanical and BAS systems are functioning normally (beyond those itemized for specific review in the inclusions portion of the project)
- Electrical: existing panels, conduit and transformers will be reused.
- Communications: IP addresses, Ethernet drops, and LAN connections or including any necessary network hardware, provided by owner.
- Modify existing graphics.
- Troubleshooting of existing equipment.
- Optimizing software for more than one web browser (Chrome is preferred).
D. VALUE ADDS

☐ NO LAPSE IN COVERAGE (Not in Scope)
Climatec LLC installed sites engaged in a TSA during the warranty period, qualify for No Lapse in Coverage. Newly installed DDC controllers and global devices found to be defective are to be replace at no additional material cost to the owner.

Note that this offering is limited to controllers within a 10 year manufacture life time stamp and excludes controls previously repaired, abused, altered, misused, damaged by fire, flood or act of God, or which have been clearly improperly maintained.

☒ REMOTE SUPPORT
Utilizing Climatec LLC in-house remote team, TSA Clients have access to live technical assistance within normal business hours. Our in house team is prepared to walk clients and fellow technicians through active situations. Technical support is available during normal business hours via phone, by logging in via a customer supplied remote connection or by utilizing Climatec LLC supplied Encrypted connection (see next offering).

Support is available during normal working hours and are limited to 30 min. intervals and for this site limited to 2 hours annually.

☐ ENCRYPTED TOSIBOX CONNECTION (Not in Scope)
Utilizing TOSIBOX® patented Plug & Go™ technology, Climatec LLC creates a fully secure remote connection between devices in minutes. Our technician will be able to securely dial into your computer, share screens, take control of the mouse/ computer, and communicate with the user. This is a plug and play offering that allows Climatec LLC to provide faster, secure support with minimal network setup.

☐ AXCESS 24/7 MONITORING (Not in Scope)
Through the use of the Axcess 24/7™ software platform, Climatec LLC will remotely monitor critical alarm points in your facility 24 hours, 7 days a week. Climatec LLC will alert the client and/or roll Climatec certified technicians as pre-directed by Client.

☐ CARBON MONOXIDE SYSTEM MAINTENANCE (Not in Scope)
Climatec LLC is to test each CO sensor for proper functionality on a yearly basis. Sensors found to be faulty are to be replaced under this agreement. System gas detection is to be simulated in efforts to test sequence of operation. Mechanical failures are to be documented and submitted to client. Strobe and horn failures are to be documented and submitted to client.

☐ FLEX HOURS (Not in Scope)
In addition to performing Climatec LLC’s Standard offerings and selected Service Agreement tasking listed in TAB E, Climatec LLC carries within this agreement a fix amount of predetermined labor to be used during normal business hours at the customer’s discretion.
☒ OPERATOR TRAINING (Informal coaching during service visit)
Climatec LLC to provide informal coaching as time allows during scheduled service visits.

☐ CERTIFIED TRAINING (Not in Scope)
Included in this proposal is certified training course for a predetermined count of staff members per year. Note that travel and hotel accommodations are not included.
SECTION A | STANDARD OFFERINGS

Software | Maintenance Performed Once a Year or as time allows
- System backup (full backup annually, partial every Visit)
- Point data backup complete
- Global controls programs and station backup complete
- Global control ROC files updated to latest revision of installed software version
- System software revisions updated to latest revision of installed software version
- Perform in-depth network diagnostic checks
- Document PC Name, Location, windows version, EMS software version

Master Hardware | Maintenance Performed Once a Year or as time allows
- Visual inspection of EMS server (includes monitors, keyboards and mouse)
- Report Climatec LLC supplied hardware items found to be defective for Clients replacement approval.
- Visual inspection of Global controller panels (ensure panels are clean and labeled)
- Verify no leaks and proper seals
- Replace system batteries every 5 years and document date
- Secure all loose wires and components
- Document any physical overrides or hard bypasses
- Ensure back up hard drive is active and working

Onsite Service Log | Performed Every Visit
- Review system log and prioritize issues with set tasking
- Document daily activity in Field Service Report
Preventive Maintenance TSA | Tasks to bePerformed Once a Year or as time allows

Central Plant Systems: Hot Water System;
- Verify set points and system resets
- Verify sequence of operations
- Tune as applicable chilled, condenser and hot water pressure loops
- Verify schedule start and stop times, and occupy commands to associated equipment.
- Document and release all overrides after confirming proper operations and consulting with client
- Address all issues and return all set points to scheduled settings

Air Handler Systems;
- Verify set points and system resets
- Verify economizer sequence of operations
- Tune damper, valves and static pressure loops
- Verify schedule start and stop times, and occupy commands to associated boxes
- Document and release all overrides after confirming proper operations and consulting with client
- Address all issues and return all set points to scheduled settings

AC Package systems (Fan Coils, AC units, Heat Pumps);
- Verify set points and resets
- Verify economizer sequence of operations when applicable
- Tune damper, valves control loops
- Verify schedule start and stop times
- Document and release all overrides after confirming proper operation and consulting with client
- Address all issues and return all set points to scheduled settings

VAV systems (Reheats, Single duct cooling only, Dual ducts);
- Verify set points and resets
- Verify heating and cooling sequence of operations
- Tune damper, valves, and air flow control loops
- Verify schedule start and stop times, and occupy commands from associated Air Handler Unit
- Document and release all overrides after confirming proper operation and consulting with client
- Address all issues and return all set points to scheduled settings

Miscellaneous fans (exhaust fans);
- Verify interlocks and schedule commands
- Tune air flow control loops if applicable
- Document and release all overrides after confirming proper operation and consulting with client
- Address all issues and return all set points to scheduled settings
F. PRICING & ACCEPTANCE

This proposed agreement is firm for one hundred and eighty (180) days, shall include the attached
Terms & Conditions, commence upon approval, and continue for a term of three (3) years. Period
- TSA Start Date _______________ TSA End Date_________________, for technical support services.

ANNUAL CHARGES:

This agreement shall be billed quarterly (as listed below) and is due and payable upon the Client’s
receipt of invoice. The annual charge for each year is:

Down Payment:  $10,961.00 *
First year service:  $12,944.00 *
Second year service:  $12,944.00 *
Third year service:  $12,944.00 *

Total over the 3-year term:  $49,793.00 *

*Including taxes

BILLING PERIOD CHARGES:

The first year billing shall be:
  one down payment upon signing:  $10,961.00 *
  quarterly (4) payments of:  $3,236.00 *

The Second year billing shall be 4 payments of:  $3,236.00 *

The Third year billing shall be 4 payments of:  $3,236.00 *

*Including taxes
BY AND BETWEEN:

CLIMATEC, LLC
2150 Towne Centre Place, Suite 200
Anaheim, CA 92806

CLIENT:
Water Replenishment District of Southern Calif.
4040 Paramount Blvd
Lakewood, CA 90712

Approvals:

CLIMATEC, LLC

CLIENT

Name

Name

Signature
Date
Signature
Date

Title

Title
G. LOCAL RATES

LOS ANGELES BRANCH SERVICE RATES & CHARGES

The following rates and charges are published for emergency and repair service on building HVAC equipment, control, fire/security systems and nurse call. These rates are subject to change at any time and only the current prevailing rate is applicable for customer billing.

Labor Rates*

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<th>Non-Contract Customers</th>
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<td>$172.50</td>
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</table>

*Effective January 01, 2018 – December 31, 2018

Material
Please consult your account representative.

Truck & Travel Expense
Truck Charge (cost per day) $75.00

Terms & Conditions
- Sales Tax will be listed separately as an additional charge
- Minimum billing of (1) hour for travel to work site
- Minimum billing of (1/2) one-half hour for dial-up service for work site
- All service calls shall be billed at a minimum of (4) hours
- Customer will notify Climatec LLC of any hazardous site conditions
- Access shall be made available to all areas required for service
- Same day service requested after 11am, may be subject to OT rates
MISCELLANEOUS CONDITIONS

Conditions here.
H. SUPPORT TEAM

24 HOUR SERVICE HOTLINE

877.689.1649

Additional Contacts

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Climatec Local #</td>
<td>949.252.6950</td>
</tr>
<tr>
<td>Climatec Corporate #</td>
<td>602.944.3330</td>
</tr>
<tr>
<td>Local Dispatch Supervisor</td>
<td><a href="mailto:agibbs@climatec.com">agibbs@climatec.com</a></td>
</tr>
<tr>
<td>Local Dispatch Manager</td>
<td><a href="mailto:dcagle@climatec.com">dcagle@climatec.com</a></td>
</tr>
<tr>
<td>Local Division Manager</td>
<td><a href="mailto:juniorm@climatec.com">juniorm@climatec.com</a></td>
</tr>
<tr>
<td>Local General Manager</td>
<td><a href="mailto:jacobb@climatec.com">jacobb@climatec.com</a></td>
</tr>
</tbody>
</table>

STEP ONE
PLACE SERVICE CALL
Service Line
877.689.1649
socalservice@climatec.com

STEP TWO
CALL LOCAL DISPATCH
Adena Gibbs or Lisa Bereczky
949.252.6950

STEP THREE
BUSINESS DEVELOPMENT SPECIALIST
Kris Moder
949.241.1778
KrisM@climatec.com
I. TERMS & CONDITIONS

1.0 GENERAL PROVISIONS

1.1 Unless stated otherwise, the services provided under this agreement shall be provided during Climatec LLC’s normal business hours. Normal business hours are Monday through Friday, 8:00AM to 5:00PM inclusive, excluding Holidays.

1.2 The Client shall provide reasonable means of access to the equipment being serviced. Climatec, LLC shall not be responsible for any removal, replacement, or refinishing of the building structure, if required to gain access to the equipment. Climatec LLC shall be permitted to start and stop all equipment necessary to perform the services herein described as arranged with the Client’s representative.

1.3 This agreement, when accepted in writing by the Client and approved by an authorized Climatec LLC representative, shall constitute the entire agreement between the two (2) parties.

2.0 CHARGES

2.1 For services not covered by this agreement, but performed by Climatec LLC upon the Client’s authorization, the Client agrees to pay Climatec LLC upon presentation of itemized invoice(s) at Climatec LLC’s prevailing rates.

2.2 If emergency service is requested by the Client and inspection does not reveal any defect for which Climatec LLC is liable under this agreement, the Client will be charged at Climatec LLC’s prevailing rates.

2.3 Unless otherwise specified, this agreement will commence on the date indicated for the term of three (3) years and shall continue from year to year until terminated. Either party may terminate this agreement at any time by giving a thirty (30) day written notice to the other. The agreement price may be adjusted on its anniversary date based on mutual agreement, prevailing labor, and material costs.

3.0 LIMITATIONS OF LIABILITY

3.1 Climatec LLC shall not be liable for any loss, delay, injury, or damage that may be caused by circumstances beyond its control including, but not restricted to; acts of God, war, civil commotion, acts of government, fire, theft, corrosion, floods, lightning strikes, freezes, strikes, lockouts, differences with workmen, riots, explosions, quarantine restrictions, delays in transportation, shortage of vehicles, fuel, labor or materials, or malicious mischief. IN NO EVENT SHALL CLIMATEC LLC BE LIABLE FOR BUSINESS INTERRUPTION, LOSSES, OR CONSEQUENTIAL OR SPECULATIVE DAMAGES.

3.2 Climatec LLC shall not be required to make safety tests, install new devices, or make modifications to any equipment to comply with recommendations or directives of insurance companies, governmental bodies, or for other reasons.
3.3 Climatec LLC shall not be required to make replacements or repairs necessitated by reason of the Client’s personnel negligence, abuse, misuse, or by reason of any other cause beyond its control except ordinary wear and tear.

3.4 The agreement pre-supposes that all equipment is in satisfactory working order. Climatec LLC will inspect the equipment within thirty (30) days of when the agreement takes effect and will advise the Client of any equipment found to be in need of repair. Climatec LLC will provide the Client with a written estimate of the cost of repairs. If the Client does not authorize Climatec LLC to make the repairs or if the Client does not have the work performed, the equipment will be eliminated from coverage and the agreement price will be adjusted. There may be some equipment which, for reasons beyond Climatec LLC’s control, cannot be inspected before this agreement takes effect. Climatec LLC will inspect such equipment on the first available visit.

3.5 The amount of any present or future sales, use, occupancy excise, or other tax (federal, state, or local) which Climatec LLC hereafter shall be obligated to pay, either on its own behalf or on the behalf of the Client or otherwise, with respect to the services and material covered by this agreement, shall be paid by the Client.

3.6 If the equipment or software included under this agreement is altered, modified, or changed by a party other than Climatec LLC, this agreement shall be modified to incorporate such changes and the agreement price shall be adjusted accordingly.

3.7 It is understood that the provisions of this agreement apply only to the systems and equipment covered herein. Repair or replacement of non-maintainable parts of the system such as ductwork, boiler shell and tubes, unit cabinets, boiler re-factory material, electrical wiring, hydronic and pneumatic piping, structural supports, etc., is not included under the agreement.

3.8 Following twelve (12) months of service or any time thereafter, if individual item(s) cannot, in Climatec LLC’s opinion, be properly repaired on-site because of excessive wear or deterioration, Climatec LLC may withdraw the item(s) from coverage upon ninety (90) days prior written notice.

3.9 This agreement shall comply with all applicable federal, state and local laws and regulations.
EXHIBIT B
CONTRACTOR RATE SCHEDULE

1.0 Contractor shall be compensated for actual services performed in accordance with this Agreement and based on the rates and pricing terms stated in Contractor’s proposal in Exhibit A.

2.0 A budgetary amount of $65,000.00 (which amount applies to Contractor’s fee) is established for this Agreement. Notwithstanding any other provision of this Agreement, the District shall not be obligated to pay Contractor any amount in excess of said budgetary amount absent prior written approval from the District. Likewise, Contractor shall not be obligated to perform services or incur expenses in excess of the budgetary amount absent prior written approval from the District.
MEMORANDUM
ITEM NO. 9

DATE: JULY 18, 2019
TO: BOARD OF DIRECTORS
FROM: ROBB WHITAKER, GENERAL MANAGER
SUBJECT: AUTHORIZE RELEASE OF A REQUEST FOR BIDS (RFB) FOR THE LEO J. VANDER LANS WATER TREATMENT FACILITY CALCIUM CHLORIDE BULK STORAGE EXPANSION PROJECT

SUMMARY
The reverse osmosis (RO) process at the Leo J. Vander Lans Water Treatment Facility (LVLWTF) produces a highly corrosive RO permeate water due the removal of minerals and hardness through the process. As a result, post-treatment of RO permeate with calcium chloride (CaCl$_2$) is necessary for stabilization before sending the final product water to the Alamitos Barrier. CaCl$_2$ addition is required to achieve regulatory limits for the Langelier Saturation Index (LSI) in the final product water.

The current storage capacity for the bulk CaCl$_2$ is insufficient and has resulted in unintended plant shutdowns on occasion. CaCl$_2$ is added to the process from a bulk 5,000-gallon capacity tank. At current plant flows (4 MGD production) the existing storage only provides 18 days of storage. The tanker trucks used to deliver CaCl$_2$ typically have a full-load volume of 4,000 gallons. In order to avoid paying short-load fees or returning chemical to the supplier, it is preferred that CaCl$_2$ deliveries not occur until the storage tank level is below 1,000 gallons. This leaves an approximate 3.5 day window to accept a full-load (4,000 gallons) of CaCl$_2$. Historically, tanker truck availability, holidays, and delivery scheduling of the CaCl$_2$ supplier have resulted in instances where the plant was unintentionally shut down due to insufficient CaCl$_2$ availability. Additional capacity will allow more operational reliability and surety, as well as extend the time between deliveries.

The expansion of the CaCl$_2$ bulk storage system through the addition of a second 5,000-gallon tank, piping, instrumentation, and other appurtenances will provide additional storage capacity and allow for sustainable operations at current and future conditions. The additional tank will also allow deliveries to be more efficiently scheduled without threat of unplanned plant shutdowns or increased costs associated with short-load deliveries. For the future 8 MGD operation of the facility, the second tank will increase the time between chemical deliveries from approximately 9 days to 18 days.
Final design of the calcium chloride bulk storage expansion project was completed in April 2019 by Hazen and Sawyer. Design reviews were provided by both WRD’s engineering and operations departments.

**FISCAL IMPACT**

Funds for this project will come from the Leo J. Vander Lans capital improvements budget. Once bids are reviewed and received, the dollar amount will be presented to the Committee.

**CAPITAL IMPROVEMENT PROJECTS (CIP) COMMITTEE RECOMMENDATION**

The Capital Improvements Projects (CIP) Committee recommends that the Board of Directors authorize the release of a Request for Bids (RFB) for the Leo J. Vander Lans Water Treatment Facility Calcium Chloride Bulk Storage Expansion Project.
WATER REPLENISHMENT DISTRICT OF SOUTHERN CALIFORNIA

LEO J. VANDER LANS ADVANCED WATER TREATMENT FACILITY CALCIUM CHLORIDE BULK STORAGE EXPANSION

(SOLICITATION REFERENCE NO. RFB-19-001)

CONTRACT NO. 1067
CONTRACT DRAWINGS
SPECIFICATIONS (DIVISIONS 00-17)

BID SUBMISSION

Engineer:
Hazen
Hazen and Sawyer
1149 South Hill Street, Suite 450
Los Angeles, California 90015

04/26/19

Packet Page 128 of 760
**Water Replenishment District of Southern California**  
**Leo J. Vander Lans Advanced Water Treatment Facility**  
**Calcium Chloride Bulk Storage Expansion**

**SECTION 0003**  
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## TECHNICAL SPECIFICATIONS
### Bid Submission

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Sealed Bids for the construction of the LEO J. VANDER LANS ADVANCED WATER TREATMENT FACILITY CALCIUM CHLORIDE BULK STORAGE EXPANSION PROJECT will be received by Water Replenishment District of Southern California, 4040 Paramount Boulevard, Lakewood, CA, 90712, until 11:00 AM local time on August 22, 2019, at which time the Bids received will be publicly opened and read.

The Project consists of furnishing all labor, materials, equipment, supplies and incidentals required to construct the expansion of the bulk storage area for Calcium Chloride system at LVL.

Bids will be received for a single prime Contract. Bids shall be on a lump sum and unit price basis, as indicated in the Bid Form. Bidding Documents may be obtained free of charge from the WRD Procurement Portal at: https://wrd.bonfirehub.com/, which will be posted under this Solicitation Reference Number and Project Title and in the format stated in the advertisement or invitation to bid. Prospective bidders must register through WRD’s Procurement Portal in order to download plans and specifications, reference documents, and to receive addenda and notifications when issued.

BIDS MUST BE SUBMITTED USING THE BID FORMS INCLUDED IN THE BID DOCUMENTS FOR THE CONSTRUCTION OF THE LEO J. VANDER LANS ADVANCED WATER TREATMENT FACILITY CALCIUM CHLORIDE BULK STORAGE EXPANSION PROJECT. Each Bid must be accompanied by a certified check drawn on a solvent bank, payable to the WRD, for an amount equal to ten percent (10%) of the total maximum amount Bid or by a satisfactory corporate surety bond for said amount and so payable, as a guarantee that the successful Bidder will within ten (10) days from the date of the award of the Contract, enter into a valid Contract with the WRD for said work in accordance with said Bid Documents.

The successful Bidder will be required to submit performance and payment bonds with the Contract. A bond in the sum of one hundred percent (100%) of the Contract price shall be furnished, guaranteeing the faithful performance of said Contract, and a bond in the sum of one hundred percent (100%) of the Contract price shall be furnished for the protection of all laborers and materialmen.

Pursuant to Public Contract Code Section 10263, Contractor will be permitted to substitute securities in lieu of retention.

Bids shall be made in accordance with the prevailing hourly rate of the wages for this locality and project as determined by the Director of Industrial Relations pursuant to Labor Code Section 1770 et. seq, a copy of which wage rate schedule is on file in the office of the WRD. The Contractor and any of its subcontractors shall pay not less than the specified prevailing rate of per diem wages for general, holiday and overtime work to all workers employed in the execution of this Contract.

Contractors submitting a bid shall possess, at the time the contract is awarded, the following class of contractor’s license issued pursuant to Division 3, Chapter 9 of the Business and Professions Code of the State of California: General Engineering Contracting A License. The Contractor shall certify that the license specified is the classification of contractor’s license required by law to enable the Contractor to perform the Work contemplated under the Contract Documents.
Water Replenishment District of Southern California  
LVL Calcium Chloride Bulk Storage Expansion Project  
Contractor shall provide WRD with a copy of its Contractor’s License and expiration date with its bid, and shall present satisfactory evidence that it is licensed in good standing.

Each Contractor submitting a bid shall complete and submit with the bid all of the mandatory forms and information requested by the Bid Documents. Failure to include any of these documents with the bid may disqualify the bid.

WRD reserves the right to reject any and all bids, and to waive any informality in any bid received, and to be the sole judge of the merits of the respective bids received. The award, if made, will be made to the lowest responsible bidder.

A mandatory pre-bid conference will be held at 10:00 AM local time on July 30, 2019 at the Water Replenishment District of Southern California, 4040 Paramount Boulevard, Lakewood, CA 90712.


LATE BIDS WILL NOT BE CONSIDERED.
WATER REPLENISHMENT DISTRICT OF SOUTHERN CALIFORNIA
Melody Wu, Project Administrator

Owner:  Water Replenishment of Southern California
By:    Board of Directors
Date:  July 18, 2019

++END OF SECTION++
**SECTION 00202**

**INSTRUCTIONS TO BIDDERS**

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ARTICLE 1 – DEFINED TERMS

1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions.

ARTICLE 2 – COPIES OF BIDDING DOCUMENTS

2.01 Complete sets of the Bidding Documents may be obtained free of charge from the WRD Procurement Portal at: https://wrd.bonfirehub.com/, which will be posted under this Solicitation Reference Number and Project Title and in the format stated in the advertisement or invitation to bid. Prospective bidders must register through WRD’s Procurement Portal in order to download plans and specifications, reference documents, and to receive addenda and notifications when issued.

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

2.03 Owner and Engineer, 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 authorize or confer a license for any other use.

ARTICLE 3 – QUALIFICATIONS OF BIDDERS

3.01 Bidders shall complete the General Contractor Questionnaire (Section 00430)

3.02 Owner may conduct such investigations as Owner deems necessary to assist in the evaluation of any Bid and to establish the responsibility, qualifications and financial ability of Bidders, proposed listed Subcontractors, suppliers and other persons and organizations to perform and furnish the Work in accordance with the Contract Documents to Owner’s satisfaction within the prescribed time. A Bidder’s failure to promptly respond to such investigations and inquiries shall result in the rejection of the Bidder’s Bid as non-responsive.

3.03 In the event the Owner renders a finding that Bidder or a listed subcontractor is not a responsible bidder, including based upon the General Contractor Questionnaire and Paragraphs 3.01 and 3.02 immediately above, the Owner will provide the Bidder and, if applicable, the affected listed subcontractor, notice of such a finding and, if requested, a due process hearing wherein the Bidder and, if applicable, the affected listed subcontractor, will be provided an opportunity to respond and contest the finding of non-responsibility and present evidence of its responsibility. The Bidder and, if applicable, the affected listed subcontractor, must notify Owner of its request for a due process hearing within five (5) working days of the date of the notice and may submit evidence or a response to the finding with the request. The Owner will notify the Bidder and, if applicable, the affected subcontractor, of the date, time, and location of the hearing, which may take place within five (5) working days of the request for the due process hearing.

3.04 If the Owner ultimately determines that a listed subcontractor is not responsible, Owner may grant permission to the Bidder to substitute the non-responsible listed subcontractor pursuant to Public Contract Code §4107(a)(9) provided that such substitution results in no change in the amount of the Bidder’s bid. If the Bidder refuses to substitute the listed...
3.05 All contractors and subcontractors listed in the Bid Form must be registered with the Department of Industrial Relations pursuant to Labor Code Section 1725.5.

3.06 A Bidder’s failure to submit required qualification information within the times indicated may disqualify Bidder from receiving an award of the Contract.

3.07 No requirement in this Article 3 to submit information will prejudice the right of Owner to seek additional pertinent information regarding Bidder’s qualifications.

3.08 Bidder is advised to carefully review those portions of the Bid Form requiring Bidder’s representations and certifications.

ARTICLE 4 – SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OTHER WORK AT THE SITE

4.01 Site and Other Areas

A. The Site is identified in the Bidding Documents. By definition, the Site includes rights-of-way, easements, and other lands furnished by Owner for the use of the Contractor. Any additional lands required for temporary construction facilities, construction equipment, or storage of materials and equipment, and any access needed for such additional lands, are to be obtained and paid for by Contractor.

4.02 Existing Site Conditions

A. Subsurface and Physical Conditions; Hazardous Environmental Conditions

1. The Supplementary Conditions identify:

   a. Those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site.
   
   b. Those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).
   
   c. Reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.
   
   d. Technical Data contained in such reports and drawings.

2. Owner will make copies of reports and drawings referenced above available to any Bidder on request. These reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the General Conditions, has been identified and established in the Supplementary 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.

3. If the Supplementary Conditions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply.
Water Replenishment District of Southern California
LVL Calcium Chloride Bulk Storage Expansion Project

4.03 Site Visit and Testing by Bidders

A. Bidder shall conduct the required Site visit during normal working hours, and shall not disturb any ongoing operations at the Site.

B. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.

C. On request, and to the extent Owner has control over the Site, and schedule permitting, the Owner may provide Bidder access to the Site to conduct such additional examinations, investigations, explorations, tests, and studies as Bidder deems necessary for preparing and submitting a successful Bid. Owner will not have any obligation to grant such access if doing so is not practical because of existing operations, security or safety concerns, or restraints on Owner’s authority regarding the Site.

D. Bidder shall comply with all applicable Laws and Regulations regarding excavation and location of utilities, obtain all permits, and comply with all terms and conditions established by Owner or by property owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.

E. If applicable, Bidder shall fill all testing holes and clean up and restore the Site to its former condition from any investigative or testing related Site disturbances upon completion of such explorations, investigations, tests, and studies.

4.04 Other Work at the Site

A. Reference is made to Article 8 of the Supplementary Conditions for the identification of the general nature of other work of which Owner is aware (if any) that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) and relates to the Work contemplated by these Bidding Documents. If Owner is party to a written contract for such other work, then on request, Owner will provide to each Bidder access to examine such contracts (other than portions thereof related to price and other confidential matters), if any.
ARTICLE 5 – BIDDER’S REPRESENTATIONS

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

A. Examine and carefully study the Bidding Documents, and any data and reference items identified in the Bidding Documents;

B. Visit the Site, conduct a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfy itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;

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

D. Carefully study all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures or utilities at the Site that have been identified in the Bidding Documents, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Bidding Documents, especially with respect to Technical Data in such reports and drawings;

E. Consider the information known to Bidder itself; 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; and (3) Bidder’s safety precautions and programs;

F. Agree, based on the information and observations referred to in the preceding paragraphs, that at the time of submitting its Bid 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 bid and within the times required, 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. Promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder;

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

J. Agree that the submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.
ARTICLE 6 – PRE-BID CONFERENCE

6.01 A pre-bid conference, if any, will be held at the time and location stated in the invitation or advertisement to bid. Representatives of Owner and Engineer will be present to discuss the Project. Bidders are encouraged to attend and participate in the conference. Engineer will transmit to all prospective Bidders of record such Addenda as Engineer considers necessary in response to questions arising at the conference. Oral statements at the pre-bid conference may not be relied upon and will not be binding or legally effective.

ARTICLE 7 – INTERPRETATIONS OF BIDDING DOCUMENTS AND ADDENDA

7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to the Engineer in writing. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all parties recorded as having received the Bidding Documents. Questions received less than seven (7) days prior to the date for opening of Bids may not be answered. Only responses to 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, supplement, or change the Bidding Documents.

ARTICLE 8 – BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of 10% of Bidder’s maximum Bid price (determined by adding all bid schedules) and in the form of a certified check, bank money order, or a Bid bond (on the form included in the Bidding Documents) issued by a surety meeting the requirements of Paragraphs 6.01 and 6.02 of the General Conditions.

8.02 The Bid security of the apparent Successful Bidder will be retained until Owner awards the Contract to such Bidder, and 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 released. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within fifteen (15) days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited. The amount of the forfeiture will be limited to the amount of the Bid security or the difference between the rejected Bid and the next lowest responsive Bid accepted by the Owner, whichever is lower. Such forfeiture shall be Owner’s exclusive remedy if Bidder defaults.

8.03 The Bid security of other Bidders that Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of seven (7) days after the Effective Date of the Contract or sixty-one (61) days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.

8.04 Bid security of other Bidders that Owner believes do not have a reasonable chance of receiving the award will be released within seven (7) days after the Bid opening.
ARTICLE 9 – CONTRACT TIMES

9.01 The number of consecutive calendar days within which, or 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, if any, for failure to timely attain a Milestone, Substantial Completion, or completion of the Work in readiness for final payment, are set forth in the Agreement.

ARTICLE 11 – SUBSTITUTE AND “OR-EQUAL” ITEMS

11.01 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration during the bidding and Contract award process of possible substitute or “or-equal” items. In cases in which the Contract allows the Contractor to request that Engineer authorize the use of a substitute or “or-equal” item of material or equipment, application for such acceptance may not be made to and will not be considered by Engineer until after the Effective Date of the Contract.

11.02 All prices that Bidder sets forth in its Bid shall be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of “or-equal” or substitution requests are made at Bidder’s sole risk.

ARTICLE 12 – SUBCONTRACTORS

12.01 Each Bidder must identify the names and addresses of the Subcontractors listed in the General Contractor Questionnaire (Section 00430). If requested by Owner, Bidder shall, within seven (7) days after the date of the request, submit to Owner an experience statement with pertinent information as to similar projects and other evidence of qualification for each such Subcontractor, person and organization.

ARTICLE 13 – PREPARATION OF BID

13.01 The Bid Form is included with the Bidding Documents.
   A. All blanks on the Bid Form shall be completed in ink and the Bid Form 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 section, Bid item, alternate, adjustment unit price item, and unit price item listed therein.
   B. If the Bid Form expressly requests pricing on a specific alternate item, then Bidder is required to provide pricing on the alternate item.

13.02 A Bid by a corporation shall be executed in the corporate name by a corporate officer (whose title must appear under the signature), accompanied by evidence of authority to sign in the Authority to Execute (Section 00435). The corporate address and State of incorporation shall be shown.
A Bid by a limited liability company shall be executed in the name of the firm by a member or other authorized person 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.

A Bid by an individual shall show the Bidder’s name and official address.

A Bid by a joint venture shall be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The official address of the joint venture shall be shown.

All names shall be printed in ink below the signatures.

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

Postal and e-mail addresses and telephone number for communications regarding the Bid shall be shown.

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

ARTICLE 14 – BASIS OF BID

14.01 Unit Price

A. Bidders shall submit a Bid on a lump sum basis and unit prices for each item of Work listed in the Bid Form.

B. The “Bid Price” (sometimes referred to as the extended price) for each unit price Bid item will be the product of the “Estimated Quantity” (which Owner or its representative has set forth in the Bid Form) for the item and the corresponding “Bid Unit Price” offered by the Bidder. The total of all unit price Bid items will be the sum of these “Bid Prices”; such total will be used by Owner for Bid comparison purposes. The final quantities and Contract Price will be determined in accordance with Paragraph 13.03 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.

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 the Bid security and the other documents required to be submitted under the terms of Article 7 of the Bid Form.

15.02 A Bid shall be received no later than the date and time prescribed and at the place indicated in the advertisement or invitation to bid and shall be enclosed in a plainly marked package 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 package plainly marked on the outside with the notation “BID ENCLOSED.” A mailed Bid shall be addressed to: Attn: Melody Wu, Water Replenishment of Southern California, 4040 Paramount Boulevard, Lakewood, CA 90712.
15.03 Bids received after the date and time prescribed in the Bidding Documents, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the Bidder unopened.

ARTICLE 16 – MODIFICATION AND WITHDRAWAL OF BID

16.01 A Bid may be withdrawn by an appropriate document duly executed in the same 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. Upon receipt of such notice, the unopened Bid will be returned to the Bidder.

16.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 16.01 above and submit a new Bid prior to the date and time for the opening of Bids.

16.03 Bids may not be changed or withdrawn after the deadline for submission of bids, except that the Owner may consent to relieve a bidder from its bid, without forfeiting its bid security, on the grounds of a clerical mistake provided that the bidder establishes to the satisfaction of the Owner that:

1. A mistake was made;
2. The bidder gave the Owner written notice within five calendar days after the opening of the bids of the mistake, specifying in the notice in detail how the mistake occurred;
3. The mistake made the bid materially different from what the bidder intended it to be; and
4. The mistake was made in filling out the bid and not due to error in judgment or to carelessness in inspecting the site of the work, or in reading the plans or specifications.

If the Owner consents to relieve a bidder of its bid after the deadline for submission of bids without forfeiting its bid security, the Owner will prepare a report documenting that the bidder has satisfactory established each of the four elements set forth above.

ARTICLE 17 – OPENING OF BIDS

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

ARTICLE 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, in 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 will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be
responsible or responsive. If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, then the Owner will reject the Bid as nonresponsive; provided that Owner also reserves the right to waive all minor informalities not involving price, time, or changes in the Work.

19.02 If Owner awards the Contract for the Work, such award shall be to the responsible Bidder submitting the lowest responsive Bid.

19.03 Evaluation of Bids

A. 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.

B. For the determination of the apparent low Bidder when unit price bids are submitted, Bids will be compared on the basis of the total of the products of the estimated quantity of each item and unit price Bid for that item, together with any lump sum items.

19.04 In evaluating whether a Bidder is responsible, Owner will consider the qualifications of the Bidder and may consider the qualifications and experience of subcontractors and suppliers proposed for those portions of the Work for which the identity of subcontractors and suppliers must be submitted as provided in the Bidding Documents.

19.05 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders and any proposed Subcontractors or Suppliers.

19.06 In the event of any ambiguity in a Bid, the Owner shall resolve such ambiguity as follows: unit prices shall govern over any extension thereof by the Bidder, and prices for individual bid items or elements shall govern over the summation thereof by the Bidder. The Owner may correct a Bid by multiplying the Bidder’s unit price for a particular Bid item by the applicable quantity, and by adding the Bid items together to obtain the Bidder’s total Bid. Bids so construed will be deemed to be the Bid submitted by the Bidder. If an ambiguity in a Bid cannot be resolved by the foregoing method, the Bid will be deemed nonresponsive and rejected by the Owner.

ARTICLE 20 – BONDS AND INSURANCE

20.01 Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner’s requirements as to performance and payment bonds and insurance. When the Successful Bidder delivers the Agreement (executed by Successful Bidder) to Owner, it shall be accompanied by required bonds and insurance documentation.

ARTICLE 21 – SIGNING OF AGREEMENT

21.01 When Owner issues a Notice of Award to the Successful Bidder, it shall be accompanied by the unexecuted counterparts of the Agreement along with the other Contract Documents as identified in the Agreement. Within 15 days thereafter, Successful Bidder shall execute and deliver the required number of counterparts of the Agreement (and any bonds and insurance documentation required to be delivered by the Contract Documents) to Owner. Within 10 days thereafter, Owner shall deliver one fully executed
ARTICLE 22 – BIDDER PROTEST OF AWARD

23.01 A Bidder may protest the award of the Contract by submitting to the Owner a written protest stating the grounds for the protest along with supporting documentation. The protest must be received by the Owner before the Owner’s action to approve the award of the Contract. The Owner’s General Manager shall investigate the grounds for the protest, examine the documentation, make inquiries as necessary, and accept or reject the protest in writing within five (5) working days of receipt. If the protest is accepted, the Owner may, at its discretion, reject the Bid in question and award the Contract in accordance with its Procurement Policies and Procedures or it may reject all bids.

Protest determinations of the General Manager may be appealed to the Board at its next scheduled meeting, provided the appeal is filed by the end of the second (2) business day of the General Manager’s determination and is otherwise eligible for posting on the Board’s agenda. The President of the Board may call a special Board meeting to hear and rule on the appeal.

Bid protests that do not comply with the deadlines and filing requirements set forth above shall not be considered. The award of the Contract by the Owner shall be contingent on the final resolution of any protests.
SECTION 00300
BID FORM

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ARTICLE 1 – BID RECIPIENT

1.01 This Bid is submitted to:
   
   **Attn: Melody Wu**
   **Water Replenishment District of Southern California**
   **4040 Paramount Boulevard**
   **Lakewood, CA 90712**

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 – BIDDER’S ACKNOWLEDGMENTS

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 90 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, and any data and reference items identified in the Bidding Documents, and hereby acknowledges receipt of the following Addenda:

   *(The table below must be completed by Bidder.)*

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B. Bidder has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfied itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. Bidder is familiar with and has satisfied itself as to all 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 adjacent to the Site and all drawings of physical conditions relating to
existing surface or subsurface structures at the Site that have been identified in the Supplementary General Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary General Conditions, especially with respect to Technical Data in such reports and drawings.

E. Bidder has considered the information known to Bidder itself; 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 any 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; and (3) Bidder’s safety precautions and programs.

F. Bidder agrees, based on the information and observations referred to in the preceding paragraph, that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents.

G. Bidder 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 Bidding Documents.

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

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

J. The submission of this Bid constitutes an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, and that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

K. All communications concerning this Bid must be in written form and shall be submitted through the Opportunity Q&A section via the WRD Procurement Portal at https://wrd.bonfirehub.com/. For guidance on how to submit a question through https://wrd.bonfirehub.com/, please visit https://support.gobonfire.com/hc/en-us/articles/115015333227-How-do-I-contact-the-Project-Owner-.

ARTICLE 4 – BIDDER’S CERTIFICATION

4.01 Bidder certifies 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 collusive 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 anything 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 (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 price(s) contained in the Bid Table (see Exhibit A of the Bid Form located below for the Bid Table).

5.02 Bidder acknowledges that (1) each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor’s overhead and profit for each separately identified item, and (2) 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.

5.03 Determination of Lowest Bid:
   1. The lowest bid shall be the lowest total price for all bid items and alternates.
   2. The Owner will award to the lowest responsive and responsible bidder as defined herein and in the Instructions to Bidders, a contract for the Project consisting of “Total Bid Price” (LINE C).

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 15.06 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 damages.

ARTICLE 7 – ATTACHMENTS TO THIS BID

7.01 The following documents are submitted with and made a condition of this Bid:
   A. Bid Bond 00410;
   B. General Contractor Questionnaire 00430;
C. Authority to Execute Bid and Contract 00435 (if necessary);
D. Non-Collusion Affidavit 00650;
E. Evidence of Contractor’s license.

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, General Conditions, and Supplementary General Conditions.
ARTICLE 9 – BID SUBMITTAL

Sole Proprietorship:

By: _________________________________________________________
(SEAL) Individual’s Name

Doing business as: ________________________________

Business address: _____________________________________________

_________________________________________________________________

_________________________________________________________________

Phone Number: _____________________________________________

Partnership:

By: _______________________________________________________
(SEAL) Firm Name

_________________________________________________________________

General Partner

Business address: _____________________________________________

_________________________________________________________________

_________________________________________________________________

Phone Number: _____________________________________________
Corporation:

By: ________________________________ Corporation Name

(SEAL)

State of Incorporation

By: ________________________________ Name of person authorized to sign

Title

(Corporate Seal)

Attest: ________________________________ Secretary

Business address: ____________________________

Phone Number: _____________________________
Joint Venture:

By: _______________________________________________________
    Name

Address: ________________________________________________

_____________________________________________________

_____________________________________________________

By: _______________________________________________________
    Name

Address: ________________________________________________

_____________________________________________________

_____________________________________________________

(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).
### MANDATORY BID SUBMITTAL FORM

**LVL Calcium Chloride Bulk Storage Expansion Project**

**Water Replenishment District of Southern California**

**Item No.** | **Description** | **Unit** | **Estimated Quantity** | **Bid Unit Price** | **Bid Price**
--- | --- | --- | --- | --- | ---
1 | Mobilization and Preparatory Work (cannot exceed 5% of the subtotal of all other bid items) | LS | 1 |  | Enter price at the bottom of this bid form on **LINE B**
2 | Demolition Site Work | LS | 1 | $ | $ |
3 | Calcium Chloride Bulk Storage System | LS | 1 | $ | $ |
4 | Electrical and Instrumentation Work | LS | 1 | $ | $ |
5 | Startup Testing, Training, Miscellaneous Items | LS | 1 | $ | $ |

**LINE A**  
**Subtotal, Bid Items 2 through 5:** $

**LINE B**  
**Price for Bid Item 1 (cannot exceed 5% of Line A):** $

**LINE C**  
**TOTAL NUMERICAL BID PRICE (Line A + Line B):** $

**TOTAL BID PRICE (Spell Out Total Bid Price Using Words)**
Submitted By:

Contractor Name: _____________________________________________
License #/Expiration Date: _______________________________________
DIR #/Expiration Date: __________________________________________
By: __________________________________________________________

Name/title

++END OF SECTION++
MANDATORY BID SUBMITTAL FORM

LVL Calcium Chloride Bulk Storage Expansion Project

SECTION 00410
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):
Water Replenishment District of Southern California
4040 Paramount Boulevard, Lakewood, California 90712

BID
Bid Due Date:  
August 22, 2019 at 11:00 AM local time

Description:  
LVL CALCIUM CHLORIDE BULK STORAGE EXPANSION PROJECT

BOND
Bond Number: ________________________________
Penal sum:  
(Figures) ________________________________
(Words) ________________________________

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  
By:  
Signature
Print Name
Title
Attest:  
Signature
Title

SURETY  
By:  
Signature (Attach Power of Attorney)
Print Name
Title
Attest:  
Signature
Title
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 thirty (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 the Bid due date without Surety’s written consent.

6. No suit or action shall be commenced under this Bond prior to thirty (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 the 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 00430

GENERAL CONTRACTOR QUESTIONNAIRE

The undersigned warrants the truth and accuracy of all statements and answers herein contained. Include additional sheets if necessary.

1. Bidder must have experience in successful completion of Chemical Systems, as a General Contractor of public works improvements within the last 5 years. List at least four (4) separate projects below with chemical description, construction bid cost, owner/agency, and date of completion.

   a. ________________________________________________________________________

   b. ________________________________________________________________________

   c. ________________________________________________________________________

   d. ________________________________________________________________________

2. Provide contact information (name of person, title/position, name of organization, address, telephone, and email address) for reference verification on the projects identified in Item 1 above. At least one contact person shall be provided for each listed project.

   a. ________________________________________________________________________

   b. ________________________________________________________________________

   c. ________________________________________________________________________

   d. ________________________________________________________________________
3. Have you ever failed to complete work awarded to you? If so, when, where and why?
_____________________________________________________________________________
_____________________________________________________________________________

4. Has a surety firm completed a contract on your behalf, or paid for completion because your firm was in default or terminated by the project owner within the last ten (10) years?

   Yes _____   No _____

   If “yes,” please explain on a separate signed sheet.

5. Has your firm changed names or license number in the past five years?

   Yes _____   No _____

   If “yes,” please explain on a separate signed sheet.

6. Has any Contractor’s State License or similar state or local agency license held by your firm or its Responsible Managing Employee (RME) or Responsible Managing Officer (RMO) been suspended within the last five years?

   Yes _____   No _____

   If “yes,” please explain on a separate signed sheet.

7. At any time during the past five years, has any surety company made payments on your firm’s behalf as a result of a default, to satisfy any claims made against a performance or payment bond issued on your firm’s behalf, in connection with a construction project, either public or private?

   Yes _____   No _____

   If “yes,” explain on a separate signed page the amount of each such claim, the name and telephone number of the claimant, the date of the claim, the grounds for the claim, the present status of the claim, the date of resolution of such claim if resolved, the method by which such was resolved if resolved, the nature of the resolution and the amount, if any, at which the claim was resolved.

8. State the true and exact, correct, and complete name under which you do business.

   BIDDER IS:   ______________________________________________________________
LIST OF SUBCONTRACTORS

The bidder is required to furnish the following information in accordance with the provisions of the Subletting and Subcontracting Fair Practices Act (California Public Contract Code §4100, et seq.).

Subcontractors, as defined in California Public Contract Code Section 4104(a)(1), must be listed in the table below if they will provide work, labor or service in an amount in excess of one-half (½) of one percent (1 %) of the total bid. Attach additional sheets as necessary.

<table>
<thead>
<tr>
<th>Subcontractor (include PWR and DIR Registration Nos.)</th>
<th>License No. &amp; Type</th>
<th>Main Office Address</th>
<th>% of Total Dollar Value Work</th>
<th>Description of Subcontract</th>
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00430 General Contractor Questionnaire  00430-3  7/22/2019
### Water Replenishment District of Southern California
#### LVL Calcium Chloride Bulk Storage Expansion Project

**MANDATORY BID SUBMITTAL FORM**

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<th>Subcontractor (include PWR and DIR Registration Nos.)</th>
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<th>% of Total Dollar Value Work</th>
<th>Description of Subcontract</th>
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Meeting Date: 7/18/2019  Item No. 9  00430 General Contractor Questionnaire  00430-4  7/22/2019  Packet Page 164 of 760
The undersigned certifies and declares under penalty of perjury under the laws of the State of California that the Bidder has agreed to enter into subcontracts with the above-listed subcontractors upon award of the Contract, the information provided for each subcontractor is true and correct, and that the Bidder will provide the documentary evidence required pursuant to Instructions to Bidders of the Bid Documents. The undersigned further certifies and declares under penalty of perjury that Bidder is familiar with and has reviewed Sections 10.1.11 through 10.1.11.3 of the Water Replenishment District of Southern California’s Administrative Code, which is attached to this section, which govern the SBE Preference Program.

Executed on _______________________________, 2019, at __________________________, California.

Signed:  ________________________________________________________
10.1.11 Small Business Enterprise Preference

It is the District's policy to encourage and promote broad-based participation in its contracting activities by all potential participants so as to maximize competition for District Contracts, to attract the greatest number of qualified bidders and to stimulate participation by responsible bidders who might otherwise be prevented from participating in the District’s procurement activities.

The District’s program is adopted pursuant to Public Contact Code Section 2002.

(a) Small Business Enterprise (SBE) Definition. For purposes of this section, a Small Business Enterprise (SBE) shall mean a small business enterprise certified as such by any branch of the Federal Government, the State of California, or by any other Public Entity within the State of California as defined by California Public Contract Code Section 1100.

(b) SBE Subcontractor Preference. Notwithstanding the requirement that the District award a contract to the lowest responsive and responsible bidder, all bidders for contracts that subcontract not less than 20% of their bid amount to SBE’s may be given a preference on their bid amount in an amount not to exceed 5%.

Notwithstanding the foregoing, the combination of all preferences to be applied to a single bid or informal quote may not exceed 5% or $50,000, whichever is less.

(i) The term “subcontractor” for purposes of the SBE Subcontractor Participation Goal shall have the meaning set forth at Public Contract Code Section 4113 but shall also include suppliers and materialmen.

(c) To qualify for the SBE Subcontractor Preference, SBEs must be certified as such at the time a bid is submitted to the District. Proof of certification must be submitted to the District not later than two business days after the deadline for submitting bids. Proof shall include a copy of each SBE’s certification or other appropriate documentary evidence by the certifying public entity. Proof of certification may be subject to verification by the General Manager. The General Manager shall not, however, be required to verify the accuracy or any such
certifications, and shall have sole discretion to determine if a subcontractor is an SBE.

(d) Before advertising for bids, the Board may modify the subcontractor participation requirement created by this section for particular procurements, or exempt particular procurements from the SBE Subcontractor Preference, if the Board determines that it would be in the District’s best interest to do so based on the nature of the services, equipment or materials to be procured or other relevant factors.


10.1.11.1 Exceptions to SBE Subcontractor Preference

The preference set forth in this Section shall not apply to the following purchases or contracts:

a) Supplies, equipment or materials provided under a cooperative purchasing agreement.

b) Purchases or contracts which are funded in whole or in part by a governmental entity and the laws, regulations, or policies governing such funding prohibit application of the preference.

c) Purchases made or contracts let under emergency situations.

10.1.11.2 Application

The SBE Subcontractor Preference provided in this Section may be applied to new contracts first solicited as of the effective date of the enabling resolution. This Section shall be implemented in a manner consistent with otherwise applicable provisions of this Chapter and competitive bidding laws.

10.1.11.3 Enforcement

a) The Contractor agrees that the District will have the right to review, obtain, and copy, or obtain in electronic form, all records pertaining to performance of the contract to enable it to audit Contractor’s costs and confirm the amount of SBE participation on the project. Contractor further agrees to provide District with, upon reasonable notice, during normal business hours, access to its premises for the
purpose of interviewing employees and inspecting and copying books, records, accounts, and other materials that may be relevant to an investigation for purposes of determining compliance or the right to have asserted the right to the SBE Subcontractor Preference. Contractor shall keep all records for a period of not less than three years from completion of the subject project.

b) The information furnished by each bidder requesting an SBE Subcontractor Preference shall be under penalty of perjury.

c) No Person shall knowingly and with intent to defraud, fraudulently obtain, retain, attempt to obtain or retain, or aid another in fraudulently obtaining or retaining or attempting to obtain or retain certification as an SBE for the purpose of this Section.

d) No Person shall willfully and knowingly make a false statement with the intent to defraud, whether by affidavit, report, or other representation, to any official of a municipality or other public entity located in Los Angeles County for the purpose of influencing the certification or denial of certification of any entity as an SBE.

e) A Person which has claimed the right to the SBE Subcontractor Preference who knew or should have known the information upon which the assertion of the right to the preference was based was incorrect, or information was ignored that was relevant to the request for the preference, and which by reason of such preference has been awarded a contract to which it would not otherwise have been entitled, shall:

(1) Pay to the District any difference between the contract amount and what the District’s costs would have been if the contract had been properly awarded; and

(2) Be assessed a penalty in an amount of not more than ten percent (10%) of the amount of the contract involved.

f) The penalties identified above shall also apply to any Person that has previously obtained proper certification and, as a result of a change in its status would no longer be eligible for certification, fails to notify the District of this information prior to responding to a Contract Solicitation or accepting a contract award.
LIST OF NAMED EQUIPMENT/MATERIAL SUPPLIERS

The bidder shall indicate below which Supplier the Bidder intends to use for each item of equipment or material listed on this form by writing in the named suppliers. (Proposed substitutes may be listed on the Proposed Substitute Equipment/Material List form but will only be considered after award of the Contract.) If no supplier is named in the Technical Specifications, the Bidder may list any supplier whose product meets all of the requirements and technical criteria specified. The listing of more than one supplier for each item of equipment/material to be furnished with the words “and/or” will not be permitted. Failure to comply with this requirement may render the Bid non-responsive and may cause its rejection.

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<th>Specification Section</th>
<th>Equipment/Material</th>
<th>Named Supplier (List Only One)</th>
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++END OF SECTION++
MANDATORY BID SUBMITTAL FORM

SECTION 00435
AUTHORITY TO EXECUTE BID AND CONTRACT

A. If the Bidder is a Corporation, attach to this page a certified copy of corporate resolutions of the Board of Directors of the Corporation authorizing an officer of the Corporation to execute the Bid and the Contract contained within this document on behalf of the Corporation. The Owner would prefer the use of the sample Resolution set forth below.

B. A corporation to which a contract is to be awarded will be required to furnish certificates as to its corporate existence.

CERTIFIED RESOLUTION

I, ___________________________________________________________, the duly elected Secretary of

(Name)

______________________________________________, a corporation organized and existing under the

(Corporate Title)

laws of the State of _______________________________________________, do hereby certify that the following Resolution was unanimously adopted and passed by a quorum of the Board of Directors of the said corporation at a meeting held in accordance with law and the by-laws of the said corporation.

"IT IS HEREBY RESOLVED THAT __________________________________________ (Name)",

the duly elected ___________________________ of ___________________________________

(Title of Officer) (Corporate Title)

be and is hereby authorized to execute and submit a Bid and Bid Bond to the Water Replenishment District of Southern California for:

______________________________________________________________________________

______________________________________________________________________________

and such other instruments in writing as may be necessary on behalf of the said corporation; and that the Bid, Bid Bond, and other such instruments signed by him/her shall be binding upon the said corporation as its own acts and deeds. The secretary shall certify the names and signatures of those authorized to act by the foregoing resolution.

The Water Replenishment District of Southern California shall be fully protected in relying upon such certification of the secretary and shall be indemnified and saved harmless from any and all
the signature of any person so certified or for refusing to honor any signature not so certified.

I further certify that the above resolution is in force and effect and has not been revised, revoked or rescinded.

In addition, I certify that the following are the names, titles and official signatures of those persons authorized to act by the foregoing resolution.

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Given under my hand and the Seal of the said corporation this __________ day of _________________, 2019.

(SEAL)

BY: ____________________________
Secretary

__________________________________________
Corporate Title

NOTE:

The above is a suggested form of the type of Corporate Resolution desired. Such form need not be followed explicitly, but the Certified Resolution submitted must clearly show to the satisfaction of the Water Replenishment District of Southern California that the person signing the Bid and Bid Bond for the corporation has been properly empowered by the corporation to do so in its behalf.

++END OF SECTION++
THIS AGREEMENT or (“Contract”) is by and between Water Replenishment District of Southern California (“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 as defined and specified in Article 9 of this Contract. The Work is generally described as follows:

ARTICLE 2 – THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: LEO J. VANDER LANS ADVANCED WATER TREATMENT FACILITY CALCIUM CHLORIDE BULK STORAGE EXPANSION PROJECT

ARTICLE 3 – ENGINEER

3.01 The Project has been designed by HAZEN AND SAWYER.

3.02 The Owner has retained HAZEN AND SAWYER (“Engineer”) and has 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 Contract Times: Days
   A. Contractor agrees and warrants that the Work will be substantially completed within 75 days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within 100 days after the date when the Contract Times commence to run. Substantially complete is defined as having the calcium chloride bulk storage tank installed and fully operational.

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 and other losses if the Work is not completed and Milestones not achieved within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with the Contract. 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):
      1. Substantial Completion: Contractor shall pay Owner $2,000 for each delay day that expires after the time (as duly adjusted pursuant to the Contract) specified in Paragraph 4.02 above for Substantial Completion until the Work is substantially complete.
      2. Completion of Remaining Work: After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Time (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner $1,000 for each delay day that expires after such time until the Work is completed and ready for final payment.
      3. Liquidated damages for failing to timely attain Substantial Completion and final completion are not additive and will not be imposed concurrently.

4.04 Special Damages
   A. In addition to the amount provided for liquidated damages, Contractor shall reimburse Owner for: (1) any fines or penalties imposed on Owner as a direct result of the Contractor’s failure to attain Substantial Completion according to the Contract Times, and (2) the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified in Paragraph 4.02 for Substantial Completion (as duly adjusted pursuant to the Contract), until the Work is substantially complete.
   B. After Contractor achieves Substantial Completion, if Contractor shall neglect, refuse, or fail to complete or repair the remaining Work within the Contract Times,
Contractor shall reimburse Owner for the actual costs reasonably incurred by Owner for construction, engineering, construction observation, inspection, and administrative services needed after the time specified in Paragraph 4.02 for Work to be completed and ready for final payment (as duly adjusted pursuant to the Contract), until the Work is completed and ready for final payment.

ARTICLE 5 – CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents the amounts indicated in the Bid Form, subject to adjustment under the terms of the Contract.

ARTICLE 6 – PAYMENT PROCEDURES

6.01 Submittal and Processing of Payments
   A. Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by Owner’s Site Representative as described in the General Conditions.

6.02 Progress Payments; Retainage
   A. Owner shall make progress payments on account of the Contract Price on the basis of Contractor’s Applications for Payment during performance of the Work as provided in Article 15 of the General Conditions. All such payments will be measured by the Schedule of Values established as described in 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 elsewhere in the Contract.
   B. Prior to Substantial Completion, five percent (5%) retainage shall be withheld from all progress payments to be paid to the Contractor, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract.
   C. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to 100-percent of the Work completed, less such amounts set off and entitled to be withheld by the Owner pursuant to Paragraph 15.01.E of the General Conditions.
   D. Alternatively, the Contractor may substitute securities in lieu of retention pursuant to Public Contract Code Section 10263.

6.03 Final Payment
   A. Upon final completion and acceptance of the Work in accordance with Paragraph 15.06 of the General Conditions, Owner shall pay the remainder of the Contract Price as recommended by Engineer as provided in said Paragraph 15.06.

ARTICLE 7 – INTEREST

7.01 All undisputed amounts not paid when due shall bear interest at the rate of 5-percent per annum, unless a different rate is mandated by law or statute.
ARTICLE 8 – CONTRACTOR’S REPRESENTATIONS

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

A. Contractor has examined and carefully studied the Contract Documents, and any data and reference items identified in the Contract Documents.

B. Contractor has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, 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 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 surface and subsurface conditions at or adjacent to the Site and all drawings of physical conditions, including but not limited to existing utilities, relating to existing surface or subsurface structures at the Site that have been identified in the Bidding Documents and Supplementary General Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Bidding Documents and Supplementary General Conditions, especially with respect to Technical Data in such reports and drawings.

E. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, drawings or data are necessary for the performance of the Work.

F. 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.

G. 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.

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

I. Contractor’s entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

ARTICLE 9 – CONTRACT DOCUMENTS

9.01 Contents

A. The Contract Documents consist of the following:

1. This Agreement (Section 00500)
2. Performance Bond (Section 00610)
3. Payment Bond (Section 00615)
4. Non-Collusion Affidavit (Section 00650)
5. General Conditions (Section 00700)
6. Supplementary General Conditions (Section 00800)
7. Any other specifications as listed in the Table of Contents of the Project Manual
8. Drawings (not attached but incorporated by reference) consisting of 23 sheets with each sheet bearing the following general title: LEO J. VANDER LANS WATER TREATMENT FACILITY CALCIUM CHLORIDE BULK STORAGE EXPANSION
9. Addenda (if applicable).
10. Exhibits to this Agreement (enumerated as follows):
   a. Bid Form (Section 00300).
11. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
   a. Notice to Proceed.
   b. Work Change Directives.
   c. Change Orders.
   d. Field Orders.

B. The documents listed in Paragraph 9.01.A above 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 the General Conditions.

ARTICLE 10 – MISCELLANEOUS

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

10.02 Assignment of Contract
   A. Unless expressly agreed to elsewhere in the Contract, 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, money that may become due and money that is 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
contra 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 successors, assigns, and legal
      representatives to the other party hereto, its 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 anything
         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.
Water Replenishment District of Southern California
LVL Calcium Chloride Bulk Storage Expansion Project

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

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

OWNER:

Water Replenishment District of Southern California

By: ____________________________

Title: President of the Board of Directors

Attest: __________________________

Title: Secretary of the Board of Directors

Address for giving notices:

Water Replenishment District of Southern California

4040 Paramount Boulevard

Lakewood, CA 90712

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)

(Since Owner is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)

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

++END OF SECTION++
SECTION 00610
PERFORMANCE BOND

CONTRACTOR (name and address): SURETY (name and address of principal place of business):

OWNER (name and address):
Water Replenishment District of Southern California
4040 Paramount Boulevard
Lakewood, California 90712

CONSTRUCTION CONTRACT
Effective Date of the Agreement: Amount: Description (name and location):

BOND
Bond Number: Date (not earlier than the Effective Date of the Agreement of the Construction Contract): Amount:
Modifications to this Bond Form: None See Paragraph 16

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

Contractor’s Name and Corporate Seal

By: ________________________________
Signature

SURETY

Surety's Name and Corporate Seal

By: ________________________________
Signature (attach power of attorney)

Print Name

Title

Attest: ________________________________
Signature

Title

Attest: ________________________________
Signature

Title
Water Replenishment District of Southern California
LVL Calcium Chloride Bulk Storage Expansion Project

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

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

2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.

3. If there is no Owner Default under the Construction Contract, the Surety’s obligation under this Bond shall arise after:

3.1 The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor’s performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner’s notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 shall be held within ten (10) business days of the Surety’s receipt of the Owner’s notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner’s right, if any, subsequently to declare a Contractor Default;

3.2 The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

3.3 The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 shall not constitute a failure to comply with a condition precedent to the Surety’s obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety’s expense take one of the following actions:

5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

7. If the Surety elects to act under Paragraphs 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:

7.1 The responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

7.2 Additional legal, design professional, and delay costs resulting from the Contractor’s Default, and
resulting from the actions or failure to act of the Surety under Paragraph 5; and

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

8. If the Surety elects to act under Paragraphs 5.1, 5.3, or 5.4, the Surety’s liability is limited to the amount of this Bond.

9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction 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 the Owner or its heirs, executors, administrators, successors, and assigns.

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

11. 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 two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit shall be applicable.

12. Notice to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

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

14. Definitions

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

14.2 Construction Contract: The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

14.3 Contractor Default: Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

14.4 Owner Default: Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

14.5 Contract Documents: All the documents that comprise the Agreement between the Owner and Contractor.

15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.
SECTION 00615
PAYMENT BOND

CONTRACTOR (name and address): SURETY (name & address of principal place of business):

OWNER (name and address):
Water Replenishment District of Southern California
4040 Paramount Boulevard, Lakewood, California 90712

CONSTRUCTION CONTRACT
Effective Date of the Agreement:
Amount:
Description (name and location):

BOND
Bond Number:
Date (not earlier than the Effective Date of the Agreement of the Construction Contract):
Amount:
Modifications to this Bond Form: None See Paragraph 18

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

Contractor’s Name and Corporate Seal
By: _________________________________
Signature

Print Name
Title
Attest: ________________________________
Signature
Title

SURETY

Surety’s Name and Corporate Seal
By: _________________________________
Signature (attach power of attorney)

Print Name
Title
Attest: ________________________________
Signature
Title
1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

3. If there is no Owner Default under the Construction Contract, the Surety’s obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner’s property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.

4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety’s expense take the following actions:

5. The Surety’s obligations to a Claimant under this Bond shall arise after the following:

5.1 Claimants who do not have a direct contract with the Contractor:

5.1.1 Have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

5.1.2 Have sent a Claim to the Surety (at the address described in Paragraph 13).

5.2 Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).

6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant’s obligation to furnish a written notice of non-payment under Paragraph 5.1.1.

7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety’s expense take the following actions:

7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

7.2 Pay or arrange for payment of any undisputed amounts.

7.3 The Surety’s failure to discharge its obligations under Paragraphs 7.1 or 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraphs 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney’s fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

8. The Surety’s total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney’s fees provided under Paragraph 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

9. Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this
16. Definitions

16.1 Claim: A written statement by the Claimant including at a minimum:

1. The name of the Claimant;
2. The name of the person for whom the labor was done, or materials or equipment furnished;
3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;
4. A brief description of the labor, materials, or equipment furnished;
5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;
7. The total amount of previous payments received by the Claimant; and
8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

16.2 Claimant: An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic’s lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms of “labor, materials, or equipment” that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor’s subcontractors, and all other items for which a mechanic’s lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

16.3 Construction Contract: The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.
Water Replenishment District of Southern California
LVL Calcium Chloride Bulk Storage Expansion Project

16.4 **Owner Default**: Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

16.5 **Contract Documents**: All the documents that comprise the agreement between the Owner and Contractor.

17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

++END OF SECTION++
STATE OF CALIFORNIA
COUNTY OF LOS ANGELES

_________________________________________________, being first duly sworn,

[NAME]

deposes and says that he/she is ____________________________________________________

[SOLE OWNER, A PARTNER, PRESIDENT, SECRETARY, ETC.]

of _______________________________________, the party submitting a bid for the construction of
the project identified in the Agreement, General Conditions, and Technical Specifications that such a bid
is not made in the interest of or on behalf of any undisclosed person, partnership, company, association,
organization, or corporation; that such bid is genuine and not collusive or sham; that said bidder has
not directly or indirectly induced or solicited any other bidder to put in a false or sham bid, and has not
directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a
sham bid, nor that anyone shall refrain from bidding; that said bidder has not in any manner, directly or
indirectly, sought by agreement, communications or conference with anyone to fix the bid price of said
bidder or any other bidder, nor to fix any overhead, profit, or cost element of such bid price, nor of that
of any other bidder, nor to secure any advantage against the public body awarding the contract or
anyone interested in the proposed contract; that all statements contained in such bid are true; and,
further, that said bidder has not, directly or indirectly, submitted their bid price or any breakdown
thereof, nor the contents thereof, nor divulged information or data relative thereto, nor paid and will
not pay any fee in connection therewith to any corporation, partnership, company, association,
organization, bid depository, nor to any member or agent thereof, nor to any other individual except to
such person or persons as have a partnership or other financial interest with said bidder in their general
business.

Date: __________________________      Signed: ________________________________

Title: ______________________________

Subscribed and sworn to before me this _____ day of _________________________, 2019.

____________________________________
Notary Public

[SEAL]
++END OF SECTION++
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SECTION 00700
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, a term printed with initial capital letters, including the term’s singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

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. Agreement — The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.

3. 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.

4. Authority Having Jurisdiction — Those agencies and authorities having jurisdiction over some portion of the Work or work activity, including Cities, Counties, and regulatory agencies.

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

6. Bidder — An individual or entity that submits a Bid to Owner.

7. Bidding Documents — The Bidding Requirements, the proposed Contract Documents, and all Addenda.

8. Bidding Requirements — The advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.

9. Change Order — A document 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, or other revision to the Contract, issued on or after the Effective Date of the Contract.

10. Change Proposal — A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.

11. Claim — (a) A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein: seeking an adjustment of Contract Price or Contract Times, or both; contesting an initial decision by Engineer
concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer’s decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract; or (b) a demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer’s decision regarding a Change Proposal; or seeking resolution of a contractual issue that Engineer has declined to address. A demand for money or services by a third party is not a Claim.

12. **Constituent of Concern** — Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601 et seq. (“CERCLA”); (b) the Hazardous Materials Transportation Act, 49 U.S.C. §§5501 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq. (“RCRA”); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, state, or local statute, law, rule, regulation, ordinance, resolution, code, order, or decree regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

13. **Contract** — The entire and integrated written contract between the Owner and Contractor concerning the Work.

14. **Contract Documents** — Those items so designated in the Agreement, and which together comprise the Contract.

15. **Contract Price** — The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.

16. **Contract Times** — The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.

17. **Contractor** — The individual or entity with which Owner has contracted for performance of the Work.

18. **Cost of the Work** — See Paragraph 13.01 for definition.

19. **Drawings** — The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.

20. **Effective Date of the Contract** — The date, indicated in the Agreement, on which the Contract becomes effective.

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

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

24. **Hazardous Environmental Condition** — The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated in the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, does not establish a Hazardous Environmental Condition.

25. **Issuing Office** — The office from which the Bidding Documents are to be issued.

26. **LACSD or CSD** — The Los Angeles County Sanitation District.

27. **Laws and Regulations; Laws or Regulations** — Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

28. **Liens** — Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

29. **Milestone** — A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date or by a time prior to Substantial Completion of all the Work.

30. **Notice of Award** — The written notice by Owner to a Bidder of Owner’s acceptance of the Bid.

31. **Notice to Proceed** — A written notice 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.

32. **Owner** — The Water Replenishment District of Southern California (WRD or District).

33. **Owner’s Site Representative or Construction Manager (if any)** — representative of the Owner assisting Owner in observing the progress and quality of the Work and conducting various other administrative tasks. The terms Onsite Site Representative and Construction Manager are to be used interchangeably.

34. **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.

35. **Project** — The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.

36. **Project Manual** — The written documents prepared for, or made available for, procuring and constructing the Work, including but not limited to the Bidding Documents or other construction procurement documents, geotechnical and existing conditions information, the Agreement, bond forms, General Conditions, Supplementary Conditions, and Specifications. The contents of the Project Manual may be bound in one or more volumes.
37. **Resident Project Representative** — The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative or “RPR” includes any assistants or field staff of Resident Project Representative.

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

39. **Schedule of Submittals** — A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer’s review of the submittals and the performance of related construction activities.

40. **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.

41. **Shop Drawings** — All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

42. **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, and such other lands furnished by Owner which are designated for the use of Contractor.

43. **Specifications** — The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

44. **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.

45. **Substantial Completion** — The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, 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. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to Substantial Completion thereof.

46. **Successful Bidder** — The Bidder whose Bid the Owner accepts, and to which the Owner makes an award of contract, subject to stated conditions.

47. **Supplementary General Conditions** — The part of the Contract that amends or supplements these General Conditions.

48. **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 a Subcontractor.

49. **Technical Data** — Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (a) subsurface conditions at the Site, or physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) or (b) Hazardous Environmental Conditions at the Site.
If no such express identifications of Technical Data have been made with respect to conditions at the Site, then the data contained in boring logs, recorded measurements of subsurface water levels, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical or environmental report prepared for the Project and made available to Contractor are hereby defined as Technical Data with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06 of this document.

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 but not limited to those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, fiber optic transmissions, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

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

52. **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; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

53. **Work Change Directive** — A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 **Terminology**

A. The words and terms discussed in the following paragraphs 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 Article 10 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 Paragraphs 15.03 or 15.04).

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. If the Contract Documents establishes an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words “furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

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.

**ARTICLE 2 – PRELIMINARY MATTERS**

2.01 **Delivery of Bonds and Evidence of Insurance**

A. **Bonds:** When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.

B. **Evidence of Contractor’s Insurance:** When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner copies of the policies of insurance (including all endorsements, and identification of applicable self-insured retentions and deductibles) required to be provided by Contractor in Article 6. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

C. **Evidence of Owner’s Insurance:** After receipt from Contractor of the executed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor copies of the policies of insurance to be provided by Owner.
under Article 6 (if any). Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

2.02 Copies of Documents
A. Owner shall furnish to Contractor one printed copy of the fully executed contract, and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.
B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner may delegate the responsibilities under this provision to Engineer.
C. Owner will furnish to Contractor two (2) copies of conformed Drawings and Specifications, incorporating and integrating all Addenda and any amendments negotiated prior to the Effective Date of the Contract, which will include two (2) sets of 11x17 reduced Drawings, two (2) sets of full-scale Drawings, two (2) copies of the Project Manual, and one (1) PDF of the Drawings and Project Manual. Additional quantities of the Contract Documents will be furnished at reproduction cost plus mailing cost if copies are mailed.

2.03 Before Starting Construction
A. Preliminary Schedules: Within ten (10) days after the Effective Date of the Contract (or as otherwise specifically required by the Contract Documents), 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;
   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.

2.04 Preconstruction Conference; Designation of Authorized Representatives
A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, 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 2.03.A, procedures for handling Shop Drawings, Samples, and other submittals, processing Applications for Payment, electronic or digital transmittals, 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 and receive information,
render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 Initial Acceptance of Schedules

A. At least ten (10) days before submission of the first Application for Payment, a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.03.A. Contractor shall have an additional ten (10) days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer 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 if it provides a workable arrangement for reviewing and processing the required submittals.

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

2.06 Electronic Transmittals

A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may transmit, and shall accept, Project-related correspondence, text, data, documents, drawings, information, and graphics, including but not limited to Shop Drawings and other submittals, in electronic media or digital format, either directly, or through access to a secure Project website.

B. If the Contract does not establish protocols for electronic or digital transmittals, then Owner, Engineer, and Contractor shall jointly develop such protocols.

C. When transmitting items in electronic media or digital format, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the recipient’s use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the items, or from those established in applicable transmittal protocols.

ARTICLE 3 – DOCUMENTS: INTENT, REQUIREMENTS, 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.

C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic or digital versions of the Contract Documents (including any printed copies derived
from such electronic or digital versions) and the printed record version, the printed record version shall govern.

D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

3.02 Reference Standards

A. Standards Specifications, Codes, Laws and Regulations

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, 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, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard specification, manual, reference standard, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner, 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 part of the Contract Documents prepared by or for Engineer.

3.03 Reporting and Resolving Discrepancies

A. Reporting Discrepancies:

1. Contractor’s Verification of Figures and Field Measurements: Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.

2. Contractor’s Review of Contract Documents: If, 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) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) 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 7.15) until the
conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. Resolving Discrepancies:

1. Except as may be otherwise specifically stated in the Contract Documents, any discrepancies in the Contract Documents are to be resolved by the Engineer. If the Contractor disputes the decision of the Engineer, the Contractor may submit a Change Proposal pursuant of Paragraph 11.06. However, in all discrepancies that concern:
   a. The provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); 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);
      such provisions, standards, laws and regulations shall take precedence and be applicable to the Work.

3.04 Requirements of the Contract Documents

A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work thereunder.

B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer’s written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly give written notice to Owner and Contractor that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.
3.05 Reuse of Documents

A. Contractor and its Subcontractors and Suppliers 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 Engineer or its consultants, including electronic media editions, or 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 Engineer and specific written verification or adaptation by Engineer; or
   2. Have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner’s express written consent, or violate any copyrights pertaining to such Contract Documents.

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.

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

4.01 Commencement of Contract Times; Notice to Proceed

A. The Contract Times will commence to run on the date provided in the Notice to Proceed issued to the Contractor.

4.02 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 such date.

4.03 Reference Points

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer’s judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 Progress Schedule

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 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 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.
   2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 11.
B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 Delays in Contractor’s Progress

A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Times and Contract Price. 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.

B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor or any of its Subcontractors, Suppliers or anyone for whom the Contractor is responsible.

C. If Contractor’s performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. 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. Such an adjustment shall be Contractor’s sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:

1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;

2. Abnormal weather conditions;

3. Acts or failures to act of utility owners (other than those performing other work at or adjacent to the Site by arrangement with the Owner, as contemplated in Article 8); and

4. Acts of war or terrorism.

D. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5.

E. Paragraph 8.03 governs delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

F. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor or any of its Subcontractors, Suppliers or anyone for whom the Contractor is responsible.

G. Contractor must submit any Change Proposal seeking an adjustment in Contract Price or Contract Times under this paragraph within fifteen (15) days of the commencement of the delaying, disrupting, or interfering event.
ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 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.

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 permanent improvements are to be made 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.

5.02 Use of Site and Other Areas

A. Limitation on Use of Site and Other Areas:

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor’s operations; (c) damage to any other adjacent land or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.12, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or at law; and (c) to the fullest extent permitted by Laws and Regulations, 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 any such claim, and against all 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, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor’s performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.
B. **Removal of Debris During Performance of the Work:** During the progress of the Work the Contractor shall keep the Site and other adjacent 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 and adjacent areas 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 of 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 structures or land to stresses or pressures that will endanger them.

5.03 Subsurface and Physical Conditions

A. **Reports and Drawings:** The Supplementary Conditions identify:

1. Those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site;
2. Those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities); and
3. Technical Data contained in such reports and drawings.
4. Bidder may request from Owner, copies of reports identified above if not included with the Bidding Documents.

B. **Reliance by Contractor on Technical Data Authorized:** Contractor may rely upon the accuracy of the Technical Data expressly identified in the Contract Documents, including but not limited to the Supplemental Conditions. However, such reports and drawings are not Contract Documents. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. The completeness of such reports and drawings 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 shown or indicated in such drawings; or
3. Any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

5.04 Differing Subsurface or Physical Conditions

A. **Notice by Contractor:** If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site 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 5.03 is materially inaccurate; or
2. Is of such a nature as to require a change in the Drawings or Specifications; 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, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

B. **Engineer’s Review:** After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine the necessity of Owner’s obtaining additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A above; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor’s resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer’s findings, conclusions, and recommendations.

C. **Owner’s Statement to Contractor Regarding Site Condition:** After receipt of Engineer’s written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer’s written findings, conclusions, and recommendations, in whole or in part.

D. **Possible Price and Times Adjustments:**

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, or both, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, 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 fall within any one or more of the categories described in Paragraph 5.04.A;
   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 Paragraph 13.03; and,
   c. 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.
2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:
   a. Contractor knew of the existence of such condition at the time Contractor made a 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 otherwise; or
   b. The existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor’s making such commitment; or
   c. Contractor failed to give the written notice as required by Paragraph 5.04.A.

3. If Owner and Contractor agree regarding Contractor’s entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than thirty (30) days after Owner’s issuance of the Owner’s written statement to Contractor regarding the subsurface or physical condition in question.

5.05 Underground Facilities

A. Contractor’s Responsibilities: The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or adjacent to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:
   1. Owner and Engineer do not warrant or guarantee 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 information and data regarding existing Underground Facilities at the Site;
      b. Locating all Underground Facilities shown or indicated in the Contract Documents as being at the Site;
      c. Coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and
      d. The safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. Notice by Contractor: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, then Contractor shall, promptly 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 7.15), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer.

C. **Engineer’s Review**: Engineer will promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor’s resumption of Work in connection with the Underground Facility in question; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and advise Owner in writing of Engineer’s findings, conclusions, and recommendations. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

D. **Owner’s Statement to Contractor Regarding Underground Facility**: After receipt of Engineer’s written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question, addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer’s written findings, conclusions, and recommendations in whole or in part.

E. **Possible Price and Times Adjustments**:

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, or both, to the extent that any existing Underground Facility at the Site that was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor’s cost of, or time required for, performance of the Work; subject, however, to the following:
   
   a. Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated the existence or actual location of the Underground Facility in question;
   
   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 Paragraph 13.03;
   
   c. 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; and
   
   d. Contractor gave the notice required in Paragraph 5.05.B.

2. If Owner and Contractor agree regarding Contractor’s entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than fifteen (15) days after Owner’s issuance of the Owner’s written statement to Contractor regarding the Underground Facility in question.
5.06 Hazardous Environmental Conditions at Site

A. Reports and Drawings:
   1. Those reports and drawings known to Owner relating to Hazardous Environmental
      Conditions that have been identified at or adjacent to the Site; and
   2. Technical Data contained in such reports and drawings.

B. Reliance by Contractor on Technical Data Authorized: Contractor may rely upon the accuracy
   of the Technical Data expressly identified in the Contract Documents, including but not
   limited to the Supplemental Conditions. However, such reports and drawings are not
   Contract Documents. Except for such reliance on Technical Data, Contractor may not rely
   upon or make any claim against Owner or Engineer, or any of their officers, directors,
   members, partners, employees, agents, consultants, or subcontractors with respect to:
      1. The completeness of such reports and drawings 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
         shown or indicated in such drawings; or
      3. Any Contractor interpretation of or conclusion drawn from any Technical Data or any
         such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for removing or remediating any Hazardous
   Environmental Condition encountered, uncovered, or revealed at the Site unless such
   removal or remediation is expressly identified in the Contract Documents to be within the
   scope of the Work.

D. Contractor shall be responsible for controlling, containing, and duly removing all
   Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or
   anyone else for whom Contractor is responsible, and for any associated costs; and for the
   costs of removing and remediating any Hazardous Environmental Condition created by the
   presence of any such Constituents of Concern.

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose
   removal or remediation is not expressly identified in the Contract Documents as being within
   the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates
   a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or
   otherwise isolate such condition; (2) stop all Work in connection with such condition and in
   any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3)
   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 the written notice required by Paragraph
   5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous
   Environmental Condition in question, then Owner may remove and remediate the Hazardous
   Environmental Condition, and impose a set-off against payments to account for the
   associated costs.
F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, then within fifteen (15) days of Owner’s written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off.

H. 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, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner’s own forces or others in accordance with Article 8.

I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, 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, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.H shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual’s or entity’s own negligence.

J. 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 the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual’s or entity’s own negligence.

K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.
ARTICLE 6 – BONDS AND INSURANCE

6.01 Performance, Payment, and Other Bonds

A. Contractor shall furnish a performance bond and a payment bond, 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. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the Supplementary Conditions, or other specific provisions of the Contract. Contractor shall also furnish such other bonds as are required by the Supplementary Conditions or other specific provisions of the Contract.

B. All bonds shall be in the form prescribed by the Contract except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in “Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies” as published in Circular 570 (as amended and supplemented) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual’s authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

C. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds in the required amounts.

D. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or its right to do business is terminated in any state or jurisdiction where any part of the Project is located, or the surety ceases to meet the requirements above, then 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 bond and surety requirements above.

E. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner’s termination rights under Article 16.

F. Upon request, Owner shall provide a copy of the payment bond to any Subcontractor, Supplier, or other person or entity claiming to have furnished labor or materials used in the performance of the Work.

6.02 Insurance — General Provisions

A. Owner and Contractor shall obtain and maintain insurance as required in this Article and in the Supplementary General Conditions.

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.
C. Contractor may obtain worker’s compensation insurance from an insurance company that has not been rated by A.M. Best, provided that such company (a) is domiciled in the state in which the project is located, (b) is certified or authorized as a worker’s compensation insurance provider by the appropriate state agency, and (c) has been accepted to provide worker’s compensation insurance for similar projects by the state within the last 12 months.

D. Contractor shall deliver to Owner, with copies to each named insured and additional insured (as identified in this Article, in the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Contractor has obtained and is maintaining the policies, coverages, and endorsements required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

E. Owner shall deliver to Contractor, with copies to each named insured and additional insured (as identified in this Article, the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Owner has obtained and is maintaining the policies, coverages, and endorsements required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

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

G. If either party does not purchase or maintain all of the insurance required of such party by the Contract, such party shall notify the other party 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.

H. If Contractor has failed to obtain and maintain required insurance, Owner may exclude the Contractor from the Site, impose an appropriate set-off against payment, and exercise Owner’s termination rights under Article 16.

I. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect to obtain equivalent insurance to protect such other party’s interests at the expense of the party who was required to provide such coverage, and the Contract Price shall be adjusted accordingly.

J. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor’s interests.

K. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor’s liability under the indemnities granted to Owner and other individuals and entities in the Contract.
6.03 Contractor’s Insurance

A. **Workers’ Compensation**: Contractor shall purchase and maintain workers’ compensation and employer’s liability insurance for:
   1. Claims under workers’ compensation, disability benefits, and other similar employee benefit acts.
   2. United States Longshoreman and Harbor Workers’ Compensation Act and Jones Act coverage (if applicable).
   3. Claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor’s employees (by stop-gap endorsement in monopolist worker’s compensation states).
   4. Foreign voluntary worker compensation (if applicable).

B. **Commercial General Liability—Claims Covered**: Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against:
   1. Claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor’s employees.
   2. Claims for damages insured by reasonably available personal injury liability coverage.
   3. 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.

C. **Commercial General Liability—Form and Content**: Contractor’s commercial liability policy shall be written on a 1996 (or later) ISO commercial general liability form (occurrence form) and include the following coverages and endorsements:
   1. Products and completed operations coverage:
      a. Such insurance shall be maintained for three (3) years after final payment.
      b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three (3) years thereafter.
   2. Blanket contractual liability coverage, to the extent permitted by law, including but not limited to coverage of Contractor’s contractual indemnity obligations in Paragraph 7.18.
   3. Broad form property damage coverage.
   4. Severability of interest.
   5. Underground, explosion, and collapse coverage.
   6. Personal injury coverage.
   7. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together); or CG 20 10 07 04 and CG 20 37 07 04 (together); or their equivalent.
8. For design professional additional insureds, ISO Endorsement CG 20 32 07 04, “Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured” or its equivalent.

D. *Automobile liability:* Contractor shall purchase and maintain automobile liability insurance against 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. The automobile liability policy shall be written on an occurrence basis.

E. *Umbrella or excess liability:* Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer’s liability, commercial general liability, and automobile liability insurance described in the paragraphs above. Subject to industry-standard exclusions, the coverage afforded shall follow form as to each and every one of the underlying policies.

F. *Contractor’s pollution liability insurance:* Contractor shall purchase and maintain a policy covering third-party injury and property damage claims, including clean-up costs, as a result of pollution conditions arising from Contractor’s operations and completed operations. This insurance shall be maintained for no less than three (3) years after final completion.

G. *Additional insureds:* The Contractor’s commercial general liability, automobile liability, umbrella or excess, and pollution liability policies shall include and list as additional insureds Owner and Engineer, and any individuals or entities identified in the Supplementary General Conditions; 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 (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis. Contractor shall obtain all necessary endorsements to support these requirements.

H. *Contractor’s professional liability insurance:* If Contractor will provide or furnish professional services under this Contract, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance shall provide protection against claims arising out of performance of professional design or related services, and caused by a negligent error, omission, or act for which the insured party is legally liable. It shall be maintained throughout the duration of the Contract and for a minimum of two (2) years after Substantial Completion. If such professional design services are performed by a Subcontractor, and not by Contractor itself, then the requirements of this paragraph may be satisfied through the purchasing and maintenance of such insurance by such Subcontractor.

I. *General provisions:* The policies of insurance required by this Paragraph 6.03 shall:

1. Include at least the specific coverages provided in this Article.

2. Be written for not less than the limits of liability provided in this Article and in the Supplementary General Conditions, or required by Laws or Regulations, whichever is greater.

3. Contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least ten (10) days prior written notice has been given to Contractor. Within three (3) days of receipt of any such written notice,
Contractor shall provide a copy of the notice to Owner, Engineer, and each other insured under the policy.

4. Remain in effect at least until final payment (and longer if expressly required in this Article) and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract Documents.

5. Be appropriate for the Work being performed and provide protection from claims that 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.

J. The coverage requirements for specific policies of insurance must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.

K. The limits of liability for the insurance required by Paragraph 6.03 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:

1. **Workers’ Compensation Insurance** with limits as required by the State of California.

2. **Employer’s Liability Insurance** with limits of $3,000,000 per occurrence.

3. **Commercial General Liability Insurance** with limits of $3,000,000 each occurrence and a general aggregate limit of $5,000,000. Coverages and endorsements shall include:
   a. Premises/operations;
   b. Products/completed operations;
   c. Property damage;
   d. Personal injury and advertising injury;
   e. Owned and non-owned equipment;
   f. Independent contractors; and
   g. Broad form contractual liability.
   h. Explosion, collapse, underground excavation and removal of lateral support;
   i. Policy shall be endorsed to delete pollution-related exclusions (including lead and asbestos)

L. **Commercial Automobile Liability Insurance** including owned, non-owned and leased or hired vehicles, with a $1,000,000 combined single limit for bodily injury and property damage, including non-owned and hired coverage.

M. **Builder’s Risk Insurance** covering loss, damage, or destruction to the Project (including boilers and machinery coverage) caused by physical damage in an amount equal to the full replacement value of the Project.
N. **Environmental Impairment Liability Insurance** covering abatement of lead, asbestos and contaminated soil shall be provided in the amount of $1,000,000 per claim and $2,000,000 annual aggregate.

O. **Additional Insureds.** The following persons or entities, including their elected officials, officers, directors, employees and agents, shall be named as additional insureds on all required insurance policies except Workers Compensation Insurance:

1. The Water Replenishment District of Southern California
2. Hazen and Sawyer

P. **Subrogation Waivers.** All required policies shall be considered primary to any insurance-maintained OWNER. All policies shall include waivers of subrogation in favor of the Water Replenishment District of Southern California and their insurers.

Q. **Occurrence Basis.** All policies shall be written on an occurrence basis.

R. **Cancelation and Modification of Coverages.** All policies shall provide that thirty (30) days prior written notice to the Water Replenishment District of Southern California must be provided before cancellation or modification of coverage provisions.

### 6.04 Owner’s Liability Insurance

A. In addition to the insurance required to be provided by Contractor under Paragraph 6.03, Owner, at Owner’s option, may purchase and maintain at Owner’s expense Owner’s own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

B. Owner’s liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner’s liability policies for any of Contractor’s obligations to the Owner, Engineer, or third parties.

### 6.05 Property Insurance

A. **Builder’s Risk:** Unless otherwise provided in the Supplementary General Conditions, Contractor shall purchase and maintain builder’s risk insurance upon the Work on a completed value basis, in the amount of the full insurable replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary General Conditions or required by Laws and Regulations). This insurance shall:

1. Include the Owner and Contractor as named insureds, and all Subcontractors, and any individuals or entities required by the Supplementary Conditions to be insured under such builder’s risk policy, as insureds or named insureds. For purposes of the remainder of this Paragraph 6.05, Paragraphs 6.06 and 6.07, and any corresponding Supplementary Conditions, the parties required to be insured shall collectively be referred to as “insureds.”

2. Be written on a builder’s risk “all risk” policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire; lightning; windstorm; riot; civil commotion; terrorism; vehicle impact;
aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; water damage (other than that caused by flood); and such other perils or causes of loss as may be specifically required by the Supplementary General Conditions. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; or flood, are not commercially available under builder’s risk policies, by endorsement or otherwise, such insurance may be provided through other insurance policies acceptable to Owner and Contractor.

3. Cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.

4. Cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects).

5. Extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).

6. Extend to cover damage or loss to insured property while in transit.

7. Allow for partial occupation or use of the Work by Owner, such that those portions of the Work that are not yet occupied or used by Owner shall remain covered by the builder’s risk insurance.

8. Allow for the waiver of the insurer’s subrogation rights, as set forth below.

9. Provide primary coverage for all losses and damages caused by the perils or causes of loss covered.

10. Not include a co-insurance clause.

11. Include an exception for ensuing losses from physical damage or loss with respect to any defective workmanship, design, or materials exclusions.

12. Include performance/hot testing and start-up.

13. Be maintained in effect, subject to the provisions herein regarding Substantial Completion and partial occupancy or use of the Work by Owner, until the Work is complete.

B. Notice of Cancelation or Change: All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 6.05 will contain a provision or endorsement that the coverage afforded will not
be canceled or materially changed or renewal refused until at least ten 10 days prior written notice has been given to the purchasing policyholder. Within three (3) days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured.

C. **Deductibles**: The purchaser of any required builder’s risk or property insurance shall pay for costs not covered because of the application of a policy deductible.

D. **Partial Occupancy or Use by Owner**: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder’s risk policy, or through Contractor) will provide notice of such occupancy or use to the builder’s risk insurer. The builder’s risk insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy; rather, those portions of the Work that are occupied or used by Owner may come off the builder’s risk policy, while those portions of the Work not yet occupied or used by Owner shall remain covered by the builder’s risk insurance.

E. **Additional Insurance**: If Contractor elects to obtain other special insurance to be included in or supplement the builder’s risk or property insurance policies provided under this Paragraph 6.05, it may do so at Contractor’s expense.

F. **Insurance of Other Property**: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, such as tools, construction equipment, or other personal property owned by Contractor, a Subcontractor, or an employee of Contractor or a Subcontractor, then the entity or individual owning such property item will be responsible for deciding whether to insure it, and if so in what amount.

6.06 Waiver of Rights

A. All policies purchased in accordance with Paragraph 6.05, expressly including the builder’s risk policy, shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all Subcontractors, all individuals or entities identified in the Supplementary Conditions as insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for:

1. Loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner’s property or the Work caused by,
arising out of, or resulting from fire or other perils whether or not insured by Owner; and

2. Loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06.

C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 6.06.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them.

D. Contractor shall be responsible for assuring that the agreement under which a Subcontractor performs a portion of the Work contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary General Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by builder’s risk insurance and any other property insurance applicable to the Work.

ARTICLE 7 – CONTRACTOR’S RESPONSIBILITIES

7.01 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.

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

7.02 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.

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, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner’s written consent, which will not be unreasonably withheld.

7.03 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, whether or not such items are specifically called for in the Contract Documents.

B. All materials and equipment incorporated into the Work shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. 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.

7.04 “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 Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item 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 is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment, or items from other proposed suppliers under the circumstances described below.

1. If Engineer in its sole discretion determines that 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, Engineer shall deem it an “or equal” item. For the purposes of this paragraph, 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;
   3) It has a proven record of performance and availability of responsive service; and
   4) It is not objectionable to Owner.

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. Contractor shall make a written application to Engineer for review of a proposed “or equal” item of material or equipment that Contractor seeks to furnish or use. The application:
   a. Shall certify that the proposed “or equal” item will:
      1) Perform adequately the functions and achieve the results called for by the general design,
      2) Be similar in substance to that specified, and
      3) Be suited to the same use as that specified.
   b. Will state:
      1) The extent, if any, to which the use of the proposed “or equal” item will necessitate a change in Contract Times,
      2) Whether use of the proposed “or equal” 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 “or equal” item, and
      3) Whether incorporation or use of the proposed “or equal” item in connection with the Work is subject to payment of any license fee or royalty.
   c. Will identify:
      1) All variations of the proposed “or equal” item from that specified, and
      2) Available engineering, sales, maintenance, repair, and replacement services.
d. Shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. Contractor’s Expense: Contractor shall provide all data in support of any proposed “or equal” item at Contractor’s expense.

C. Engineer’s Evaluation and Determination: Engineer will be allowed a reasonable time to evaluate each “or-equal” request. Engineer may require Contractor to furnish additional data about the proposed “or-equal” item. Engineer will be the sole judge of acceptability. No “or-equal” item will be ordered, furnished, installed, or utilized until Engineer’s review is complete and Engineer determines that the proposed item is an “or-equal”, which will be evidenced by an approved Shop Drawing or other written communication. 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 “or equal” item request.

E. Reimbursement of Engineer’s Cost: Engineer will record Engineer’s costs in evaluating a proposed or submitted “or equal” item request by Contractor. Whether or not Engineer approves an “or equal” item request so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed “or equal” item request. 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 “or equal” item request.

F. Effect of Engineer’s Determination: Neither approval nor denial of an “or-equal” request shall result in any change in Contract Price. The Engineer’s denial of an “or-equal” request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents.

G. Treatment as a Substitution Request: If Engineer determines that an item of material or equipment proposed by Contractor does not qualify as an “or-equal” item, Contractor may request that Engineer considered the proposed item as a substitute pursuant to Paragraph 7.05.

7.05 Substitutes

A. Unless the specification or description of an item of material or equipment required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment under the circumstances described below. To the extent possible such requests shall be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of material or equipment from anyone other than Contractor.
2. The requirements for review by Engineer will be as set forth in Paragraph 7.05.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

3. Contractor shall make a written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:
   a. Shall certify that the proposed substitute item will:
      1) Perform adequately the functions and achieve the results called for by the general design,
      2) Be similar in substance to that specified, and
      3) Be suited to the same use as that specified.
   b. Will state:
      1) The extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times,
      2) 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
      3) Whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.
   c. Will identify:
      1) All variations of the proposed substitute item from that specified, and
      2) Available engineering, sales, maintenance, repair, and replacement services.
   d. Shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. Engineer’s Evaluation and Determination: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer’s review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer’s determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

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

D. Reimbursement of Engineer’s Cost: Engineer will record Engineer’s costs in evaluating a substitute proposed or submitted by Contractor. 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.

E. Contractor’s Expense: Contractor shall provide all data in support of any proposed substitute at Contractor’s expense.

F. Effect of Engineer’s Determination: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer’s denial of a substitution request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.05.D, by timely submittal of a Change Proposal.

7.06 Concerning Subcontractors, Suppliers, and Others

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner.

B. Contractor shall retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of designated parts of the Work if required by the Contract to do so.

C. Subsequent to the submittal of Contractor’s Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against which Contractor has reasonable objection.

D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable, during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within five (5) days.

E. Owner may require the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors, Suppliers, or other individuals or entities for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor, Supplier, or other individual or entity so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity.

F. If Owner requires the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, or both, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within fifteen (15) days of Owner’s requirement of replacement.
G. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

H. On a monthly basis Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

I. 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.

J. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers, and all other individuals or entities performing or furnishing any of the Work.

K. Contractor shall restrict all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed herein.

L. 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.

M. All Work performed for Contractor by a Subcontractor or Supplier shall be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer.

N. 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 the particular Subcontractor or Supplier.

O. 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 money due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

7.07 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 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. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors 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 specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. 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 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.

7.08 Permits

A. Unless otherwise provided in the Contract Documents, 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 the submission of Contractor’s Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

7.09 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.

7.10 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 or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and 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 such Work or other action. It shall not be Contractor’s responsibility to make certain that the Work described in
the Contract Documents is in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor’s obligations under Paragraph 3.03.

C. Owner or Contractor may give notice to the other party of any changes after the submission of Contractor’s Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within fifteen (15) days of such notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.11 Record Documents

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

7.12 Safety and Protection

A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. 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;
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, other work in progress, utilities, and Underground Facilities 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 Owner; the owners of adjacent property, Underground Facilities, and other utilities; and other contractors and utility owners performing work at or adjacent to the Site, when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

C. Contractor shall comply with the applicable requirements of Owner’s safety programs, if any. The Supplementary General Conditions identify any Owner’s safety programs that are applicable to the Work.
D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor’s safety program with which Owner’s, Engineer’s and Construction Manager’s (if any) employees and representatives must comply while at the Site.

E. All damage, injury, or loss to any property referred to in Paragraphs 7.12.A.2 or 7.12.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 remedied by Contractor at its expense.

F. Contractor’s duties and responsibilities for safety and protection shall continue until such time as the Work is completed and Owner has accepted occupancy and control of the Work.

G. Contractor’s duties and responsibilities for safety and protection shall resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.13 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.

7.14 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 Laws or Regulations.

7.15 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 give Engineer prompt written notice 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.

7.16 Shop Drawings, Samples, and Other Submittals

A. Shop Drawing and Sample Submittal Requirements:

1. Before submitting a Shop Drawing or Sample, Contractor shall have:
   a. Reviewed and coordinated the 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 and equipment 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 of that submittal, and that Contractor approves the 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 set forth in a written communication separate from the Shop Drawings or Sample submittal; and, in addition, in the case of Shop Drawings by a specific notation made on each Shop Drawing submitted to Engineer for review and approval of each such variation.

B. *Submittal Procedures for Shop Drawings and Samples*: Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals. Each submittal will be identified as Engineer may require.

1. Shop Drawings:
   a. Contractor shall submit the number of copies required in the Specifications.
   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 7.16.D.

2. Samples:
   a. Contractor shall submit the number of Samples required in the Specifications.
   b. Contractor shall 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 7.16.D.

3. 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. *Other Submittals*: Contractor shall submit other submittals to Engineer in accordance with the accepted Schedule of Submittals, and pursuant to the applicable terms of the Specifications.

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 or to safety precautions or programs incident thereto.

3. Engineer’s review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. Engineer’s review and approval of a Shop Drawing or Sample 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 7.16.A.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 will document any such approved variation from the requirements of the Contract Documents in a Field Order.

5. Engineer’s review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 7.16.A and B.

6. Engineer’s review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, shall not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer’s receipt, review, acceptance nor approval of a Shop Drawing, Sample, or other submittal shall result in such item becoming a Contract Document.

8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.D.4.

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.

2. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Engineer will record Engineer’s time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Engineer’s charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved submittal item, Contractor shall be responsible for Engineer’s charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.
7.17 Contractor’s General Warranty and Guarantee

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on Contractor’s warranty and guarantee.

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

1. Abuse, modification, or improper maintenance or 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.

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 or Construction Manager (if any);

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;

6. The issuance of a notice of acceptability by Engineer;

7. Any inspection, test, or approval by others; or

8. Any correction of defective Work by Owner.

D. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract shall govern with respect to Contractor’s performance obligations to Owner for the Work described in the assigned contract.

7.18 Indemnification

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall defend, indemnify and hold harmless Owner, Engineer, and Construction Manager (if any) 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 the performance of the Work, 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.
B. In any and all claims against Owner, Engineer or Construction Manager (if any) or any of their 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 7.18.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 7.18.A shall not extend to the liability of Engineer and Engineer’s officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:

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.

7.19 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 Laws and Regulations.

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, 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, 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 7.16.D.1.

E. Contractor shall not be responsible for the adequacy of the performance or design criteria specified by Owner or Engineer.
ARTICLE 8 – OTHER WORK AT THE SITE

8.01 Other Work

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner’s employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner’s employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any utility work at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford each other contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner’s employees, proper and safe access to the Site, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work. 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.

D. If the proper execution or results of any part of Contractor’s Work depends upon work performed by others under this Article 8, 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.

8.02 Coordination

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner’s employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary General Conditions or provided to Contractor prior to the start of any such other work:

1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;

2. An itemization of the specific matters to be covered by such authority and responsibility; and

3. The extent of such authority and responsibilities.

B. Unless otherwise provided in the Supplementary General Conditions, Owner shall have sole authority and responsibility for such coordination.
8.03 Legal Relationships

A. If, in the course of performing other work at or adjacent to the Site for Owner, the Owner’s employees, any other contractor working for Owner, or any utility owner causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within fifteen (15) days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment shall take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract. When applicable, any such equitable adjustment in Contract Price shall be conditioned on Contractor assigning to Owner all Contractor’s rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. 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.

B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due to Contractor, and assign to such other contractor or utility owner the Owner’s contractual rights against Contractor with respect to the breach of the obligations set forth in this paragraph.

C. When Owner is performing other work at or adjacent to the Site with Owner’s employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor’s failure to take reasonable and customary measures with respect to Owner’s other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due to Contractor.

D. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor’s failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor’s actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall: (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) 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 any such claims, and against all 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 such damage, delay, disruption, or interference.

**ARTICLE 9 – OWNER’S RESPONSIBILITIES**

9.01 Communications to Contractor

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer and/or the Construction Manager.

9.02 Replacement of Engineer

A. Owner may at its discretion appoint an engineer to replace Engineer. The replacement engineer’s status under the Contract Documents shall be that of the former Engineer.

9.03 Furnish Data

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 Pay When Due

A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 Lands and Easements; Reports, Tests, and Drawings

A. Owner’s duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner’s duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner’s identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 Insurance

A. Owner’s responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 Change Orders

A. Owner’s responsibilities with respect to Change Orders are set forth in Article 11.

9.08 Inspections, Tests, and Approvals

A. Owner’s responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 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.
9.10 Undisclosed Hazardous Environmental Condition
   A. Owner’s responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 Evidence of Financial Arrangements
   A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner’s obligations under the Contract Documents (including obligations under proposed changes in the Work).

9.12 Safety Programs
   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.
   B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

9.13 Owner’s Site Representative or Construction Manager
   A. Owner may designate an “Owner’s Site Representative” or “Construction Manager” to represent Owner at the Site and assist Owner in observing the progress and quality of the Work. The Construction Manager is not the Engineer’s consultant, agent, or employee. The Construction Manager, if any, will be identified at the pre-construction meeting.
   B. The Construction Manager will act as directed by and under the supervision of the Owner and will confer with the Owner regarding its actions. The Construction Manager’s dealings in matters pertaining to the Work shall, in general, be only with the Contractor, and dealings with Subcontractors shall only be through or with the full knowledge of the Contractor.
   C. The Construction Manager shall have the following duties and responsibilities set forth in this paragraph.
      1. Represent the Owner in connection with overseeing the Work and advising the Owner as to compliance by the Contractor with the Contract Documents.
      2. Review the progress schedule, shop drawing submittals schedule, and progress payment requests prepared by the Contractor and consult with the Owner and Engineer concerning their acceptability.
      3. Plan, schedule and conduct preconstruction and construction conferences. Arrange a schedule of progress meetings and other job conferences as required and notify those who are expected to attend. Conduct meetings and prepare, maintain and circulate copies of meeting minutes.
      4. Serve as the Owner’s liaison with the Contractor, working principally through the Contractor’s Project Manager and superintendent.
      5. Review Submittals, RFI’s, memos, design criteria, certified payroll records and all other administrative documents requested by Owner and coordinate review of these documents with Engineer.
      6. Issue clarifications relating to the Contract Documents;
      7. Coordination with Engineer regarding Contract Document revisions and reissuance;
      8. Review, reject or approve Contractor’s project progress schedules.
9. Conduct on-site observations of the Work in progress to assist the Owner in determining if the Work is proceeding in accordance with the Contract Documents.

10. Verify that the tests, equipment, and systems startups and operating and maintenance instruction are conducted as required by the Contract Documents and in presence of the required personnel, and that the Contractor maintains adequate records thereof.

11. Coordination with Engineer regarding Contractor-requested clarifications and interpretations of the Contract Documents.

12. Coordination with Owner and Engineer for consideration and evaluation of Contractor’s suggestions for minor modifications to the Contract Documents.

13. Construction Manager, in conjunction with the Engineer, will review applications for payment from the Contractor for accuracy and Contract compliance, noting particularly their relation to the schedule of values, work completed, and materials and equipment delivered at the Site but not yet incorporated in the Work.

14. Coordinate with and assist the Owner and Engineer in connection with the review, consideration, issuance, negotiation and resolution of Change Orders and Contractor’s claims for additional compensation.

15. During the course of the Work, verify that certificates, maintenance and operation manuals, and other data required to be assembled and furnished by Contractor are applicable to the items installed.

16. Develop a list of pre-punch list of items which require correction prior to final Inspection. Coordination with the Owner regarding preparation of a Notice of Completion, as applicable.

17. Participate in the final inspection, along with Owner’s inspectors, the Owner, Engineer, and the Contractor, and prepare a punch list of items to be completed or corrected.

18. Verify that all items on the punch list have been completed or corrected and make recommendations to the Engineer and the Owner concerning acceptance.

D. The Construction Manager shall not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including “or-equal” items).

2. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.

3. Undertake any of the responsibilities of the Engineer.

4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of Contractor’s work.

5. Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.

6. Accept Shop Drawing or Sample submittals from anyone other than Contractor.
ARTICLE 10 – ENGINEER’S STATUS DURING CONSTRUCTION

10.01 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.

10.02 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 design 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 10.08. 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.

10.03 Project Representative
   A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as designated by Owner and Engineer.

10.04 Rejecting Defective Work
   A. Engineer has the authority to reject Work in accordance with Article 14.

10.05 Shop Drawings, Change Orders and Payments
   A. Engineer’s authority, and limitations thereof, as to Shop Drawings and Samples, are set forth in Paragraph 7.16.

   B. 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, are set forth in Paragraph 7.19.

   C. Engineer’s authority as to Change Orders is set forth in Article 11.

   D. Engineer’s authority as to Applications for Payment is set forth in Article 15.
10.06 Determinations for Unit Price Work
A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.07 Decisions on Requirements of Contract Documents and Acceptability of Work
A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.08 Limitations on Engineer’s Authority and Responsibilities
A. Neither Engineer’s authority nor responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

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 15.06.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 10.08 shall also apply to the Resident Project Representative, if any.

10.09 Compliance with Safety Program
A. While at the Site, Engineer’s employees and representatives will comply with the specific applicable requirements of Owner’s and Contractor’s safety programs (if any) of which Engineer has been informed.
ARTICLE 11 – AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK

11.01 Change Procedures

A. Submittals: Contractor shall submit the name of the individual who is authorized to receive change documents and is responsible for informing others in Contractor’s employ or subcontractors of changes to the Work.

B. Contractor shall carefully study and compare Contract Documents before proceeding with fabrication and installation of Work and promptly advise Architect/Engineer of any error, inconsistency, omission, or apparent discrepancy.

C. Requests for Interpretation (RFI) and Clarifications: Contractor shall allot time in construction scheduling for coordination with Engineer.

1. Use CSI Form 13.2A (or similar) - Request for Interpretation for requesting interpretations.

2. Engineer may respond with a direct answer on the Request for Interpretation form, or with CSI Form 13.3A Clarification Notice, or EJCDC C-942 Field Order or similar.

D. Engineer will advise of minor changes in the Work not involving adjustment to Contract Sum/Price or Contract Time by issuing supplemental instructions via Field Order.

E. Engineer or Construction Manager (if any) may issue a Proposal Request including a detailed description of proposed changes with supplementary or revised Drawings and Specifications. Contractor will prepare and submit proposal within seven (7) days, which shall include the cost and schedule requirements to complete the subject work.

F. Contractor may propose changes by submitting a request for changes to Engineer, describing proposed change and its full effect on the Work. This will include a statement describing the reason for the change and the effect on the Contract Price and Contract Time with full documentation and a statement describing the effect on the Work by other contractors.

G. Change Order Pricing: Change order pricing, whether based on units or lump sum, shall include all costs associated with the subject work, including but not limited to materials, equipment, labor, overhead and profit, related mobilization and demobilization, as applicable.

H. Time and Material/Force-Account Change Order: Contractor shall submit an itemized account and supporting data after completion of change, within the time limits indicated in Conditions of the Contract. Engineer will determine the change allowable in Contract Price and Contract Time as provided in Contract Documents.

I. Contractor shall maintain detailed records of the Work done on time and material force-account basis. Contractor shall provide full information required for evaluation of proposed changes and to substantiate costs for changes in the Work.

J. Execution of Change Orders: Engineer or Construction Manager (if any) will issue Change Orders for signatures of the parties.
K. Correlation of Contractor Submittals:
   1. Contractor shall promptly revise the Schedule of Values/Application for Payment forms to record each authorized Change Order as a separate line item and adjust Contract Sum/Price accordingly.
   2. Contractor shall promptly revise Progress Schedules to reflect the change in Contract Time and submit to Engineer for review.
   3. Contractor shall promptly record changes on Record Documents.

11.02 Amending and Supplementing Contract Documents

A. The Contract Documents may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

1. Change Orders:
   a. If an amendment or supplement to the Contract Documents includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order. A Change Order also may be used to establish amendments and supplements of the Contract Documents that do not affect the Contract Price or Contract Times.
   b. Owner and Contractor may amend those terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, without the recommendation of the Engineer. Such an amendment shall be set forth in a Change Order.

2. Work Change Directives: A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive’s effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.04 regarding change of Contract Price. Contractor must submit any Change Proposal seeking an adjustment of the Contract Price or the Contract Times, or both, no later than thirty (30) days after the completion of the Work set out in the Work Change Directive.

3. Field Orders: Engineer may authorize minor changes in the Work if the changes 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. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.03 Owner-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. Such changes shall
be supported by Engineer’s recommendation. Such changes may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work shall be performed under the applicable conditions of the Contract Documents. Nothing in this paragraph shall obligate Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor’s safety obligations under the Contract Documents or applicable Laws and Regulations.

11.04 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, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.

11.05 Change of Contract Price

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment of Contract Price shall comply with the provisions of Article 12.

B. 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, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03); or

2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.04.C.2); or

3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor’s fee for overhead and profit (determined as provided in Paragraph 11.04.C).

C. Contractor’s Fee: When applicable, 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 13.01.B.1 and 13.01.B.2, the Contractor’s fee shall be 15 percent;

   b. For costs incurred under Paragraph 13.01.B.3, the Contractor’s fee shall be five (5) 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 11.01.C.2.a and
11.01.C.2.b is that the Contractor’s fee shall be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.A.1 and 13.01.A.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of five (5) percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted work the maximum total fee to be paid by Owner shall be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the work;

d. No fee shall be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;

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 11.04.C.2.a through 11.04.C.2.e, inclusive.

11.06 Change of Contract Times

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment in the Contract Times shall comply with the provisions of Article 12.

B. An adjustment of the Contract Times shall be subject to the limitations set forth in Paragraph 4.05, concerning delays in Contractor’s progress.

C. Contractor’s construction schedule shall include five (5) work days of delay due to weather for which no adjustment in contract time will be made.

11.07 Change Proposals

A. Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; appeal an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; contest a set-off against payment due; or seek other relief under the Contract. The Change Proposal shall specify any proposed change in Contract Times or Contract Price, or both, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents.

1. Procedures: Contractor shall submit each Change Proposal to Engineer promptly (but in no event later than fifteen (15) days) after the start of the event giving rise thereto, or after such initial decision. The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within fifteen (15) days after the submittal of the Change Proposal. The supporting data shall be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event. Engineer will advise
Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal.

2. **Engineer’s Action:** Engineer will review each Change Proposal and, within thirty (30) days after receipt of the Contractor’s supporting data, either deny the Change Proposal in whole, approve it in whole, or deny it in part and approve it in part. Such actions shall be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within thirty (30) days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer’s inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

3. **Binding Decision:** Engineer’s decision will be final and binding, unless Contractor appeals the decision by filing a Claim under Article 12.

4. **Supporting Data:** Contractor’s request for extensions of Contract Time (including any milestones) shall contain the proper supporting data which shall include: (1) the cause for and estimated duration of the requested extension; (2) a description of the portions of the Work affected; (3) a schedule identifying exactly how the critical path or milestone was affected; and (4) all other pertinent documents and detail that might be necessary for Engineer and/or Owner to properly evaluate the request.

B. **Resolution of Certain Change Proposals:** If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice shall be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

11.08 **Execution of Change Orders**

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. 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;

2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.02, (b) required because of Owner’s acceptance of defective Work under Paragraph 14.04 or Owner’s correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer’s recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters; and

4. Changes in the Contract Price or Contract Times, or other changes, which embody the substance of any final and binding results under Paragraph 11.06, or Article 12.

B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of this Paragraph 11.07, it shall be deemed to be of full force and effect, as if fully executed.
11.09 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), the giving of any such notice will be Contractor’s responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12 – CLAIMS

12.01 Claims

A. Claims Process: The following disputes between Owner and Contractor shall be submitted to the Claims process set forth in this Article:

1. Appeals by Owner or Contractor of Engineer’s decisions regarding Change Proposals;
2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents; and
3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters.

B. Submittal of Claim: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than thirty (30) days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within thirty (30) days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim shall rest with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, or both, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor’s knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. Review and Resolution: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim shall be stated in writing and submitted to the other party, with a copy to Engineer.

D. Mediation:

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate shall stay the Claim submittal and response process.
2. If Owner and Contractor agree to mediation, then after sixty (60) days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process shall resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process shall resume as of the date of the conclusion of the mediation, as determined by the mediator or as indicated by either party in writing.
3. Owner and Contractor shall each pay one-half of the mediator’s fees and costs.

E. Partial Approval: If the party receiving a Claim approves the Claim in part and denies it in part, such action shall be final and binding unless within thirty (30) days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. Denial of Claim: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within thirty (30) days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim shall be final and binding unless within thirty (30) days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. Final and Binding Results: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim shall be incorporated in a Change Order to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 Cost of the Work

A. Purposes for Determination of Cost of the Work: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

2. To determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. Costs Included: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work 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 13.01.C, and shall include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers’ compensation, health and retirement benefits, bonuses, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing...
Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the 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.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from Subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor’s Cost of the Work and fee shall be determined in the same manner as Contractor’s Cost of the Work and fee as provided in this Paragraph 13.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.

5. Supplemental costs including the following:
   a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor’s employees incurred in discharge of duties connected with the Work.
   b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
   c. Construction Equipment and Machinery:
      1. Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.
      2. Costs for equipment and machinery owned by Contractor are to be charged at a rate shown for such equipment in the Rental Rate Blue Book published by Equipment Watch, adjusted to the regional area of the Project. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs. Costs will include the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the Work. The cost of any such equipment or machinery, or
parts thereof, shall cease to accrue when the use thereof is no longer necessary for the changed Work. Equipment or machinery with a value of less than $1,000 will be considered small tools.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

e. Deposits lost for causes other than 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, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 6.05), provided such losses and damages have resulted from causes other than 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. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor’s fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. 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, expeditors, 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 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here 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 Paragraph 13.01.B.

D. **Contractor’s Fee**: When the Work as a whole 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, Change Proposal, Claim, set-off, or other 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 11.04.C.

E. **Documentation**: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

### 13.02 Allowances

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. **Cash Allowances**: Contractor agrees that:

1. The cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. Contractor’s costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

C. **Contingency Allowance**: Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

### 13.03 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. Payments to Contractor for Unit Price Work will be based on actual quantities.

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. 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 Owner and Contractor, subject to the provisions of the following paragraph.

E. The unit price of an item of Unit Price Work shall be subject to reevaluation and adjustment under the following conditions:

1. If the variation in the quantity of a particular item of Unit Price Work actually furnished or performed by Contractor differs by more than 25% from the estimated quantity of such item indicated in the Agreement; and
2. If there is no corresponding adjustment with respect to any other item of Work; and
3. If Contractor believes that Contractor has incurred additional expense as a result thereof, Contractor may submit a Change Proposal, or if Owner believes that the quantity variation entitles Owner to an adjustment in the unit price, Owner seek an adjustment in the Contract Price.

ARTICLE 14 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

14.01 Access to Work

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction will have access to the Site and the Work at reasonable 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.

14.02 Tests, Inspections, and Approvals

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work shall be governed by the provisions of Paragraph 14.05.

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, obtaining, and paying for all inspections and tests required:

1. By the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. To attain Owner’s and Engineer’s acceptance of materials or equipment to be incorporated in the Work;

3. By manufacturers of equipment furnished under the Contract Documents;

4. For testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

5. For acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor’s purchase thereof for incorporation in the Work.

Such inspections and tests shall be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. 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. Such uncovering shall be at Contractor’s expense unless Contractor had given Engineer timely notice of Contractor’s intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 Defective Work

A. Contractor’s Obligation: It is Contractor’s obligation to assure that the Work is not defective.

B. Engineer’s Authority: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. Notice of Defects: Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. Correction, or Removal and Replacement: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. Preservation of Warranties: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner’s special warranty and guarantee, if any, on said Work.

F. Costs and Damages: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the
costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 Acceptance of Defective Work

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer’s confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner’s evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work shall be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 Uncovering Work

A. Engineer has the authority to require special inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer’s observation, and then replace the covering, all at Contractor’s expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then 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, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages 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 pending Contractor’s full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. 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. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within fifteen (15) days of the determination that the Work is not defective.
14.06 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, then 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.

14.07 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, 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, then Owner may, after seven (7) days written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, 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, 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 incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be 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 14.07.

ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 Progress Payments

A. Basis for Progress Payments: The Schedule of Values established as provided in Article 2 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 during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. Applications for Payments:

1. At least twenty (20) days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer
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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. 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, a warehouse bond, 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.

4. Contractor shall deliver, together with each Application for Payment, (a) an
Unconditional Waiver and Release applicable to Work with respect to which Contractor
has already received payment (in a form consistent with Public Contract Code Section
8132 or 8136), (b) a Conditional Waiver and Release that is applicable to Work
completed prior to the date of such Application for Payment for which Contractor seeks
payment (in a form consistent with Public Contract Code Section 8134 or 8138), and (c)
any other information, documentation or certification that Owner reasonably requests
in connection with any liens, waivers or releases. Owner’s receipt of such executed
waivers shall be a condition precedent to Owners obligation to pay any amounts
pertaining to a particular Application for Payment. In addition, Owner may at any time
direct Contractor to certify in writing that all payrolls, invoices for material and
equipment, and other indebtedness connected with the Work and associated with an
Application for Payment have been paid.

C. Review of Applications:

1. Engineer will, within seven (7) days after receipt of each Application for Payment,
including each resubmittal, 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.

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 13.03, 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; 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 money 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. 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 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer’s opinion to protect Owner from loss because:

   a. The Work is defective, requiring correction or replacement;

   b. The Contract Price has been reduced by Change Orders;

   c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

   d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

   e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.
f. There are other items entitling Owner to a set off against the amount recommended pursuant to the terms of the Contract Documents.

D. Payment Becomes Due:

1. Thirty (30) days after presentation of the Application for Payment to Owner with Engineer’s recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. Reductions in Payment by Owner:

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:
   a. Claims have been made against Owner on account of Contractor’s conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages on account of Contractor’s conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;
   b. Fines or penalties that are assessed against the Owner that are the responsibility of the Contractor, its Subcontractors or Suppliers, including but not limited to, civil wage and penalty assessments by the California Department of Industrial Relations;
   c. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;
   d. Contractor has failed to provide and maintain required bonds or insurance;
   e. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;
   f. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;
   g. The Work is defective, requiring correction or replacement;
   h. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
   i. The Contract Price has been reduced by Change Orders;
   j. An event that would constitute a default by Contractor and therefore justify a termination for cause has occurred;
   k. Liquidated damages have accrued as a result of Contractor’s failure to achieve Milestones, Substantial Completion, or final completion of the Work;
   l. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;
   m. There are other items entitling Owner to a set off against the amount recommended pursuant to the terms of the Contract Documents.
2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, 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, if Contractor remedies the reasons for such action. The reduction imposed shall be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner’s refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 15.01.C.1 and subject to interest as provided in the Agreement.

15.02 Contractor’s Warranty of Title
   A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of: (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than seven days after the time of payment by Owner.

15.03 Substantial Completion
   A. When Contractor considers the entire Work ready for its intended use, Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

   B. Promptly after Contractor’s notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

   C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which shall fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have seven (7) days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within fourteen (14) days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner’s objections Engineer concludes that the Work is substantially complete, then Engineer will, within said fourteen (14) days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.
D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner’s use or occupancy of the Work following Substantial Completion, review the builder’s risk insurance policy with respect to the end of the builder’s risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner’s use or occupancy of the Work.

E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. 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 punch list.

15.04 Partial Use or Occupancy

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. At any time Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be 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 15.03.A through E for that part of the Work.

2. At any time Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work 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 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 considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 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.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.05 regarding builder’s risk or other property insurance.

15.05 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, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 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, annotated record documents (as provided in Paragraph 7.11), and other documents, Contractor may make application for final payment.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:
   a. All documentation called for in the Contract Documents;
   b. Consent of the surety, if any, to final payment;
   c. Satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.
   d. A list of all disputes that Contractor believes are unsettled; and
   e. Complete and legally effective releases and/or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens, if any, filed in connection with the Work.

   f. If any Subcontractor or Supplier fails to furnish such releases and/or waivers, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

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 have been fulfilled, Engineer will, within seven (7) days after receipt of the final Application for Payment, indicate in writing Engineer’s recommendation of final payment and present the Application for Payment to Owner for payment. Such recommendation shall account for any set-offs against payment that are necessary in Engineer’s opinion to protect Owner from loss for the reasons stated above with respect to progress payments. 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 15.07. 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. Completion of Work: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer’s written recommendation of final payment.

D. Payment Becomes Due: Thirty (30) days after the presentation to Owner of the final Application for Payment and accompanying documentation, the amount recommended by Engineer (less any further sum Owner is entitled to set off against Engineer’s recommendation, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions above with respect to progress payments) will become due and shall be paid by Owner to Contractor.

15.07 Waiver of Claims

A. The making of final payment will not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 15.05, from Contractor’s failure to comply with the Contract Documents, from any reduction in payment in Paragraph 15.05(E), or the terms of any special guarantees specified therein, from outstanding Claims by Owner, or from Contractor’s prior and continuing obligations under the Contract Documents.

B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted or appealed under the provisions of Article 17.

15.08 Correction Period

A. If within one (1) 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 required by the Contract Documents, or by any specific provision of the Contract Documents), any Work is found to be defective, or if the repair of any damages to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as permitted by Laws and Regulations, is found to be defective, then Contractor shall promptly, without cost to Owner and in accordance with Owner’s written instructions:

1. Correct the defective repairs to the Site or such other adjacent 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 to 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. Contractor shall pay 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 such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others).
C. In special circumstances where a particular item of equipment is placed in continuous service 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, the correction period hereunder with respect to such Work will be extended for an additional period of one (1) year after such correction or removal and replacement has been satisfactorily completed.

E. Contractor’s obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION

16.01 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 ninety (90) consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension. Any Change Proposal seeking such adjustments shall be submitted no later than fifteen (15) days after the date fixed for resumption of Work.

16.02 Owner May Terminate for Cause

A. The occurrence of any one or more of the following events will constitute a default by Contractor and 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 supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule);
2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;
3. Contractor’s disregard of Laws or Regulations of any public body having jurisdiction; or
4. Contractor’s repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) ten (10) days written notice that Owner is considering a declaration that Contractor is in default and termination of the contract, Owner may proceed to:

1. Declare Contractor to be in default, and give Contractor (and any surety) notice that the Contract is terminated; and
2. Enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, 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 complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within seven (7) days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.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 the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, 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.

F. 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, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond shall govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 Owner May Terminate For Convenience

A. Upon seven (7) days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract for convenience. In such case, Contractor shall be paid for (without duplication of any items):

1. Completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. 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 fair and reasonable sums for overhead and profit on such expenses; and

3. Other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. Contractor shall not be paid on account of loss of anticipated overhead, profits, or revenue, or other economic loss arising out of or resulting from such termination.

16.04 Contractor May Stop Work or Terminate

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than ninety (90) consecutive days by Owner or under an order of court or other public authority, or (2)
Engineer fails to act on any Application for Payment within thirty (30) days after it is submitted, or (3) Owner fails for thirty (30) days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven (7) days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within thirty (30) days after it is submitted, or Owner has failed for thirty (30) days to pay Contractor any sum finally determined to be due, Contractor may, seven (7) days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor’s stopping the Work as permitted by this paragraph.

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

17.01 Methods and Procedures

A. Disputes Subject to Final Resolution: The following disputed matters are subject to final resolution under the provisions of this Article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full; and;

2. Disputes between Owner and Contractor concerning the Work or obligations under the Contract Documents, and arising after Final Payment has been made.

B. Binding Arbitration: If the voluntary mediation does not resolve the dispute, then the dispute shall be resolved by binding arbitration before a retired Judge of the Superior Court or a retired federal court judge or magistrate, in accordance with the provisions of California Code of Civil Procedure (CCP) Sections 1280 et. seq. The Award of the arbitrator shall be entitled to be confirmed by the Superior Court, and if so confirmed, entered as a judgment pursuant to the provisions of CCP 1285 et. seq.

C. Multiparty Proceeding: The parties agree that all parties necessary to resolve a claim shall be parties to the same dispute resolution proceeding. The Contractor shall provide provisions in its contracts with all of its subcontractors that the dispute resolution procedures of the Contract are binding upon all subcontractors (as well as any lower-tier subcontractors) to insure consolidation of such dispute resolution proceedings.

D. Cost of Dispute Resolution: The prevailing party in any dispute arising out of or relating to this Agreement or its breach that is resolved by binding arbitration, and any court proceedings related to the confirmation of the award, shall be entitled to recover from the other party reasonable attorney’s fees, costs and expenses incurred by the prevailing party in connection with such dispute resolution process.
ARTICLE 18 – MISCELLANEOUS

18.01 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, by a commercial courier service or otherwise, to the individual or to a member of the firm or to an officer of the corporation for which it is intended; or
   2. Delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the sender of the notice.

18.02 Computation of Times
A. When any period of time is referred to in the Contract 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.

18.03 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. 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.

18.04 Limitation of Damages
A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 No Waiver
A. A party’s non-enforcement of any provision shall not constitute a waiver of that provision, nor shall it affect the enforceability of that provision or of the remainder of this Contract.

18.06 Survival of Obligations
A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

18.07 Controlling Law
A. This Contract is to be governed by the law of the state in which the Project is located.
18.08 Headings

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

++END OF GENERAL CONDITIONS++
# SECTION 00800
## SUPPLEMENTARY GENERAL CONDITIONS

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ARTICLE 1 – 1 - DEFINITIONS AND TERMINOLOGY

1.01 Defined Terms

SC-1.01. A Add the following terms to Section 1.01.A:
1. LVL – Leo J. Vander Lans Advanced Water Treatment Facility

ARTICLE 2 – 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

2.01 Subsurface and Physical Conditions

SC-5.03. A Add the following new paragraphs immediately after Paragraph 5.03.B:
C. The following reports of explorations and tests of subsurface conditions at or adjacent to the Site are known to Owner:

2.02 Hazardous Environmental Conditions

SC-5.06. A Add the following subparagraphs immediately following 5.06.A.2:
3. The following reports regarding Environmental Conditions at or adjacent to the Site are known to Owner:

ARTICLE 3 – 7 – CONTRACTOR’S RESPONSIBILITIES

3.01 Shop Drawings, Samples, and Other Submittals

SC-7.16. A Delete Paragraph 7.16 B. in its entirety, and insert the following:
B. Submittal Procedures for Shop Drawings and Samples: Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals. Each submittal will be identified as Engineer may require.
1. Shop Drawings and Samples:
   a. Submittals shall be made using Owner’s web-based document control system, EADOC.
   b. When large drawings or product samples are required to be submitted that cannot be submitted through EADOC, Contractor shall:
      1) Upload a transmittal sheet for the submittal to EADOC.
      2) Submit electronic files to Engineer in Adobe Acrobat (.PDF) format via EADOC.
      3) Submit 6 full-size hard copies and 1 half-sized hard copy (not exceeding 11x17 inches) to Engineer via traditional delivery.
   c. 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 7.16.D.
   d. Contractor shall submit the number of Samples required in the Specifications.
   e. Contractor shall 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 7.16.D.
   f. 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.

ARTICLE 4 – 8 – OTHER WORK AT THE SITE

4.01  8.02 Coordination

SC-8.02. A Delete Paragraph 8.02.A in its entirety and replace with the following:

A. Owner intends to contract with others for the performance of other work at or adjacent to the Site. Other contractors may be performing work simultaneously at the Site.

1. The Resident Project Representative shall have authority to coordinate the various contractors and work forces at the Site, including placing limitations on any contractor’s access as necessary to facilitate work-progress of all parties to the extent practical;

2. The following specific matters are to be covered by such authority and responsibility: Identifying limits of Contractor’s material and equipment storage area at the Site, hours of access, and routes to the material and equipment storage area, which are subject to change periodically.
3. The extent of such authority and responsibilities is: The Resident Project Representative’s authority to coordinate and manage activities at the Site intended to minimize conflicts between contractors, if applicable.

ARTICLE 5 – 10 – ENGINEER’S STATUS DURING CONSTRUCTION

5.01 10.03 Project Representative

SC-10.03. A Add the following new paragraph immediately after Paragraph 10.03.A of the General Conditions:

B. On this Project, by agreement with the Owner, Engineer will not furnish a Resident Project Representative to represent Engineer at the Site or assist Engineer in observing the progress and quality of the Work.

++END OF SECTION++
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Schedule of Values.
   B. Application for Payment.
   C. Change procedures.
   D. Defect assessment.
   E. Unit prices.
   F. Description of Bid Items

1.02 SCHEDULE OF VALUES
   A. Contractor shall develop a Schedule of Values (lump sum price breakdown) as specified in the Standard Specifications for Public Works Construction and incorporate into the cost loading function of the CPM schedule.

   B. Construction Manager and Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Construction Manager will review with Contractor, Construction Manager’s preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Construction Manager’s written decision thereon will be final and binding (except as modified by Construction Manager to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of Article 15 of the General Conditions.

   C. 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.

   D. The estimated quantities 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 Construction Manager subject to the provisions of Article 15 of the General Conditions.

   E. 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.

   F. Owner and Contractor may make a Claim for an adjustment in the Contract Price in accordance with Article 11 of the General Conditions if:
      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;
2. There is no corresponding adjustment with respect to any other item of Work; and

3. Contractor believes it is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price and the parties are unable to agree as the amount of any such increase or decrease.

1.03 APPLICATION FOR PAYMENT

A. Base Applications for Payment on the Schedule of Values described above, and submit to Owner in accordance the General Conditions.

B. Submit one copy of each Application for Payment each calendar month, as indicated in Article 15 of the General Conditions.

C. Submit an updated construction schedule with each Application for Payment.

1.04 CHANGE PROCEDURES (See Article 11 of the General Conditions)

1.05 DEFECT ASSESSMENT

A. Replace the Work, or portions of the Work, not conforming to specified requirements.

B. If, in the opinion of Owner’s Site Representative, it is not practical to remove and replace the Work, Owner’s Site Representative will direct appropriate remedy or adjust payment.

C. When allowed by Owner, the defective Work may remain, but the unit price will be reduced 50 percent.

D. When allowed by Owner, Defective Work may be partially repaired according to instructions from Owner’s Site Representative, and unit sum/price of the portion of Work assessed as defective will be reduced 50 percent.

E. Individual Specification Sections may modify these options or may identify specific formula or percentage price reduction.

F. Authority of Owner’s Site Representative to assess defects and identify payment adjustments is final.

G. Nonpayment for Rejected Products: Payment will not be made for rejected products for any of the following reasons:
   1. Products wasted or disposed of in a manner that is not in accordance with the Contract Documents.
   2. Products determined as unacceptable before or after placement.
   3. Products not completely unloaded from transporting vehicle.
   4. Products placed beyond lines and levels of the required Work.
   5. Products remaining on hand after completion of the Work.
1.06 UNIT PRICES

A. Authority: Measurement methods are delineated in individual Specification Sections and the Description of Bid Items in this section.

B. Measurement methods delineated in individual Specification Sections complement criteria of this Section. In event of conflict, requirements of this section govern.

C. Take measurements and compute quantities. Owner’s Site Representative will verify measurements and quantities.

D. Unit Quantities: Quantities and measurements indicated on Bid Form are for Contract purposes only. Actual approved quantities provided shall determine payment.
   1. When actual Work requires more or fewer quantities than those quantities indicated, provide required quantities at contracted unit sum/prices.
   2. When actual Work requires 25% or greater change in quantity than those quantities indicated, Owner or Contractor may claim a Contract Price adjustment.

E. Payment Includes: Full compensation for required labor, products, tools, equipment, plant and facilities, transportation, services and incidentals; erection, application, or installation of item of the Work; overhead and profit.

F. Final payment for Work governed by unit prices will be made on the basis of actual measurements and quantities accepted by Engineer multiplied by unit price for Work incorporated in accordance with the Contract Documents.

G. Measurement of Quantities:
   1. Weigh Scales: Inspected, tested, and certified by applicable State weights and measures department within past year.
   2. Platform Scales: Of sufficient size and capacity to accommodate conveying vehicle.
   3. Metering Devices: Inspected, tested, and certified by applicable State department within past year.
   4. Measurement by Volume: Measured by cubic dimension using mean length, width, and height or thickness.
   5. Measurement by Area: Measured by square dimension using mean length and width or radius.
   7. Stipulated Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as completed item or unit of the Work.
1.07 DESCRIPTION OF BID ITEMS

A. See Section 01025 for Payment Items

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

++END OF SECTION++
PART 1  GENERAL

1.01 SECTION INCLUDES
   A. Web-Based Document Control System, EADOC
   B. Progress meetings

1.02 WEB-BASED DOCUMENT CONTROL SYSTEM, EADOC
   A. Contractor shall use the Owner’s web-based document control system, EADOC, to submit and receive all construction related documentation related to this project. Costs associated for the use of the software have been paid for by the OWNER. The website address, login and passwords to be used will be provided by the Construction Manager after award of the contract.

   B. Owners Site Representative will provide training to Contractor for use of the EADOC system. The information to be generated, transmitted and tracked by the document control system shall include, but not be limited to the following:
      1. Correspondence
      2. Meeting Agendas and Meeting Minutes
      3. Applications for Payment
      4. Shop Drawings.
      5. Request for Information (RFI’s).
      6. Field Orders
      7. Work Change Directives
      8. Change Proposals
      9. Change Orders
      11. Project Schedules.

1.03 PROGRESS MEETINGS
   A. Contractor’s Site Superintendent shall attend weekly coordination meetings with Owner’s Representatives throughout progress of the Work.

   B. Owner’s Site Representative will arrange meetings, prepare agenda facilitate the meetings, and prepare and distribute meeting minutes.

   C. **Attendance Required:** Contractor’s Site Superintendent, major subcontractors and suppliers, as appropriate to agenda topics for each meeting.

   D. Sample Agenda:
      1. Review minutes of previous meetings
2. Review of Work progress  
3. Field observations, problems, and decisions  
4. Identification of problems which impede planned progress  
5. Review of submittals schedule and status of submittals  
6. Review of off-site fabrication and delivery schedules  
7. Maintenance of progress schedule  
8. Corrective measures to regain projected schedules  
9. Planned progress during succeeding work period  
10. Coordination of projected progress  
11. Maintenance of quality and work standards  
12. Effect of proposed changes on progress schedule and coordination  
13. Other business relating to Work

PART 2  PRODUCTS – Not Used

PART 3  EXECUTION – Not Used

++END OF SECTION++
SECTION 01010

SUMMARY OF WORK

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Work to be done under this Contract and in accordance with these Specifications consists of furnishing all equipment, superintendence, labor, skill, material and all other Items necessary for the construction of the Calcium Chloride Bulk Tank Expansion.

The Contractor shall perform all work required for such construction in accordance with the Contract Documents and subject to the terms and conditions of the Contract, complete and ready for use.

B. The principal features of the Work to be performed under this Contract includes:

SINGLE PRIME CONTRACT: Includes furnishing and installing a Calcium Chloride bulk storage containment area, 5,000 gallon bulk storage tank, mechanical piping and trenches, associated electrical and instrumentation.

C. The foregoing description(s) shall not be construed as a complete description of all work required.

1.02 CONTRACT DOCUMENTS

A. The Work to be done is shown on the set of Drawings entitled 20125-003 Calcium Chloride Bulk Storage Expansion and dated 04/26/2019. The numbers and titles of all Drawings appear on the index sheet of the Drawings, Drawing G-01. All drawings so enumerated shall be considered an integral part of the Contract Documents as defined herein.

B. Certain Document Sections refer to Divisions of the Contract Specifications. Sections are each individually numbered portions of the Specifications (numerically) such as 08110, 13182, 15206, etc. The term Division is used as a convenience term meaning all Sections within a numerical grouping. Division 16 would thus include Sections 16000 through 16902.

C. Where references in the Contract Documents are made to Contractors for specific disciplines of work (i.e. Electrical Contractor, etc.), these references shall be interpreted to be the single prime Contractor when the project is bid or awarded as a single prime contract.

1.03 GENERAL ARRANGEMENT

A. Drawings indicate the extent and general arrangement of the work. If any departures from the Drawings are deemed necessary by the Contractor to accommodate the materials and equipment he proposes to furnish, details of such departures and reasons therefore shall be submitted as soon as practicable to the Engineer for approval. No such departures shall be made without the prior written approval of the Engineer. Approved changes shall be made without additional cost to the Owner for this work or related work under other Contracts of the Project.
B. The specific equipment proposed for use by the Contractor on the project may require changes, in structures, auxiliary equipment, piping, electrical, mechanical, controls or other work to provide a complete satisfactory operating installation. The Contractor shall submit to the Engineer, for approval, all necessary Drawings and details showing such changes to verify conformance with the overall project structural and architectural requirements and overall project operating performance. The Bid Price shall include all costs in connection with the preparation of new drawings and details and all changes to construction work to accommodate the proposed equipment, including increases in the costs of other Contracts.

1.04 CONSTRUCTION PERMITS, EASEMENTS AND ENCROACHMENTS

A. The Owner shall obtain or cause to be obtained all permanent and temporary construction easements as shown on the Drawings.

B. The Contractor shall obtain, keep current and pay all fees for any necessary construction permits from those authorities, agencies, or municipalities having jurisdiction over land areas, utilities, or structures which are located within the Contract limits and which will be occupied, encountered, used, or temporarily interrupted by the Contractor's operations unless otherwise stated. Record copies of all permits shall be furnished to the Engineer.

C. When construction permits are accompanied by regulations or requirements issued by a particular authority, agency or municipality, it shall be the Contractor's responsibility to familiarize himself and comply with such regulations or requirements as they apply to his operations on this Project.

1.05 ADDITIONAL ENGINEERING SERVICES

A. In the event that the Engineer is required to provide additional engineering services as a result of substitution of materials or equipment which are not "or equal" by the Contractor, or changes by the Contractor in dimension, weight, power requirements, etc., of the equipment and accessories furnished, or if the Engineer is required to examine and evaluate any changes proposed by the Contractor for the convenience of the Contractor, then the Engineer's charges in connection with such additional services shall be charged to the Contractor by the Owner.

B. Structural design shown on the Contract Drawings is based upon typical weights for major items of equipment as indicated on the Contract Drawings and specified. If the equipment furnished exceeds the weights of said equipment, the Contractor shall assume the responsibility for all costs of redesign and for any construction changes required to accommodate the equipment furnished, including the Engineer's expenses in connection therewith.

B. In the event that the Engineer is required to provide additional engineering services as a result of Contractor's errors, omissions, or failure to conform to the requirements of the Contract Documents, or if the Engineer is required to examine and evaluate any changes proposed by the Contractor solely for the convenience of the Contractor, then the Engineer's charges in connection with such additional services shall be charged to the Contractor by the Owner.
1.06 ADDITIONAL OWNER’S EXPENSES

A. In the event the Work of this Contract is not completed within the time set forth in the Contract or within the time to which such completion may have been extended in accordance with the Contract Documents, the additional engineering or inspection charges incurred by the Owner may be charged to the Contractor and deducted from the monies due him. Extra work or supplemental Contract work added to the original Contract, as well as extenuating circumstances beyond the control of the Contractor, will be given due consideration by the Owner before assessing engineering and inspection charges against the Contractor.

B. Unless otherwise specifically permitted, the normal time of work under this Contract is limited to 8 hours per day, Monday through Friday. Work beyond these hours will result in additional expense to the Owner. Any expenses and/or damages, including the cost of the Engineer's on site personnel, arising from the Contractor's operations beyond the hours and days specified above shall be borne by the Contractor.

C. Charges assessed to the Contractor for additional engineering and inspection costs will be determined based on actual hours charged to the job by the Engineer. Daily rates will depend on the number and classifications of employees involved, but in no case shall such charges exceed $400 per day for field personnel and $600 per day for engineering personnel, based on an eight hour workday.

D. Charges for additional Owner's expenses shall be in addition to any liquidated damages assessed in accordance with the Contract.

1.07 TIME OF WORK

A. The normal time of work for this Contract is limited to 40 hours per week and shall generally be between the hours of 7:00 a.m. and 4:00 p.m., Monday through Friday. The Contractor may elect to work beyond these hours or on weekends provided that all costs incurred by the Owner for additional engineering shall be borne by the Contractor.

1. The Owner shall deduct the cost of additional engineering costs from monies due the Contractor.

B. If it shall become imperative to perform work at night, the Owner and Engineer shall be informed a reasonable time in advance of the beginning of such work. Temporary lighting and all other necessary facilities for performing and inspecting the work shall be provided and maintained by the Contractor.

C. Unless otherwise specifically permitted, all work that would be subject to damage shall be stopped during inclement, stormy or freezing weather. Only such work as will not suffer injury to workmanship or materials will be permitted. Contractor shall carefully protect his work against damage or injury from the weather, and when work is permitted during freezing weather, he shall provide and maintain approved facilities for heating the materials and for protecting the finished work.

1.08 SUBSURFACE DATA
A. Subsurface data are offered in good faith solely for placing the Bidder in receipt of all information available to the Owner and Engineer and in no event is to be considered as part of the Contract Documents.

B. The Bidder must interpret such subsurface data according to his own judgment and acknowledge that he is not relying upon the same as accurately describing the subsurface conditions, which may be found to exist.

1. The test boring logs present factual information of the subsurface conditions at the specific test boring location only. The Bidder should not consider, or conclude, that the subsurface conditions will be consistent between test boring locations.

C. The Bidder further acknowledges that he assumes all risks contingent upon the nature of the subsurface conditions to be actually encountered by him in performing the work covered by the Contract, even though such actual conditions may result in the Bidder performing more or less work than he originally anticipated.

D. The Bidder is further advised that the Owner has made prior sub-surface investigations and a report has been prepared, in connection with this project for the Engineer, a copy of which is appended to the rear of these specifications.

E. In making this data available, the Owner makes no guarantee, either expressed or implied, as to their accuracy or to the accuracy of any interpretation thereof.

1.09 SURVEYS AND LAYOUT

A. All work under this Contract shall be constructed in accordance with the lines and grades shown on the Drawings or as directed by the Engineer. Elevation of existing ground and appurtenances are believed to be reasonably correct but are not guaranteed to be absolute and therefore are presented only as an approximation. Any error or apparent discrepancy in the data shown or omissions of data required for accurately accomplishing the stake out survey shall be referred immediately to the Engineer for interpretation or correction.

B. All survey work for construction control purposes shall be made by the Contractor at his expense. The Contractor shall provide a Licensed Surveyor as Chief of Party, competently qualified men, all necessary instruments, stakes, and other material to perform the work.

C. Contractor shall establish all baselines for the location of the principal component parts of the work together with a suitable number of bench marks and batter boards adjacent to the work. Based upon the information provided by the Contract Drawings, the Contractor shall develop and make all detail surveys necessary for construction, including slope stakes, batter boards, stakes for all working points, lines and elevations.

D. Contractor shall have the responsibility to carefully preserve the bench marks, reference points and stakes, and in the case of destruction thereof by the Contractor or resulting from his negligence, the Contractor shall be charged with the expense and damage resulting therefrom and shall be responsible for any mistakes that may be caused by the unnecessary loss or disturbance of such bench marks, reference points and stakes.

E. Existing or new control points, property markers and monuments that will be or are destroyed during the normal causes of construction shall be reestablished by the Contractor and all reference ties recorded therefore shall be furnished to the Engineer.
computations necessary to establish the exact position of the work shall be made and preserved by the Contractor.

F. The Engineer may check all or any portion of the work and the Contractor shall afford all necessary assistance to the Engineer in carrying out such checks. Any necessary corrections to the work shall be immediately made by the Contractor. Such checking by the Engineer shall not relieve the Contractor of any responsibilities for the accuracy or completeness of his work.

G. At completion of the work, the Contractor shall furnish Record Drawings indicating the final layout of all structures, roads, all structures, existing bench marks, etc. The Record Drawings shall indicate all critical elevations of piping, structures, finish grades, etc.

H. Contractor shall have all weirs surveyed by a licensed land surveyor and adjusted to match specified elevations as shown on the Contract Drawings. Weirs shall be surveyed at no more than ten (10) feet spacing, but no less than 2 points shall be surveyed on each section of weir plate. Final elevations shall be set to within a tolerance of +/- 0.05 inches of specified elevation. If a greater tolerance is allowed, it will be noted on the Contract Drawings. A final report showing all specified and surveyed elevations shall be certified by the surveyor and delivered to the Engineer.

1.11 FIRE PROTECTION

A. Contractor shall take all necessary precautions to prevent fires at or adjacent to the work, buildings, etc., and shall provide adequate facilities for extinguishing fires which do occur. Burning, if permitted in Division 2, shall be limited to areas approved by the Engineer and Owner and properly controlled by the Contractor.

B. When fire or explosion hazards are created in the vicinity of the work as a result of the locations of fuel tanks, or similar hazardous utilities or devices, the Contractor shall immediately alert the local Fire Marshal, the Engineer, and the Owner of such tank or device. The Contractor shall exercise all safety precautions and shall comply with all instructions issued by the Fire Marshal and shall cooperate with the Owner of the tank or device to prevent the occurrence of fire or explosion.

1.12 CHEMICALS

A. All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, or reactant of other classification, must show approval of either the EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with all applicable rules and regulations.

1.13 FIRST AID FACILITIES AND ACCIDENTS

A. First Aid Facilities

1. The Contractor shall provide at the site such equipment and facilities as are necessary to supply first aid to any of his personnel who may be injured in connection with the work.

B. Accidents
1. The Contractor shall promptly report, in writing, to the Engineer and Owner all accidents whatsoever out of, or in connection with, the performance of the work, whether on or adjacent to the site, which cause death, personal injury or property damage, giving full details and statements of witnesses.

2. If death, serious injuries, or serious damages are caused, the accident shall be reported immediately by telephone or messenger to both the Owner and the Engineer.

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

1.14 ULTIMATE DISPOSITION OF CLAIMS BY ONE CONTRACTOR ARISING FROM ALLEGED DAMAGE BY ANOTHER CONTRACTOR

A. During the progress of the work, other Contractors may be engaged in performing other work or may be awarded other Contracts for additional work on this project. In that event, the Contractor shall coordinate the work to be done hereunder with the work of such other Contractors and the Contractor shall fully cooperate with such other Contractors and carefully fit its own work to that provided under other Contracts as may be directed by the Engineer. The Contractor shall not commit or permit any act which will interfere with the performance of work by any other Contractor.

B. If the Engineer shall determine that the Contractor is failing to coordinate his work with the work of the other Contractors as the Engineer directed, then the Owner shall have the right to withhold any payments otherwise due hereunder until the Contractor completely complies with the Engineer’s directions.

C. If the Contractor notifies the Engineer in writing that another Contractor is failing to coordinate his work with the work of this Contract as directed, the Engineer will promptly investigate the charge. If the Engineer finds it to be true, he will promptly issue such directions to the other Contractor with respect thereto as the situation may require. The Owner, the Engineer, nor any of their agents shall not, however, be liable for any damages suffered by the Contractor by reason of the Contractor’s failure to promptly comply with the directions so issued by the Engineer, or by reason of another Contractor’s default in performance, it being understood that the Owner does not guarantee the responsibility or continued efficiency of any Contractor.

D. The Contractor shall indemnify and hold the Owner and the Engineer harmless from any and all claims of judgments for damages and from costs and expenses to which the Owner may be subjected or which it may suffer or incur by reason of the Contractor’s failure to comply with the Engineer’s directions promptly.

E. Should the Contractor sustain any damage through any act or omission of any other Contractor having a Contract with the Owner for the performance of work upon the site or of work which may be necessary to be performed for the proper execution of the work to be performed hereunder, or through any act or omission of a Subcontractor of such Contract, the Contractor shall have no claim against the Owner or the Engineer for such damage, but shall have a right to recover such damage from the other Contractor under the provision
similar to the following provisions which have been or will be inserted in the Contracts with such other Contractors.

F. Should any other Contractor having or who shall hereafter have a Contract with the Owner for the performance of work upon the site sustain any damage through any act or omission of the Contractor hereunder or through any act or omission of any Subcontractor of the Contractor, the Contractor agrees to reimburse such other Contractor for all such damages and to defend at his own expense any suit based upon such claim and if any judgment or claims against the Owner shall be allowed, the Contractor shall pay or satisfy such judgment or claim and pay all costs and expenses in connection therewith and shall indemnify and hold the Owner harmless from all such claims.

G. The Owner's right to indemnification hereunder shall in no way be diminished, waived or discharged, by its recourse to assessment of liquidated damages as provided in the Contract, or by the exercise of any other remedy provided for by Contract Documents or by law.

1.15 BLASTING AND EXPLOSIVES

A. THE USE OF BLASTING OR EXPLOSIVES SHALL NOT BE ALLOWED UNDER THIS PROJECT.

1.16 LIMITS OF WORK AREA

A. The Contractor shall confine his construction operations within the Contract limits shown on the Drawings and/or property lines and/or fence lines. Storage of equipment and materials, or erection and use of sheds outside of the Contract limits, if such areas are the property of the Owner, shall be used only with the Owner's approval. Such storage or temporary structures, even within the Contract's limits, shall be confined to the Owner's property and shall not be placed on properties designated as easements or rights-of-way unless specifically permitted elsewhere in the Contract Documents.

1.17 WEATHER CONDITIONS

A. No work shall be done when the weather is unsuitable. The Contractor shall take necessary precautions (in the event of impending storms) to protect all work, materials, or equipment from damage or deterioration due to floods, driving rain, or wind, and snow storms. The Owner reserves the right, through the opinion of the Engineer, to order that additional protection measures over and beyond those proposed by the Contractor, be taken to safeguard all components of the Project. The Contractor shall not claim any compensation for such precautionary measures so ordered, nor claim any compensation from the Owner for damage to the work from weather elements.

B. The mixing and placing of concrete or pavement courses, the laying of masonry, and installation of sewers and water mains shall be stopped during rainstorms, if ordered by the Engineer; and all freshly placed work shall be protected by canvas or other suitable covering in such manner as to prevent running water from coming in contact with it. Sufficient coverings shall be provided and kept ready at hand for this purpose. The limitations and requirements for mixing and placing concrete, or laying of masonry, in cold weather shall be as described elsewhere in these Specifications.
1.18 PERIODIC CLEANUP: BASIC SITE RESTORATION

A. During construction, the Contractor shall regularly remove from the site of the work all accumulated debris and surplus materials of any kind which result from his operations. Unused equipment and tools shall be stored at the Contractor's yard or base of operations for the Project.

B. When the work involves installation of sewers, drains, water mains, manholes, underground structures, or other disturbance of existing features in or across streets, rights-of-way, easements, or private property, the Contractor shall (as the work progresses) promptly backfill, compact, grade, and otherwise restore the disturbed area to the basic condition which will permit resumption of pedestrian or vehicular traffic and any other critical activity or functions consistent with the original use of the land. The requirements for temporary paving of streets, walks, and driveways are specified elsewhere. Unsightly mounds of earth, large stones, boulders, and debris shall be removed so that the site presents a neat appearance.

C. The Contractor shall perform the cleanup work on a regular basis and as frequently as ordered by the Engineer. Basic site restoration in a particular area shall be accomplished immediately following the installation or completion of the required facilities in that area. Furthermore, such work shall also be accomplished, when ordered by the Engineer, if partially completed facilities must remain incomplete for some time period due to unforeseen circumstances.

D. Upon failure of the Contractor to perform periodic cleanup and basic restoration of the site to the Engineer's satisfaction, the Owner may, upon five (5) days prior written notice to the Contractor, without prejudice to any other rights or remedies of the Owner, cause such work for which the Contractor is responsible to be accomplished to the extent deemed necessary by the Engineer, and all costs resulting therefrom shall be charged to the Contractor and deducted from the amounts of money that may be due him.

1.19 USE OF FACILITIES BEFORE COMPLETION

A. The Owner reserves the right to enter and use any portion of the constructed facilities before final completion of the whole work to be done under this Contract. However, only those portions of the facilities which have been completed to the Engineer's satisfaction, as evidenced by his issuing a Certificate of Substantial Completion covering that part of the work, shall be placed in service.

B. It shall be the Owner's responsibility to prevent premature connections to or use of any portion of the installed facilities by private or public parties, persons or groups of persons, before the Engineer issues his Certificate of Substantial Completion covering that portion of the work to be placed in service.

C. Consistent with the approved progress schedule, the Contractor shall cooperate with the Owner, his agents, and the Engineer to accelerate completion of those facilities, or portions thereof, which have been designated for early use by the Owner.

1.20 CONSTRUCTION VIDEO

A. The Contractor shall video the entire project site including all concrete and asphalt pavements, curb and gutter, fencing to remain, structures to be demolished, and existing
structures that are to be modified. The original video image shall be turned over to the Engineer prior to beginning construction activities. The video shall be provided as an Audio Video Interleave File (.avi) and shall be provided on DVD+R/DVD-ROM compatible media only. The video shall clearly identify existing site and structural conditions prior to construction.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

- END OF SECTION -
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Schedule of Values.
B. Application for Payment.
C. Change procedures.
D. Defect assessment.
E. Unit prices.
F. Description of Bid Items

1.02 SCHEDULE OF VALUES

A. Contractor shall develop a Schedule of Values (lump sum price breakdown) as specified in the Standard Specifications for Public Works Construction and incorporate into the cost loading function of the CPM schedule.

B. Construction Manager and Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Construction Manager will review with Contractor, Construction Manager’s preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Construction Manager’s written decision thereon will be final and binding (except as modified by Construction Manager to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of Article 15 of the General Conditions.

C. 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.

D. The estimated quantities 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 Construction Manager subject to the provisions of Article 15 of the General Conditions.

E. 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.

F. Owner and Contractor may make a Claim for an adjustment in the Contract Price in accordance with Article 11 of the General Conditions if:

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;
2. There is no corresponding adjustment with respect to any other item of Work; and

3. Contractor believes it is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price and the parties are unable to agree as the amount of any such increase or decrease.

1.03 APPLICATION FOR PAYMENT

A. Base Applications for Payment on the Schedule of Values described above, and submit to Owner in accordance the General Conditions.

B. Submit one copy of each Application for Payment each calendar month, as indicated in Article 15 of the General Conditions.

C. Submit an updated construction schedule with each Application for Payment.

1.04 CHANGE PROCEDURES (See Article 11 of the General Conditions)

1.05 DEFECT ASSESSMENT

A. Replace the Work, or portions of the Work, not conforming to specified requirements.

B. If, in the opinion of Owner’s Site Representative, it is not practical to remove and replace the Work, Owner’s Site Representative will direct appropriate remedy or adjust payment.

C. When allowed by Owner, the defective Work may remain, but the unit price will be reduced 50 percent.

D. When allowed by Owner, Defective Work may be partially repaired according to instructions from Owner’s Site Representative, and unit sum/price of the portion of Work assessed as defective will be reduced 50 percent.

E. Individual Specification Sections may modify these options or may identify specific formula or percentage price reduction.

F. Authority of Owner’s Site Representative to assess defects and identify payment adjustments is final.

G. Nonpayment for Rejected Products: Payment will not be made for rejected products for any of the following reasons:
   1. Products wasted or disposed of in a manner that is not in accordance with the Contract Documents.
   2. Products determined as unacceptable before or after placement.
   3. Products not completely unloaded from transporting vehicle.
   4. Products placed beyond lines and levels of the required Work.
   5. Products remaining on hand after completion of the Work.
1.06 UNIT PRICES

A. Authority: Measurement methods are delineated in individual Specification Sections and the Description of Bid Items in this section.

B. Measurement methods delineated in individual Specification Sections complement criteria of this Section. In event of conflict, requirements of this section govern.

C. Take measurements and compute quantities. Owner’s Site Representative will verify measurements and quantities.

D. Unit Quantities: Quantities and measurements indicated on Bid Form are for Contract purposes only. Actual approved quantities provided shall determine payment.
   1. When actual Work requires more or fewer quantities than those quantities indicated, provide required quantities at contracted unit sum/prices.
   2. When actual Work requires 25% or greater change in quantity than those quantities indicated, Owner or Contractor may claim a Contract Price adjustment.

E. Payment Includes: Full compensation for required labor, products, tools, equipment, plant and facilities, transportation, services and incidentals; erection, application, or installation of item of the Work; overhead and profit.

F. Final payment for Work governed by unit prices will be made on the basis of actual measurements and quantities accepted by Engineer multiplied by unit price for Work incorporated in accordance with the Contract Documents.

G. Measurement of Quantities:
   1. Weigh Scales: Inspected, tested, and certified by applicable State weights and measures department within past year.
   2. Platform Scales: Of sufficient size and capacity to accommodate conveying vehicle.
   3. Metering Devices: Inspected, tested, and certified by applicable State department within past year.
   4. Measurement by Volume: Measured by cubic dimension using mean length, width, and height or thickness.
   5. Measurement by Area: Measured by square dimension using mean length and width or radius.
   7. Stipulated Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as completed item or unit of the Work.
1.07 DESCRIPTION OF BID ITEMS

A. See Section 01025 for Payment Items

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

++END OF SECTION++
SECTION 01301
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Web-Based Document Control System, EADOC
B. Progress meetings

1.02 WEB-BASED DOCUMENT CONTROL SYSTEM, EADOC
A. Contractor shall use the Owner’s web-based document control system, EADOC, to submit and receive all construction related documentation related to this project. Costs associated for the use of the software have been paid for by the OWNER. The website address, login and passwords to be used will be provided by the Construction Manager after award of the contract.

B. Owners Site Representative will provide training to Contractor for use of the EADOC system. The information to be generated, transmitted and tracked by the document control system shall include, but not be limited to the following:
   1. Correspondence
   2. Meeting Agendas and Meeting Minutes
   3. Applications for Payment
   4. Shop Drawings.
   5. Request for Information (RFI’s).
   6. Field Orders
   7. Work Change Directives
   8. Change Proposals
   9. Change Orders
   11. Project Schedules.

1.03 PROGRESS MEETINGS
A. Contractor’s Site Superintendent shall attend weekly coordination meetings with Owner’s Representatives throughout progress of the Work.

B. Owner’s Site Representative will arrange meetings, prepare agenda facilitate the meetings, and prepare and distribute meeting minutes.

C. Attendance Required: Contractor’s Site Superintendent, major subcontractors and suppliers, as appropriate to agenda topics for each meeting.

D. Sample Agenda:
   1. Review minutes of previous meetings
2. Review of Work progress
3. Field observations, problems, and decisions
4. Identification of problems which impede planned progress
5. Review of submittals schedule and status of submittals
6. Review of off-site fabrication and delivery schedules
7. Maintenance of progress schedule
8. Corrective measures to regain projected schedules
9. Planned progress during succeeding work period
10. Coordination of projected progress
11. Maintenance of quality and work standards
12. Effect of proposed changes on progress schedule and coordination
13. Other business relating to Work

PART 2  PRODUCTS – Not Used

PART 3  EXECUTION – Not Used

++END OF SECTION+
SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 -- GENERAL

1.01 THE REQUIREMENT

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

1.02 PAYMENT ITEMS

A. Mobilization, Demobilization and Clean-up (Bid Item No. 1)

Mobilization, Demobilization and Clean-up bid item shall not exceed 5% of the total price of the Contractor's Bid. Work under this item shall include preparatory and clean up operations including, but not limited to, those necessary for the movement of personnel, equipment, materials and incidentals to and from the project site, securing a temporary construction yard, providing a temporary field office facility, dust control and maintaining the site in a safe and orderly manner during construction.

This item also includes the costs incurred for securing bonds, insurance, financing, permits and licenses. The work under this item shall also include final project close-out and cleanup operations, including, but not limited to, the work necessary for the removal of equipment, supplies, incidentals and debris, cleaning the site of all soils and construction debris, correction of minor deficiencies in the work and for all other work required by the District

B. Demolition Site Work (Bid Item No. 2)

The Contract Lump Sum price for the demolition site work shall include furnishing all labor, material and equipment for removal and disposal of equipment, material and pavements as described on the Contract Drawings and within the Contract Documents, complete and operable and no additional compensation will be allowed therefore.
C. Calcium Chloride Bulk Storage System (Bid Item No. 3)

The Contract Lump Sum price for the Calcium Chloride Bulk Storage System shall include furnishing all labor, material and equipment for installing the concrete containment area, metal canopy, piping, valves and bulk storage tank, pipe testing and disinfection, and all other incidental items as specified in the Contract Drawings and Contract Documents, complete and operable, and no additional compensation will be allowed therefore.

D. Electrical and Instrumentation Work (Bid Item No.4)

The Contract Lump Sum Price for Electrical Work shall include furnishing all labor, materials and equipment for installing the electrical work and instrumentation required for a complete and operable system as specified in the construction drawings and Contract Documents, and no additional compensation will be allowed therefore.

E. Startup Testing, Training, Miscellaneous Items (Bid Item No.5)

The Contract Lump Sum price for the Startup Testing, Training, Misc. Items shall include furnishing all labor, material and equipment for a start-up all of equipment, training of O&M staff on all equipment, testing all equipment both individually and as a system, and all other incidental items as specified in the construction plans and Contract Documents, complete and operable, and no additional compensation will be allowed therefore.

1.03 PAYMENT

A. Refer to the Water Replenishment District of Southern California (WRD) General Conditions documentation for conditions and details of payment.

- END OF SECTION -
SECTION 01070

ABBREVIATIONS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The following is a partial list of typical abbreviations which may be used in the Specifications, and the organizations to which they refer:

- AASHTO - American Association of State Highway and Transportation Officials
- ACI - American Concrete Institute
- ACIFS - American Cast Iron Flange Standards
- AFBMA - Anti-Friction Bearing Manufacturer's Association
- AGA - American Gas Association
- AGMA - American Gear Manufacturers Association
- AIA - American Institute of Architects
- AISC - American Institute of Steel Construction
- AISI - American Iron and Steel Institute
- ANSI - American National Standard Institute
- API - American Petroleum Institute
- ASCE - American Society of Civil Engineers
- ASHRAE - American Society of Heating, Refrigeration, and Air Conditioning Engineers
- ASME - American Society of Mechanical Engineers
- ASTM - American Society for Testing and Materials
- AWS - American Welding Society
- AWWA - American Water Works Association
- CEMA - Conveyor Equipment Manufacturer's Association
- CRSI - Concrete Reinforcing Steel Institute
- DIPRA - Ductile Iron Pipe Research Association
- Fed Spec - Federal Specifications
- IEEE - Institute of Electrical and Electronic Engineers
- IPCEA - Insulated Power Cable Engineers Association
- ISO - Insurance Services Offices
- LVL - Leo J Vander Lans
- NBS - National Bureau of Standards
- NEC - National Electric Code
- NEMA - National Electrical Manufacturers Association
- OSHA - Occupational Safety and Health Act
- PCI - Precast Concrete Institute
- UL - Underwriters Laboratories, Inc.
- USGS - United States Geological Survey
- WRD - Water Replenishment District of Southern California

PART 2 -- PRODUCTS

(NOT USED)
PART 3 -- EXECUTION

(NOT USED)

- END OF SECTION -
SECTION 01090

REFERENCE STANDARDS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Wherever reference is made to any published standards, codes, or standard specifications, it shall mean the latest standard code, specification, or tentative specification of the technical society, organization, or body referred to, which is in effect at the date of invitation for Bids.

B. All materials, products, and procedures used or incorporated in the work shall be in strict conformance with applicable codes, regulations, specifications, and standards.

C. A partial listing of codes, regulations, specifications, and standards includes the following:

- Air Conditioning and Refrigeration Institute (ARI)
- Air Diffusion Council (ADC)
- Air Moving and Conditioning Association (AMCA)
- The Aluminum Association (AA)
- American Architectural Manufacturers Association (AAMA)
- American Concrete Institute (ACI)
- American Gear Manufacturers Association (AGMA)
- American Hot Dip Galvanizers Association (AHDGA)
- American Institute of Steel Construction, Inc. (AISC)
- American Iron and Steel Institute (AISI)
- American National Standards Institute (ANSI)
- American Society of Civil Engineers (ASCE)
- American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)
- American Society of Mechanical Engineers (ASME)
- American Society for Testing and Materials (ASTM)
- American Standards Association (ASA)
- American Water Works Association (AWWA)
American Welding Society (AWS)
American Wood-Preserver's Association (AWPA)
Anti-Friction Bearing Manufacturers Association (AFBMA)
Building Officials and Code Administrators (BOCA)
Conveyor Equipment Manufacturers Association (CEMA)
Consumer Product Safety Commission (CPSC)
Factory Mutual (FM)
Federal Specifications
Instrument Society of America (ISA)
Institute of Electrical and Electronics Engineers (IEEE)
National and Local Fire Codes
Lightning Protection Institute (LPI)
National Electrical Code (NEC)
National Electrical Manufacturer's Association (NEMA)
National Electrical Safety Code (NESC)
National Electrical Testing Association (NETA)
National Fire Protection Association (NFPA)
Regulations and Standards of the Occupational Safety and Health Act (OSHA)
Southern Building Code Congress International, Inc. (SBCCI)
Sheet Metal & Air Conditioning Contractors National Association (SMACNA)
Standard Building Code
Standard Mechanical Code
Standard Plumbing Code
Uniform Building Code (UBC)
Underwriters Laboratories Inc. (UL)
D. Contractor shall, when required, furnish evidence satisfactory to the Engineer that materials and methods are in accordance with such standards where so specified.

E. In the event any questions arise as to the application of these standards or codes, copies shall be supplied on-site by the Contractor.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

- END OF SECTION -
SECTION 01200

PROJECT MEETINGS

PART 1 -- GENERAL

1.01 PRE-BID MEETING

A. A pre-bid meeting will be held at the time and place to be designated in the Instructions to Bidders.

B. The Engineer will be available to discuss the project and answer pertinent questions. No oral interpretation will be made as to the meaning of the Documents. Interpretation, if deemed necessary by the Engineer, will be in the form of an Addendum to the Contract Documents.

1.02 PRECONSTRUCTION MEETING

A. A preconstruction meeting will be held after Award of Contract, but prior to starting work at the site.

B. Attendance:

1. Owner
2. Engineer
3. Contractor
4. Major subcontractors
5. Safety representative
6. Representatives of governmental or other regulatory agencies.

C. Minimum Agenda:

1. Tentative construction schedule
2. Critical work sequencing
3. Designation of responsible personnel
4. Processing of Field Decisions and Change Orders
5. Adequacy of distribution of Contract Documents
6. Submittal of Shop Drawings and samples
7. Procedures for maintaining record documents
8. Use of site and Owner's requirements
9. Major equipment deliveries and priorities
10. Safety and first aid procedures
11. Security procedures
12. Housekeeping procedures
13. Processing of Partial Payment Requests
14. General regard for community relations

1.03 PROGRESS MEETING

A. Progress meetings will be held monthly at the Project Site during the performance of the work of this Contract. Additional meetings may be called as progress of work dictates.

B. Engineer will preside at meetings and record minutes of proceedings and decisions. Engineer will distribute copies of minutes to participants.

C. Attendance:
   1. Engineer
   2. Contractor
   3. Subcontractors, only with Engineer's approval or request, as pertinent to the agenda

D. Minimum Agenda:
   1. Review and approve minutes of previous meetings.
   2. Review progress of Work since last meeting.
   3. Review proposed construction schedule.
   4. Note and identify problems which impede planned progress.
   5. Develop corrective measures and procedures to regain planned schedule.
   6. Revise construction schedule as indicated and plan progress during next work period.
   7. Maintaining of quality and work standards.
   8. Complete other current business.
   9. Schedule next progress meeting.
PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

- END OF SECTION -
PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Progress Schedule

1. Within thirty (30) days after issuance of the Notice to Proceed, the Contractor shall prepare and submit five (5) copies of his proposed progress schedule to the Engineer for review and approval.

2. If so required, the schedule shall be revised until it is approved by the Engineer.

3. Schedule shall be updated monthly, depicting progress to the last day of the month and five (5) copies submitted to the Engineer not later than the fifth day of the month, and prior to the application for progress payment. Failure to provide monthly schedule updates will be grounds for the Engineer or Owner to withhold progress payment approval.

4. Schedule shall be prepared in the form of a horizontal bar chart showing in detail the proposed sequence of the work and identifying construction activities for each structure and for each portion of work.

5. Schedule shall be time scaled, identifying the first day of each week. The Schedule shall be provided with estimated dates for Early Start, Early Finish, Late Start and Late Finish. The work shall be scheduled to complete the Project within the Contract time. The Late Finish date shall equal the Contract Completion Date.

6. Schedule shall show duration (number of days) and float for each activity. Float shall be defined as the measure of leeway in starting or completing a scheduled activity without adversely affecting the project completion date established by the Contract Documents.

7. Updated schedule shall show all changes since the previous submittal.

8. All revisions to the schedule must have the prior approval of the Engineer.

B. Equipment and Material Orders Schedule

1. Contractor shall prepare and submit five (5) copies of his schedule of principal items of equipment and materials to be purchased to the Engineer for review and approval.

2. If so required, the schedule shall be revised until it is approved by the Engineer.

3. Schedule shall be updated monthly and five (5) copies submitted to the Engineer not later than the fifth day of every month with the application for progress payment.
4. The updated schedule shall be based on the Progress Schedule developed under the requirements of Paragraph 1.01(A) of this Section.

5. Schedule shall be in tabular form with appropriate spaces to insert the following information for principal items of equipment and materials:
   a. Dates on which Shop Drawings are requested and received from the manufacturer.
   b. Dates on which certification is received from the manufacturer and transmitted to the Engineer.
   c. Dates on which Shop Drawings are submitted to the Engineer and returned by the Engineer for revision.
   d. Dates on which Shop Drawings are revised by manufacturer and resubmitted to the Engineer.
   e. Date on which Shop Drawings are returned by Engineer annotated either "Furnish as Submitted" or "Furnish as Corrected".
   f. Date on which accepted Shop Drawings are transmitted to manufacturer.
   g. Date of manufacturer's scheduled delivery.
   h. Date on which delivery is actually made.

C. Working Drawings

1. Within thirty (30) days after the Notice to Proceed, each prime Contractor shall prepare and submit five (5) copies of his preliminary schedule of Working Drawing submittals to the Engineer for review and approval. If so required, the schedule shall be revised until it is approved by the Engineer.

2. Working Drawings include, but are not limited to, Shop Drawings, layout drawings in plan and elevation, installation drawings, elementary wiring diagrams, interconnecting wiring diagrams, manufacturer's data, etc. Contractor shall be responsible for securing all of the information, details, dimensions, Drawings, etc., necessary to prepare the Working Drawings required and necessary under this Contract and to fulfill all other requirements of his Contract. Contractor shall secure such information, details, Drawings, etc., from all possible sources including the Drawings, Working Drawings prepared by subcontractors, Engineers, suppliers, etc.

3. Working Drawings shall accurately and clearly present the following:
   a. All working and installation dimensions.
   b. Arrangement and sectional views.
   c. Units of equipment in the proposed positions for installation, details of required attachments and connections, and dimensioned locations between units and in relation to the structures.
d. Necessary details and information for making connections between the various trades including, but not limited to, power supplies and interconnecting wiring between units, accessories, appurtenances, etc.

4. In the event that the Engineer is required to provide additional engineering services as a result of a substitution of materials or equipment by the Contractor, the additional services will be provided in accordance with Section 01010 - Summary of Work, and will be covered in supplementary or revised Drawings which will be issued to the Contractor. All changes indicated that are necessary to accommodate the equipment and appurtenances shall be incorporated into the Working Drawings submitted to the Engineer.

5. Working Drawings specifically prepared for this Project shall be on mylar or other approved reproducible material sheets of the same size as the Drawings. Working Drawings shall conform to recognized drafting standards and be neat, legible and drawn to a large enough scale to show in detail the required information.

6. The Drawings are used for engineering and general arrangement purposes only and are not to be used for Working Drawings.

7. Shop Drawings
   a. Contractor shall submit for review by the Engineer Shop Drawings for all fabricated work and for all manufactured items required to be furnished by the Contract Documents.
   b. Structural and all other layout Drawings prepared specifically for the Project shall have a plan scale of not less than 1/4-inch = 1 foot.
   c. Where manufacturer's publications in the form of catalogs, brochures, illustrations or other data sheets are submitted in lieu of prepared Shop Drawings, such submittals shall specifically indicate the item for which approval is requested. Identification of items shall be made in ink, and submittals showing only general information are not acceptable.

8. Layout and Installation Drawings
   a. Contractor shall prepare and submit for review by the Engineer layout and installation drawings for all pipes, valves, fittings, sewers, drains, heating and ventilation ducts, all electrical, heating, ventilating and other conduits, plumbing lines, electrical cable trays, lighting fixture layouts, and circuiting, instrumentation, interconnection wiring diagrams, communications, power supply, alarm circuits, etc., under this Contract. The final dimensions, elevation, location, etc., of pipe, valves, fittings, sewers, ducts, conduits, electrical cable trays, equipment, etc., may depend upon the dimensions of equipment and valves to be furnished by the Contractor.
   b. Layout and installation drawings are required for both interior and exterior piping, valves, fittings, sewers, drains, heating and ventilation ducts, conduits, plumbing lines, electrical cable trays, etc.
c. Layout and installation Drawings shall show connections to structures, equipment, sleeves, valves, fittings, etc.

d. Drawings shall show the location and type of all supports, hangers, foundations, etc., and the required clearances to operate valves, equipment, etc.

e. The Drawings for pipes, ducts, conduits, etc., shall show all 3-inch and larger electrical conduits and pressure piping, electrical cable trays, heating and ventilation ducts or pipes, structure, manholes or any other feature within four (4) feet (measured as the clear dimension) from the pipe duct, conduit, etc., for which the profile is drawn.

9. Contractor Responsibilities

a. All submittals from subcontractors, manufacturers or suppliers shall be sent directly to the Contractor for checking. Contractor shall thoroughly check all Drawings for accuracy and conformance to the intent of the Contract Documents. Drawings found to be inaccurate or otherwise in error shall be returned to the subcontractors, manufacturers, or suppliers by the Contractor for correction before submitting them to the Engineer.

b. All submittals shall be bound, dated, properly labeled and consecutively numbered. Information on the label shall indicate Specification Section, Drawing number, subcontractor’s, manufacturer’s or supplier’s name and the name or type of item the submittal covers. Each part of a submittal shall be marked and tabulated.

c. Working Drawings shall be submitted as a single complete package including all associated drawings relating to a complete assembly of the various parts necessary for a complete unit or system.

d. Shop Drawings shall be submitted as a single complete package for any operating system and shall include all items of equipment and any mechanical units involved or necessary for the functioning of such system. Where applicable, the submittal shall include elementary wiring diagrams showing circuit functioning and necessary interconnection wiring diagrams for construction.

e. ALL SUBMITTALS SHALL BE THOROUGHLY CHECKED BY THE CONTRACTOR FOR ACCURACY AND CONFORMANCE TO THE INTENT OF THE CONTRACT DOCUMENTS BEFORE BEING SUBMITTED TO THE ENGINEER AND SHALL BEAR THE CONTRACTOR’S STAMP OF APPROVAL CERTIFYING THAT THEY HAVE BEEN SO CHECKED. SUBMITTALS WITHOUT THE CONTRACTOR’S STAMP OF APPROVAL WILL NOT BE REVIEWED BY THE ENGINEER AND WILL BE RETURNED TO THE CONTRACTOR.

f. If the submittals contain any departures from the Contract Documents, specific mention thereof shall be made in the Contractor’s letter of transmittal. Otherwise, the review of such submittals shall not constitute approval of the departure.
g. No materials or equipment shall be ordered, fabricated, shipped or any work performed until the Engineer returns to the Contractor the submittals, herein required, annotated "Furnish as Submitted", "Furnish as Corrected", or "Furnish as Corrected – Confirm." If a submittal is returned "Furnish as Corrected – Confirm" the portions of work covered by the submittal that require confirmation by the Engineer shall not be ordered, fabricated, shipped, or any work performed until those portions are approved in a subsequent submittal either "Furnish as Submitted" or "Furnish as Corrected".

h. Where errors, deviations, and/or omissions are discovered at a later date in any of the submittals, the Engineer's prior review of the submittals does not relieve the Contractor of the responsibility for correcting all errors, deviations, and/or omissions.

10. Procedure for Review

a. Submittals shall be transmitted in sufficient time to allow the Engineer at least thirty (30) working days for review and processing.

b. Contractor shall transmit three (3) copies of all technical data or drawing to be reviewed.

c. Submittal shall be accompanied by a letter of transmittal containing date, project title, Contractor's name, number and titles of submittals, a list of relevant specification sections, notification of departures from any Contract requirement, and any other pertinent data to facilitate review.

d. Submittals will be annotated by the Engineer in one of the following ways:

   "Furnish as Submitted" (FAS) - no exceptions are taken

   "Furnish as Corrected" (FAC) - minor corrections are noted and shall be made.

   "Furnish as Corrected – Confirm" (FACC) - some corrections are noted and a partial resubmittal or additional information are required as specifically requested.

   "Revise and Resubmit" (R&R) - major corrections are noted and a full resubmittal is required.

   "For Information Only – Not Reviewed" (FIO) – submittal was received and was distributed for record purposes without review.

e. If a submittal is satisfactory to the Engineer in full or in part, the Engineer will annotate the submittal "Furnish as Submitted", "Furnish as Corrected", or "Furnish as Corrected – Confirm", retain four (4) copies and return remaining copies to the Contractor. If reproducible transparencies are submitted, the Engineer will retain the copies and return the reproducible transparencies to the Contractor. In the case of "Furnish as Corrected – Confirm" a partial resubmittal or additional information are required as specifically requested.
f. If a full resubmittal is required, the Engineer will annotate the submittal "Revise and Resubmit" and transmit three (3) copies to the Contractor for appropriate action. If reproducible transparencies are submitted, the Engineer will retain the copies and return the reproducible transparencies to the Contractor.

g. Contractor shall continue to resubmit submittals in part if they are returned “Furnish as Corrected – Confirm” or in full if they are returned “Revise and Resubmit” as required by the Engineer until submittals are acceptable to the Engineer. It is understood by the Contractor that Owner may charge the Contractor the Engineer's charges for review in the event a submittal is not approved (either "Furnish as Submitted" or "Furnish as Corrected") by the third submittal for a system or piece of equipment. These charges shall be for all costs associated with engineering review, meetings with the Contractor or manufacturer, etc., commencing with the fourth submittal of a system or type of equipment submitted for a particular Specification Section.

h. Acceptance of a Working Drawing by the Engineer will constitute acceptance of the subject matter for which the Drawing was submitted and not for any other structure, material, equipment or appurtenances indicated or shown.

11. Engineer's Review
   a. Engineer's review of the Contractor's submittals shall in no way relieve the Contractor of any of his responsibilities under the Contract. An acceptance of a submittal shall be interpreted to mean that the Engineer has no specific objections to the submitted material, subject to conformance with the Contract Drawings and Specifications.

   b. Engineer's review will be confined to general arrangement and compliance with the Contract Drawings and Specifications only, and will not be for the purpose of checking dimensions, weights, clearances, fittings, tolerances, interferences, coordination of trades, etc.

12. Record Working Drawings
   a. Contractor shall maintain current record drawings onsite for the Engineer's review. Record drawings shall be updated monthly at a minimum.

   b. Prior to final payment, the Contractor shall furnish the Engineer one complete set of all accepted Working Drawings, including Shop Drawings, for equipment, piping, electrical work, heating system, ventilating system, air conditioning system, instrumentation system, plumbing system, structural, interconnection wiring diagrams, etc.

   c. Working Drawings furnished shall be corrected to include any departures from previously accepted Drawings.
D. Operation and Maintenance Manuals

1. One (1) preliminary copies of Operation and Maintenance Manuals, prepared specifically for this Project, shall be furnished for each item of equipment furnished under this Contract. The preliminary manuals shall be provided to the Engineer not less than 60 days prior to the start-up of the respective equipment.

2. The preliminary manuals shall be reviewed by the Engineer prior to the Contractor submitting final copies for distribution to the Owner. Following review of the preliminary copies of the Operation and Maintenance Manuals, one (1) copy will be returned to the Contractor with required revisions noted, or the acceptance of the Engineer noted.

3. Manuals shall contain complete information in connection with assembly, operation, lubrication, adjustment, wiring diagrams and schematics, maintenance, and repair, including detailed parts lists with drawings or photographs identifying the parts.

4. Manuals furnished shall be assembled and bound in separate volumes, by major equipment items or trades, and properly indexed to facilitate locating any required information. In addition, manuals should be labeled in the front cover with the project, name, equipment description, and manufacturer contact information.

5. Engineer and the Owner shall be the sole judge of the acceptability and completeness of the manuals and may reject any submittal for insufficient information included, incorrect references and/or the manner in which the material is assembled.

6. Following the Engineer’s review of the preliminary manuals, the Contractor shall submit three (3) paper copies and one (1) electronic copy of the final Operation and Maintenance Manuals to the Engineer. The manuals shall reflect the required revisions noted during the Engineer’s review of the preliminary documents. Failure of the final manuals to reflect the required revisions noted by the Engineer during a review of the Preliminary documents will result in the manuals being returned to the Contractor. Acceptable final Operation and Maintenance Manuals shall be provided not less than two week prior to equipment start-up.

E. Certified Shop Test Reports

1. Each piece of equipment for which pressure, head, capacity, rating, efficiency, performance, function or special requirements are specified or implied shall be tested in the shop of the manufacturer in a manner which shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents and applicable test codes and standards. Contractor shall keep the Engineer advised of the scheduling of shop tests so that the Engineer may arrange for the witnessing or inspection at the proper time and place.

2. The Contractor shall secure from the manufacturers three (3) copies of the actual test data, the interpreted results and a complete description of the testing facilities and testing setup, all accompanied by a certificate of authenticity sworn to by a responsible official of the manufacturing company and notarized. These reports shall be forwarded to the Engineer for review.
3. In the event any equipment fails to meet the test requirements, the manufacturer shall make all necessary changes, adjustments or replacements and the tests shall be repeated, at no additional cost to the Owner or Engineer, until the equipment test requirements are acceptable to the Engineer.

4. No equipment shall be shipped to the Project until the Engineer notifies the Contractor, in writing, that the shop test reports are acceptable.

F. Samples

1. Contractor shall furnish for review all samples as required by the Contract Documents or requested by the Engineer.

2. Samples shall be of sufficient size or quantity to clearly illustrate the quality, type, range of color, finish or texture and shall be properly labeled to show the nature of the material, trade name of manufacturer and location of the work where the material represented by the sample will be used.

3. Samples shall be checked by the Contractor for conformance to the Contract Documents before being submitted to the Engineer and shall bear the Contractor's stamp of approval certifying that they have been so checked. Transportation charges on samples submitted to the Engineer shall be prepaid by the Contractor.

4. Engineer's review will be for compliance with the Contract Documents and his comments will be transmitted to the Contractor with reasonable promptness.

5. Accepted samples will establish the standards by which the completed work will be judged.

G. Construction Photographs

1. The General Contractor shall take photographs at the locations and at such stages of the construction as directed by the Engineer. Kodak color film and color print paper or equal to be used for all negatives, proofs and enlargements.

2. When directed by the Engineer, frequency of photographs may be increased to weekly sessions provided that the equivalent number of exposures is not exceeded. Engineer may waive requirements for photographs during inactive construction periods in favor of increased photographs during active construction sequences.

3. Submittal Requirements

   a. Submit electronic photographs to the Owner in .jpeg format.

PART 2 -- PRODUCTS

(NOT USED)
PART 3 -- EXECUTION

(NOT USED)

- END OF SECTION -
SECTION 01350
SEISMIC ANCHORAGE AND BRACING

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Furnish all equipment, labor, materials, and services required to design and provide seismic restraint and bracing for all nonstructural architectural, mechanical, electrical, and plumbing components and their supports and attachments permanently attached to the primary structure in which the components are to be installed in accordance with the Contract Documents and the seismic restraint requirements of California Building Code and Chapter 13 in ASCE 7.

B. Furnish mechanical, electrical, and plumbing equipment manufacturer certifications showing seismic compliance in accordance with Chapter 13 of ASCE 7 for equipment designated as an essential component or to remain operational following a seismic event.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01450 – Special Inspections
B. Section 05010 – Metal Materials
C. Section 05050 – Metal Fastening
D. Section 05120 – Structural Steel
E. Section 15000 – Basic Mechanical Requirements
F. Section 15020 – Pipe Supports
G. Section 15400 – Plumbing
H. Section 16000 – Basic Electrical Requirements
I. Division 17 – Control and Information Systems
J. Further requirements for seismic anchorage and bracing may be included in other Sections of the Specifications. See section for the specific item in question.

1.03 DEFINITIONS

A. Nonstructural components: All architectural, mechanical, electrical or plumbing elements or systems and their supports or attachments provided under this contract which are permanently attached to the floors, roof, walls, columns and beams of newly constructed buildings, building additions, existing buildings or non-building structures.
1. Architectural nonstructural components include, but are not limited to, interior nonstructural walls and partitions, exterior wall panels and glazing elements, glass curtain walls, skylights, cabinets, suspended ceilings, fascias, and cladding.

2. Mechanical nonstructural components include, but are not limited to, HVAC units, fans, water and wastewater treatment process equipment, instrumentation cabinets, piping and ductwork.

3. Electrical nonstructural components include, but are not limited to, conduit systems, cable tray systems, boxes, transformers, panelboards, switchboards, switchgear, busway, individual motor controllers, motor control centers, variable frequency drives, automatic transfer switches, and lighting systems.

4. Plumbing nonstructural components include, but are not limited to, sprinkler systems and associated piping, and sump pumps.

B. Seismic Restraint: Attachments and supports, including braces, frames, legs, hangers, saddles, and struts which anchor and brace nonstructural components to minimize their displacement during an earthquake and transmit loads between non-structural components and their attachments to the structure or building.

C. Attachment: Elements including anchor bolts, welded connections, and mechanical fasteners which secure non-structural components or supports to the structure.

D. Hazardous: Toxic, flammable, explosive or corrosive materials in excess of building code mandated threshold quantities for non-hazardous condition.

E. Nonbuilding Structures: All self-supporting structures which are supported by an independent foundation or by other structures which include, but are not limited to, storage tanks, silos, exhaust stacks, storage racks, and towers.

F. Delegated Design: Design of a structure or structural element(s) which has been deferred by the contract documents to be performed during the project construction stage, by a registered design professional retained by the contractor and with the design submitted as a shop drawing to the Engineer.

1.04 EXEMPTIONS

A. The following nonstructural components are exempt from requiring seismic anchorage and bracing: (See paragraph 1.07.C herein for Seismic Design Category)

1. All mechanical, electrical and plumbing nonstructural components in Seismic Design Category D, E or F provided all the following apply:
   a. \( I_p = 1.0 \).
   b. Components are positively attached to the structure without consideration of frictional resistance and have flexible connections between the components and associated ductwork, piping and conduit.
c. Either of the following:

i. Component center of mass is 4 ft or less above a floor level and weighs 400 lbs or less.

ii. Component weighs 20 lbs or less or 5 plf or less for distribution systems.

2. Other exemptions as allowed by the Specifications, Codes and Standards referenced herein.

1.05 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the Specifications, all work herein shall conform to or exceed the applicable requirements of the following documents. The building code shall be the version in effect at the time of Bid within the jurisdiction where the Work is located. All other referenced specifications, codes, and standards refer to the version as referenced by the building code. If no version is referenced by the building code, then the most current issue available at the time of Bid shall be used.

1. California Building Code

2. ASCE/SEI 7 Minimum Design Loads for Buildings and Other Structures

3. NFPA 13 Standard for Installation of Sprinkler Systems

4. FEMA 412 Installing Seismic Restraints for Mechanical Equipment

5. FEMA 413 Installing Seismic Restraints for Electrical Equipment

6. FEMA 414 Installing Seismic Restraints for Duct and Pipe

7. SMACNA Sheet Metal and Air Conditioning Contractors’ National Association, Seismic Restraint Manual: Guidelines for Mechanical Systems

8. ACI 318 Building Code Requirements for Structural Concrete and Commentary

9. ACI 355.2 Qualifications of Post-Installed Mechanical Anchors in Concrete

10. ACI 355.4 Qualifications of Post-Installed Adhesive Anchors in Concrete
1.06 SUBMITTALS

A. Submit the following in accordance with Section 01300, Submittals.

1. Seismic anchorage and bracing shop drawings for all architectural, mechanical, electrical, and plumbing nonstructural components, elements and systems not meeting any of the exemptions in paragraph 1.4 above and do not have a design for seismic anchorage and bracing provided within the contract documents. Submittals shall include the following:

a. Component manufacturer’s cut sheets and fabrication details for equipment bases and foundations, including dimensions, structural member sizes, support point locations and equipment operational loads. Equipment anchorage details shall clearly indicate anchor size, pattern, embedment and edge distance requirements to satisfy operational and seismic forces. Details shall also indicate grout, bearing pads, isolators, etc required for complete installation.

b. Design calculations, signed and sealed by a Professional Engineer registered in the State of California confirming the proposed seismic restraints and attachment will provide sufficient strength and stiffness to resist the design earthquake and limit damage to nonstructural components and the entire support is sufficient to resist the combined gravity and seismic loads. Separate calculation submittals for vertical and lateral load support systems shall not be allowed.

c. Detailed Shop Drawings, signed and sealed by a Professional Engineer registered in the State of California, showing specific details of the support design including material, installation, attachments, connection hardware, etc, and the restraint layout and location of all hangers and supports (resisting both gravity and seismic loads), including restraint orientation and direction of force(s) to be resisted. Within each submittal, the Contractor shall include a cumulative set of hanger and support location drawings (one cumulative ‘living drawing for each building structure) containing all proposed mechanical, electrical and plumbing support locations submitted to date showing the locations of all support attachments to the primary structure. Load magnitudes shall be indicated at attachments to the structure where the sum of the reaction loads on a single member exceeds 1000 pounds vertically or exceeds 500 pounds horizontally. Unless requested by the Engineer, load magnitudes need not be submitted for load values less than these stated values. Separate shop drawing submittals for vertical and lateral load support systems shall not be allowed.

d. For components required to be certified as seismically qualified in accordance with paragraph 1.06.A.2 below, submit installation guidelines provided by the equipment manufacturer for proper seismic mounting of the equipment.

2. For each mechanical, electrical and plumbing nonstructural components and systems furnished, including associated equipment appurtenances and
attachments, designated as essential components in Seismic Design Categories C through F, provide Manufacturer’s Certification signed and sealed by a registered Professional Engineer in the State of California to show the component is seismically qualified in accordance with the Specifications, Codes, and Standards requirements referenced herein. The following requirements shall be met:

a. Seismic qualification shall be substantiated either by approved shake table testing or experience data, with the evidence of such qualification testing or experience data submitted to the Engineer along with the manufacturer’s statement certifying the equipment shall remain operable following the design seismic event.

b. Components with hazardous contents shall also be certified by the manufacturer to maintain containment following the design seismic event based on analysis, approved shake table testing, or experience data. Evidence demonstrating compliance shall be submitted to the Engineer.

c. Seismic qualification testing shall be based on ASCE 7 and on a nationally recognized testing standard procedure such as ICC-ES AC 156.

1.07 DESIGN REQUIREMENTS

A. Seismic restraints systems for nonstructural components shall be subject to the most current local Building Code in conjunction with the seismic provisions of the California Building Code and referenced ASCE 7 Chapter 13.

B. Seismic restraints systems for nonbuilding structures shall be subject to the most current local Building Code in conjunction with the seismic provisions of the California Building Code and referenced ASCE 7 Chapter 15.

C. Nonstructural components shall be assigned to the same Seismic Design Category as the structure they occupy or to which they are attached. Design of seismic support system and anchorage shall follow the site-specific seismic criteria noted on the drawings. Criteria shall include site-specific spectral response coefficients, site class, seismic design category, and risk category.

D. Component Importance Factor $I_p$ shall be 1.5 for all essential nonstructural components noted in item 1.03.E above. All other nonstructural components shall utilize $I_p = 1.0$ unless noted otherwise.

E. Components shall be restrained and braced for earthquake forces both in the vertical and each orthogonal direction. Seismic restraint systems shall limit deflections of components per ASCE 7 and the displacements shall not impede component functionally and containment.
F. Anchorage shall be designed in accordance with ASCE 7. Mechanical fasteners used to secure nonstructural architectural, mechanical, electrical and plumbing components shall meet the requirements of Specification Section 05050. All mechanical fasteners used to anchor essential components and other elements so designated in Specification Section 05050 shall be considered Structural Anchors.

G. Avoid crossing structural expansion joints with seismic supports or bracing. Nonstructural components shall not be attached to multiple structure elements which may respond differently in an earthquake without provisions to accommodate independent movement. Flexible expansion loops or offsets, flexible joints, bellows type pipe expansion joints, couplings, etc shall be provided at structure expansion joints to allow for independent structure movement and thermal movement of piping, ductwork and conduit. Minimum movement capability in the vertical and each orthogonal direction shall equal the width of the joint.

H. Provide flexible connections, piping, conduit, etc at foundation levels where below grade utilities enter into the structure.

I. Design of support system for components with multiple attachments shall take into account the stiffness and ductility of the supporting members. Equipment designed as free-standing shall only be attached at its base. Use of non-free standing equipment requiring both vertical and lateral attachment is contingent upon loads applied to the structure and requires approval by the Engineer.

J. The seismic restraint design shall be based on actual equipment data (dimensions, weight, center of gravity, etc) obtained from the specifications or the approved equipment manufacturer. The equipment manufacturer shall verify the attachment points on the equipment can safely withstand the combination of seismic, self-weight and other loads imposed.

K. Attachments of nonstructural component supports and seismic restraints causing the building structure slabs, beams, walls, columns, etc. to be overstressed shall not be permitted.

L. Where the weight of a nonstructural component is greater than or equal to 25 percent of the effective seismic weight (as defined by ASCE 7) of the structure it is attached to, the component shall be classified as a nonbuilding structure and its support designed in accordance with ASCE 7 Chapter 15.

M. No reaction loads (either vertical or lateral) from nonstructural component supports and seismic restraints shall be allowed on any element where design has been delegated unless the additional loads on the element have been coordinated with the delegated designer and the submittal is accompanied by a sealed letter from the delegated designer indicating the element has been designed to support the reaction loads.

N. Reaction loads from nonstructural component supports and seismic restraints shall be transferred directly to the primary structural members, with no components supported from secondary members unless otherwise approved.

O. No holes shall be drilled into any structural steel for attachment of component supports without prior approval of the Engineer.
PART 2 -- PRODUCTS

2.01 MATERIALS

A. Seismic restraints and braces shall be constructed of appropriate materials and connecting hardware to provide a continuous load path between the component and supporting structure of sufficient strength and stiffness to resist the calculated design seismic forces and displacements.

B. Component restraint, bracing and connection materials shall be compatible with and in general match the component and component gravity support materials. Contact between dissimilar metals shall be prevented. See Section 15020 – Pipe Supports for additional details.

C. Post-installed concrete anchors used for seismic restraint and bracing anchorage shall be considered structural anchors per Section 05050 and shall be prequalified for use in seismic applications.

D. Powder actuated fasteners in steel or concrete shall not be used for sustained tension loads in Seismic Design Categories D, E or F unless approved for seismic loading or specifically exempted by ASCE 7. Powder actuated fasteners in masonry shall not be used unless approved for seismic loading regardless of Seismic Design Category.

E. Friction clips shall not be used in Seismic Design Categories D, E or F for supporting sustained tension loads in combination with resisting seismic forces. C-type and large flange clamps may be used for hanger attachments provided restraining straps meeting NFPA 13 requirements are utilized and loosening of threaded connections is prevented by lock nuts, burred threads, etc.

PART 3 -- EXECUTION

3.01 INSTALLATION OF SEISMIC RESTRAINTS AND ANCHORAGES

A. No components, seismic anchorages or restraints shall be installed prior to review and acceptance by the Engineer and permitting agency.

B. Seismic certified equipment shall be installed per the manufacturer’s recommendations. Fasteners shall meet manufacturer’s requirements.

C. Following installation, all seismic restraints, bracing and seismically qualified equipment shall be inspected. See Specification Section 01450 for Special Inspection requirements.
SECTION 01400
QUALITY CONTROL

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Testing Laboratory Services

1. Laboratory testing and checking required by the Specifications, including the cost of transporting all samples and test specimens, shall be provided and paid for by the Owner unless otherwise indicated in the Specifications.

2. Materials to be tested include, but are not necessarily limited to the following: cement, concrete aggregate, concrete, bituminous paving materials, structural and reinforcing steel, waterproofing, select backfill, crushed stone or gravel and sand.

3. Tests required by the Owner shall not relieve the Contractor from the responsibility of supplying test results and certificates from manufacturers or suppliers to demonstrate conformance with the Specifications.

4. Procedure

a. The Contractor shall plan and conduct his operations to permit taking of field samples and test specimens, as required, and to allow adequate time for laboratory tests.

b. The collection, field preparation and storage of field samples and test specimens shall be as directed by the Engineer with the cooperation of the Contractor.

5. Significance of Tests

a. Test results shall be binding on both the Contractor and the Owner, and shall be considered irrefutable evidence of compliance or noncompliance with the Specification requirements, unless supplementary testing shall prove, to the satisfaction of the Owner, that the initial samples were not representative of actual conditions.

6. Supplementary and Other Testing

a. Nothing shall restrict the Contractor from conducting tests he may require. Should the Contractor at any time request the Owner to consider such test results, the test reports shall be certified by an independent testing laboratory acceptable to the Owner. Testing of this nature shall be conducted at the Contractor's expense.
1.02 FIELD TESTING OF EQUIPMENT

A. All equipment shall be set, aligned and assembled in conformance with the manufacturer's drawings and instructions.

B. Preliminary Field Tests, Yellow Tag

1. As soon as conditions permit, after the equipment has been secured in its permanent position, the Contractor shall check the equipment for alignment, direction of rotation and that it is free from defects.

2. Contractor shall flush all bearings, gear housings, etc., in accordance with the manufacturer's recommendations, to remove any foreign matter accumulated during shipment, storage or erection. Lubricants shall be added as required by the manufacturer's instructions.

3. When the Contractor has demonstrated to the Engineer that the equipment is ready for operation, a yellow tag will be issued. The tag will be signed by the Engineer, or his assigned representative and attached to the equipment. The tag shall not be removed.

4. Preliminary field tests, yellow tag, must be completed before equipment is subjected to final field tests, blue tag.

C. Final Field Tests, Blue Tag

1. Upon completion of the installation, and at a time approved by the Engineer, equipment will be tested by operating it as a unit with all related piping, ducting, electrical controls and mechanical operations.

2. The equipment will be placed in continuous operation as prescribed or required and witnessed by the Engineer or his assigned representative and the Owner or his assigned representative.

3. The tests shall prove that the equipment and appurtenances are properly installed, meet their operating cycles and are free from defects such as overheating, overloading, and undue vibration and noise. Equipment shall be tested for the characteristics as specified for the item.

4. Each pump shall be tested at maximum rated speed for at least four points on the pump curve for capacity, head and electric power input. The rated motor nameplate current and power shall not be exceeded at any point within the specified range. Vibrometer readings shall be taken when directed by the Engineer and the results recorded. Additional tests shall be performed as prescribed in other sections of the Specifications.

5. Pumps with drive motors rated at less than five horsepower shall only be tested for excess current or power when overheating or other malfunction becomes evident in general testing.
6. Until final field tests are acceptable to the Engineer, the Contractor shall make all necessary changes, readjustments and replacements at no additional cost to the Owner.

7. Defects which cannot be corrected by installation adjustments will be sufficient grounds for rejection of any equipment.

8. Upon acceptance of the field tests, a blue tag will be issued. The tag will be signed by the Engineer and attached to the unit. The tag shall not be removed and no further construction work will be performed on the unit, except as required during start-up operations and directed by the Engineer.

9. All costs in connection with such tests including all materials, equipment, instruments, labor, etc., shall be borne by the Contractor.

1.03 IMPERFECT WORK, EQUIPMENT, OR MATERIALS

A. Any defective or imperfect work, equipment, or materials furnished by the Contractor which is discovered before the final acceptance of the work, as established by the Certificate of Substantial Completion, or during the subsequent guarantee period, shall be removed immediately even though it may have been overlooked by the Engineer and estimated for payment. Any equipment or materials condemned or rejected by the Engineer shall be tagged as such and shall be immediately removed from the site. Satisfactory work or materials shall be substituted for that rejected.

B. The Engineer may order tests of imperfect or damaged work, equipment, or materials to determine the required functional capability for possible acceptance, if there is no other reason for rejection. The cost of such tests shall be borne by the Contractor; and the nature, tester, extent and supervision of the tests will be as determined by the Engineer. If the results of the tests indicate that the required functional capability of the work, equipment, or material was not impaired, consistent with the final general appearance of same, the work, equipment, or materials may be deemed acceptable. If the results of such tests reveal that the required functional capability of the questionable work, equipment, or materials has been impaired, then such work, equipment, or materials shall be deemed imperfect and shall be replaced. The Contractor may elect to replace the imperfect work, equipment, or material in lieu of performing the tests.

1.04 INSPECTION AND TESTS

A. The Contractor shall allow the Engineer ample time and opportunity for testing materials and equipment to be used in the work. He shall advise the Engineer promptly upon placing orders for material and equipment so that arrangements may be made, if desired, for inspection before shipment from the place of manufacture. The Contractor shall at all times furnish the Engineer and his representatives, facilities including labor, and allow proper time for inspecting and testing materials, equipment, and workmanship. The Contractor must anticipate possible delays that may be caused in the execution of his work due to the necessity of materials and equipment being inspected and accepted for use. The Contractor shall furnish, at his own expense, all samples of materials required by the Engineer for testing, and shall make his own arrangements for providing water, electric power, or fuel for the various inspections and tests of structures and equipment.

B. The Contractor shall furnish the services of representatives of the manufacturers of certain equipment, as prescribed in other Sections of the Specifications. The Contractor shall also place his orders for such equipment on the basis that, after the equipment has been tested
prior to final acceptance of the work, the manufacturer will furnish the Owner with certified statements that the equipment has been installed properly and is ready to be placed in functional operation. Tests and analyses required of equipment shall be paid for by the Contractor, unless specified otherwise in the Section which covers a particular piece of equipment.

C. Where other tests or analyses are specifically required in other Sections of these Specifications, the cost thereof shall be borne by the party (Owner or Contractor) so designated in such Sections. The Owner will bear the cost of all tests, inspections, or investigations undertaken by the order of the Engineer for the purpose of determining conformance with the Contract Documents if such tests, inspection, or investigations are not specifically required by the Contract Documents, and if conformance is ascertained thereby. Whenever nonconformance is determined by the Engineer as a result of such tests, inspections, or investigations, the Contractor shall bear the full cost thereof or shall reimburse the Owner for said cost. In this connection, the cost of any additional tests and investigations, which are ordered by the Engineer to ascertain subsequent conformance with the Contract Documents, shall be borne by the Contractor.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

- END OF SECTION -
SECTION 01470

WATERTIGHTNESS TESTING OF CONCRETE STRUCTURES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. It is the intent of these Specifications that all concrete work and sealing work around built-in items and penetrations be performed as required to insure that groundwater, surface water, and water or liquids in tanks, channels and containers will not intrude into any equipment rooms, pipe galleries, habitable areas or other generally dry areas.

B. The required watertightness shall be achieved by quality concrete construction and proper sealing of all joints and penetrations.

C. Each unit shall be tested separately and the leakage tests shall be made prior to backfilling and before equipment is installed. Testing water shall be from any potable, non-potable, or natural moving source such as a river or stream, but not from any still water source such as a lake or pond, and not from any wastewater source.

D. All water holding structures shall be tested for leakage by the Contractor. The Contractor shall provide at his own expense all labor, material, temporary bulkheads, pumps, water measuring devices, etc., necessary to perform the required tests.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01400 – Quality Control

B. Section 03300 – Cast-in-Place Concrete

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. ACI 350.1-10 - Specification for Tightness Testing of Environmental Engineering Concrete Structures

1.04 SUBMITTALS

A. Testing procedures shall be submitted for approval prior to the test.

B. Testing Report: Prior to placing the structure in service, submit for review and approval a detailed bound report summarizing the watertightness test data, describing the testing procedure and showing the calculations on which the test data is based.

PART 2 – PRODUCTS (NOT USED)
PART 3 – EXECUTION

3.01 TEST PREPARATION

A. The design capability of the structure to withstand testing shall be verified for the pressures to be applied. Another type of test shall not be substituted for hydrostatic tightness testing without approval of the Engineer.

B. The structure shall not be tested before all elements of the structure which resist any portion of the retained liquid pressure are in place and the concrete has attained its specified compressive strength.

C. Unless otherwise specified, coatings shall not be applied until after the hydrostatic tightness testing is complete. Liners that are mechanically locked to the surface during the placement of the concrete shall be installed before the hydrostatic tightness testing. Interior liners shall be visually examined for deficiencies (pinholes, tears and partially fused splices) and must pass integrity testing. Deficiencies shall be prepared.

D. Clean the exposed concrete surfaces of the structure, including the floor, of all foreign material and debris. Prior to testing, standing water in or outside of the structure that would interfere with the inspection of the exposed concrete surfaces of the structure shall be removed.

E. The concrete surfaces and concrete joints shall be thoroughly inspected for potential leakage points. Areas of potential leakage shall be repaired before filling the containment structure with water.

F. All openings, fittings, and pipe penetrations in the structure shell shall be inspected at both faces of the concrete, if practical. Defective or cracked concrete shall be repaired prior to testing. All structural penetrations and inlet/outlets shall be securely sealed to prevent the loss of water from the structure during the test. All structural penetrations shall be monitored before and during the test to determine the watertightness of these appurtenances. If the structure is to be filled using the inlet/outlet pipe, positive means shall be provided to check that water is not entering or leaving through this pipe once the structure is filled to the test level. Leakage at these inlet/outlets shall be repaired prior to testing. No allowance shall be made in test measurements for uncorrected known points of leakage.

G. The flow from any underdrain system, if a system is provided, shall be monitored during this same period, and any increase in flow shall be recorded and considered for information as a part of the hydrostatic tightness testing.

H. The ground water level shall be brought to a level below the top of the base slab and kept at that elevation or at a lower elevation during the test.

I. No backfill shall be placed against the walls or on the wall footings of the structure to be tested unless otherwise specified.
3.02 PROCEDURE

A. The initial filling of a new structure should not exceed a rate of 4 ft/h. Filling shall be continued until the water surface is at the design maximum liquid level, or either 1 in. below any fixed overflow level in covered containment structure or 4 in. in open structure, whichever is lower.

B. The exterior surfaces of the structure shall be inspected during the period of filling the structure. If any flow of water is observed from the structure exterior surfaces, including joints or cracks, the defect causing the leakage shall be repaired prior to testing.

C. Watertightness Test - Part 1: Qualitative Criteria

1. The water shall be kept at the test level for at least 3 days prior to Part 2 of the testing.

2. The exterior surfaces of the structure shall be observed in both the early mornings and later afternoons during the 3-day period before Part 2 of the test. If any water is observed on the structure exterior surfaces, including joints, repaired honeycombed areas and cracks, where moisture can be picked up on a dry hand, the containment structure shall be considered to have failed Part 1 of the test.

3. Wet areas on top of wall footing shall not be cause to fail Part 1 of the test unless the water can be observed to be flowing.

4. Part 2 of the test may begin prior to completion of repairs for Part 1. However, all defects causing the failure of Part 1 shall be repaired before the structure is accepted.

D. Watertightness Test - Part 2: Quantitative Criteria

1. The test measurements shall not be scheduled for a period when the forecast is for a difference of more than 35°F between the ambient temperature readings at the times of the initial and final level measurements of the water surface. The test shall also not be scheduled when the weather forecast indicates the water surface would be frozen before the test is completed.

2. The vertical distance to the water surface shall be measured to within 1/16 in. from a fixed point on the structure above the water surface. Measurements shall be recorded at 24-hour intervals. Measurements taken at the same time of day will reduce the probability of temperature difference.

3. Measurements shall be taken at two locations, 180° apart, which will minimize the effect of differential settlement. Measurements shall be taken at the same locations to reduce the probability of measurement differences.

4. The test period shall be at least the theoretical time required to lower the water surface 3/8 in. assuming a loss of water at 0.050% of the water volume per 24-hour period. The test period shall not be longer than five days.

5. The water temperature shall be recorded at a depth of 18 in. below the water surface at the start and end of the test.
6. A floating, restrained, partially filled, calibrated, open container for evaporation and precipitation measurement should be positioned in open structures and the water level in the container recorded at 24-hour intervals. Determination of evaporation by a shallow pan-type measuring device is not acceptable due to possible heating of the bottom of the shallow pan resulting in accelerated evaporation.

3.03 EVALUATION

A. The containment structure shall continue to be observed in both the early mornings and late afternoons to verify compliance with Part 1 of the test during Part 2.

B. At the end of the test period, the water surface shall be recorded to within 1/16-in at the location of original measurements. The water temperature and the evaporation and precipitation measurements shall be recorded.

C. The allowable loss of water for tightness tests shall not exceed 0.050% of the test water volume in 24 hours.

D. The change in water volume in the structure shall be calculated and corrected, if necessary, for evaporation, precipitation, and temperature based on the change recorded in the water level from the open container. If the loss exceeds the allowable loss, the structure shall be considered to have failed the test.

E. During Part 2 of the test, observed flow or seepage of water from the exterior surface, including that from cracks and joints, should be considered as a failed test. The structure shall also be considered to have failed the test if moisture can be transferred from the exterior surface to a dry hand. Dampness or wetness on top of a footing shall not be considered as a failure test.

3.04 RETESTING

A. A restart of the test shall be required when test measurements become unreliable due to unusual precipitation or other external factors.

B. The Contractor shall be permitted to immediately retest when no visible leakage is exhibited. If the structure fails the second test or if the Contractor does not exercise the option of immediately retesting after the first test failure, the interior of the structure shall be inspected by a diver or by other means to determine probable areas of leakage. The structure shall only be retested after the most probable areas of leakage are repaired.

C. If the leakage exceeds the allowable limit, the work shall be corrected by methods approved by the Engineer.

D. Upon completion of the necessary remedial work, the leakage test shall be repeated until it is successfully passed.
3.05 NOTIFICATION BY ENGINEER

A. If any leaks, in excess of the specified amount, are not remedied by the Contractor within four (4) weeks of notification by the Engineer, regardless of whether the cause of these leaks is or is not determined, the Engineer shall have the authority to have these leaks repaired by others. The cost of repairs, by others, shall be deducted from monies due or to become due to the General Contractor.

- END OF SECTION -
SECTION 01520

MAINTENANCE OF UTILITY OPERATIONS DURING CONSTRUCTION

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The existing plant will be maintained in continuous operation by the Owner during the entire construction period of all Contracts as hereinafter specified. The intent of this section is to outline the minimum requirements necessary to allow the Owner to continuously operate and maintain the treatment facility in order to remain in compliance with all permit requirements.

B. Work under each Contract shall be scheduled and conducted by each Contractor so as not to impede any treatment process, reduce the quality of the plant effluent or cause odor or other nuisance except as explicitly permitted hereinafter. In performing the work shown and specified, the Contractor shall plan and schedule his work to meet the plant and collection system operating requirements, and the constraints and construction requirements as outlined in this Section. No discharge of raw or inadequately treated wastewater shall be allowed. The Contractor shall pay all civil penalties, costs, assessments, etc., associated with any discharge of raw or inadequately treated wastewater associated with the Contractor's work.

C. The General Contractor shall be responsible for coordinating the general construction and electrical, HVAC and plumbing construction schedules and for ensuring that permanent or temporary power is available for all existing, proposed, and temporary facilities that are required to be on line at any given time.

D. The Contractor has the option of providing additional temporary facilities that can eliminate a constraint, provided it is done without cost to the Owner and provided that all requirements of these Specifications are fulfilled. The Contractor shall submit any such plan for providing additional temporary facilities to eliminate a constraint to the PM for review. Such plans must be approved by the Engineer and Owner prior to the Contractor proceeding. Work not specifically covered in the following paragraphs may, in general, be done at any time during the contract period, subject to the operating requirements and constraints and construction requirements outlined hereinafter. All references to days in this Section shall be consecutive calendar days.

1.02 GENERAL CONSTRAINTS

A. The Contractor shall schedule the Work so that the plant is maintained in continuous operation. All treatment processes shall be maintained in continuous operation during the construction period except during approved process interruptions. All short-term system or partial systems shutdowns and diversions shall be approved by the Engineer. Long-term process shutdowns and diversions shall conform to the requirements hereinafter specified and shall be minimized by the Contractor as much as possible. If in the judgement of the Engineer a requested shutdown is not required for the Contractor to perform the Work, the Contractor shall utilize approved alternative methods to accomplish the Work. All shutdowns shall be coordinated with and scheduled at times suitable to the Owner. Shutdowns shall not begin until all required materials are on hand and ready for installation. Each shutdown...
period shall commence at a time approved by the Owner, and the Contractor shall proceed with the Work continuously, start to finish, until the Work is completed and normal plant operation is restored. If the Contractor completes all required Work before the specified shutdown period has ended, the Owner may immediately place the existing system back into service.

B. The Contractor shall schedule short-term and long-term shutdowns in advance and shall present all desired shutdowns in the 30 and 60-day schedules at the progress meetings (see Section 01200). Shutdowns shall be fully coordinated with the Plant Superintendent at least 48 hours before the scheduled shutdown. Owner personnel shall operate Owner's facilities involved in the short-term and long-term shutdowns and diversions.

C. Short term shutdowns in plant flow will be allowed for tie-ins to existing facilities, installation of temporary bulkheads, etc. All such shutdowns shall be scheduled for week-end low-flow periods and shall be limited to less than two (2) hours depending on incoming flow rate and storage volume in the collection and treatment system. Any shutdown of two (2) hours or longer duration shall be defined as a long-term shutdown. The Contractor shall provide appropriate diversion facilities to be approved by the Owner, when the plant cannot be shut down for a sufficient long time to accomplish the required work. The Contractor may be allowed additional time for short-term interruptions if he can demonstrate to the Owner and Engineer that the collection system will not surcharge or overflow during the requested shutdown period. The schedule and duration of short-term shutdowns shall be at the discretion of the Owner.

D. Any temporary work, facilities, roads, walks, protection of existing structures, piping, blind flanges, valves, equipment, etc. that may be required within the Contractor's work limits to maintain continuous and dependable plant operation shall be furnished by the Contractor at the direction of the Engineer at no extra cost to the Owner.

E. The Owner shall have the authority to order Work stopped or prohibited that would, in his opinion, unreasonably result in interrupting the necessary functions of the plant operations.

F. If the contractor impairs performance or operation of the plant as a result of not complying with specified provisions for maintaining plant operations, then the contractor shall immediately make all repairs or replacements and do all work necessary to restore the plant to operation to the satisfaction of the Engineer. Such work shall progress continuously to completion on a 24-hours per day, seven work days per week basis.

G. The Contractor shall provide the services of emergency repair crews on call 24-hours per day to affect repairs to portions of the plant affected by the Contractor's operations.

1.03 GENERAL OPERATING REQUIREMENTS, CONSTRAINTS, AND CONSTRUCTION REQUIREMENTS

A. Access to Plant Site, Roadways, and Parking Areas

1. An unobstructed traffic route through the Main Gate shall be maintained at all times for the Owner's operations personnel and maintenance equipment. Parking for personal vehicles of construction personnel shall not be allowed within the fence of the treatment plant. Construction personnel may park on City property outside the...
plant fence in areas approved by the Engineer. The General Contractor shall be responsible for providing access to and for preparing and maintaining/approved parking areas.

2. An unobstructed traffic route around the plant site shall be maintained at all times for the Owner’s operations personnel and maintenance equipment. Vehicular access to the treatment units and buildings for Owner personnel shall be maintained at all times by the Contractor.

3. The Contractor shall provide temporary measures to protect the existing pavement by filling over with earthen material or supplying other measures acceptable to the Engineer, and he shall repair any damage to existing paved surfaces that occurs during the construction period. Any areas disturbed along the shoulders of the access road and interior roads and elsewhere inside and outside of the plant shall be repaired, graded, seeded, etc. as necessary to match pre-existing conditions.

4. The General Contractor shall not undertake the restoration/construction of new roadway (paved, gravel, or asphalt overlay) shown on the Contract Drawings, until all other work on the plant improvements has been completed.

B. Personnel Access

1. Treatment plant personnel shall have access to all areas which remain in operation throughout the construction period. The Contractor shall locate stored material, dispose of construction debris and trash, provide temporary walkways, provide temporary lighting, and other such work as directed by the Engineer to maintain personnel access to areas in operation. Access and adequate parking areas for plant personnel must be maintained throughout construction.

C. Plumbing Facilities

1. Unless otherwise allowed by the Engineer, sanitary facilities in the existing structures shall be operational at all times for plant operating personnel. All other building plumbing systems such as roof and floor drains, pumping, etc., shall be maintained for all structures.

D. Building Heating and Ventilating

1. Building heating and ventilating for the existing plant structures shall be in service for the entire construction period. Additional temporary heating and ventilation shall be provided as required to maintain facilities under construction adequately heated and vented. The temperatures to be maintained in any areas occupied by plant operating personnel such as offices, lunchrooms, locker rooms, bathrooms, etc., shall be at least 65°F. The temperatures to be maintained in all other interior plant areas, whether new, existing or temporary, shall be maintained at a minimum of 55°F.
E. Power, Light and Communications Systems (General)

1. Electric power, lighting service and communications systems shall be maintained in uninterrupted operation in all areas which remain in operation. Individual units may be disconnected as required for replacement, but service shall be available at all times including periods when plant elements are out of service. Shutdown of electrical facilities shall be limited to not more than five (5) hours. The Owner may allow longer outages under conditions determined by the Owner by making use of the existing and/or the proposed engine-generator at the plant. All costs associated with operation of the engine-generators shall be paid by the Contractor. The Electrical Contractor shall coordinate shutdowns required with the General Contractor to minimize the total number of shutdowns required to complete construction. Owner's phone service to the plant shall be maintained in continuous operation during construction.

F. Draining Process Pipes and Conduits (General)

1. The contents of all pipes and conduits to be removed, replaced or relocated (or dewatered for a specific purpose) shall be transferred to a suitable facility in a manner approved by the Owner through hoses or piping, or by using pumps if hydraulic conditions so require them. The Contractor shall provide the pumps, piping and hoses at no additional cost to the Owner. No uncontrolled spillage of a pipe or conduit shall be permitted. Any spillage, other than potable water, shall be immediately washed down and flushed into the appropriate process flow train.

G. Potable Water System

1. Potable water service shall be maintained in continuous service at all times during construction except for short term interruptions required for tie-ins. Shutdown of the potable water system shall be fully planned and coordinated with the Plant Superintendent and shall be limited to not more than two (2) hours. Existing fire hydrants within the plant site shall be operational at all times, unless otherwise approved by the Owner.

H. Non-potable Water System

1. The existing non-potable water service shall be maintained in continuous operation during construction except for short term tie-ins of new or temporary facilities to existing facilities, until the new system is brought into service. Temporary non-potable service for the chlorine and pump seal water systems shall be provided by the Contractor as necessary to insure continuous, uninterrupted service of these critical systems. The Contractor shall furnish any required temporary non-potable water systems at no additional cost to the Owner. The Contractor may require temporary support or relocation or demolition of existing non-potable water facilities to proceed with construction. The Contractor shall provide all temporary supports, relocation of existing piping, or demolition of existing non-potable water piping including placement with temporary or permanent non-potable water piping as required at no additional cost to the Owner. Shutdown of the non-potable water system shall be fully coordinated with the Plant Superintendent and shall be limited to not more than five (5) hours.
I. Sump Pumps and Sumps
   1. All existing sumps shall be maintained in an operable condition with either existing
      pumps or temporary pumps. Interim piping, power and controls shall be provided as
      required by the staged construction sequence.

J. Seal Water and Service Water Piping
   1. A supply of service and seal water and the necessary connections to existing
      equipment shall be maintained during construction. Interim piping shall be provided
      as required.

1.04 SPECIFIC OPERATIONAL CONSTRAINTS
   A. None

PART 2 -- PRODUCTS
   (NOT USED)

PART 3 -- EXECUTION
   (NOT USED)

- END OF SECTION -
SECTION 01530

PROTECTION OF EXISTING FACILITIES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Contractor shall be responsible for the preservation and protection of property adjacent to the work site against damage or injury as a result of his operations under this Contract. Any damage or injury occurring on account of any act, omission or neglect on the part of the Contractor shall be restored in a proper and satisfactory manner or replaced by and at the expense of the Contractor to an equal or superior condition than previously existed.

B. Contractor shall comply promptly with such safety regulations as may be prescribed by the Owner or the local authorities having jurisdiction and shall, when so directed, properly correct any unsafe conditions created by, or unsafe practices on the part of, his employees. In the event of the Contractor's failure to comply, the Owner may take the necessary measures to correct the conditions or practices complained of, and all costs thereof will be deducted from any monies due the Contractor. Failure of the Engineer to direct the correction of unsafe conditions or practices shall not relieve the Contractor of his responsibility hereunder.

C. In the event of any claims for damage or alleged damage to property as a result of work under this Contract, the Contractor shall be responsible for all costs in connection with the settlement of or defense against such claims. Prior to commencement of work in the vicinity of property adjacent to the work site, the Contractor, at his own expense, shall take such surveys as may be necessary to establish the existing condition of the property. Before final payment can be made, the Contractor shall furnish satisfactory evidence that all claims for damage have been legally settled or sufficient funds to cover such claims have been placed in escrow, or that an adequate bond to cover such claims has been obtained.

1.02 PROTECTION OF WORK AND MATERIAL

A. During the progress of the work and up to the date of final payment, the Contractor shall be solely responsible for the care and protection of all work and materials covered by the Contract.

B. All work and materials shall be protected against damage, injury or loss from any cause whatsoever, and the Contractor shall make good any such damage or loss at his own expense. Protection measures shall be subject to the approval of the Engineer.

1.03 BARRICADES, WARNING SIGNS AND LIGHTS

A. The General Contractor shall provide, erect and maintain as necessary, strong and suitable barricades, danger signs and warning lights along all roads accessible to the public, as required by the authority having jurisdiction, to insure safety to the public. All barricades and obstructions along public roads shall be illuminated at night and all lights for this purpose shall be kept burning from sunset to sunrise.
B. Each Contractor shall provide and maintain such other warning signs and barricades in areas of and around their respective work as may be required for the safety of all those employed in the work, the Owner's operating personnel, or those visiting the site.

1.04 EXISTING UTILITIES AND STRUCTURES

A. The term existing utilities shall be deemed to refer to both publicly-owned and privately-owned utilities such as electric power and lighting, telephone, water, gas, storm drains, process lines, sanitary sewers and all appurtenant structures.

B. Where existing utilities and structures are indicated on the Drawings, it shall be understood that all of the existing utilities and structures affecting the work may not be shown and that the locations of those shown are approximate only. It shall be the responsibility of the Contractor to ascertain the actual extent and exact location of existing utilities and structures. In every instance, the Contractor shall notify the proper authority having jurisdiction and obtain all necessary directions and approvals before performing any work in the vicinity of existing utilities.

C. Prior to beginning any excavation work, the Contractor shall, through field investigations, determine any conflicts or interferences between existing utilities and new utilities to be constructed under this project. This determination shall be based on the actual locations, elevations, slopes, etc., of existing utilities as determined in the field investigations, and locations, elevation, slope, etc. of new utilities as shown on the Drawings. If an interference exists, the Contractor shall bring it to the attention of the Engineer as soon as possible. If the Engineer agrees that an interference exists, he shall modify the design as required. Additional costs to the Contractor for this change shall be processed through a Change Order as detailed elsewhere in these Contract Documents. In the event the Contractor fails to bring a potential conflict or interference to the attention of the Engineer prior to beginning excavation work, any actual conflict or interference which does arise during the Project shall be corrected by the Contractor, as directed by the Engineer, at no additional expense to the Owner.

D. The work shall be carried out in a manner to prevent disruption of existing services and to avoid damage to the existing utilities. Temporary connections shall be provided, as required, to insure uninterruption of existing services. Any damage resulting from the work of this Contract shall be promptly repaired by the Contractor at his own expense in a manner approved by the Engineer and further subject to the requirements of any authority having jurisdiction. Where it is required by the authority having jurisdiction that they perform their own repairs or have them done by others, the Contractor shall be responsible for all costs thereof.

E. Where excavations by the Contractor require any utility lines or appurtenant structures to be temporarily supported and otherwise protected during the construction work, such support and protection shall be provided by the Contractor. All such work shall be performed in a manner satisfactory to the Engineer and the respective authority having jurisdiction over such work. In the event the Contractor fails to provide proper support or protection to any existing utility, the Engineer may, at his discretion, have the respective authority to provide such support or protection as may be necessary to insure the safety of such utility, and the costs of such measures shall be paid by the Contractor.

PART 2 -- PRODUCTS
(NOT USED)

PART 3 -- EXECUTION

(NO UTED)

- END OF SECTION -
SECTION 01540

DEMOLITION AND REMOVAL OF EXISTING STRUCTURES AND EQUIPMENT

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. This Section covers the demolition, removal, and disposal of existing buildings, structures, pavement, curbs, and sidewalk, removal and disposal of asbestos materials, and any existing equipment including electrical, plumbing, heating and ventilating equipment and piping not required for the operation of the rehabilitated plant as indicated on the Drawings and as specified hereinafter. The Contractor shall furnish all labor, materials and equipment to demolish buildings and structures and to remove fixtures, anchors, supports, piping and accessories designated to be removed on the Drawings.

1.02 TITLE TO EQUIPMENT AND MATERIALS

A. Contractor shall have no right or title to any of the equipment, materials or other items to be removed from the existing buildings or structures unless and until said equipment, materials and other items have been removed from the premises. The Contractor shall not sell or assign, or attempt to sell or assign any interest in the said equipment, materials or other items until the said equipment, materials or other items have been removed.

B. Contractor shall have no claim against the Owner because of the absence of such fixtures and materials.

1.03 CONDITION OF STRUCTURES AND EQUIPMENT

A. The Owner does not assume responsibility for the actual condition of structures and equipment to be demolished and removed.

B. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner so far as practicable.

C. The information regarding the existing structures and equipment shown on the Drawings is based on visual inspection and a walk-through survey only. Neither the Engineer nor the Owner will be responsible for interpretations or conclusions drawn therefrom by the Contractor.

PART 2 -- PRODUCTS

(NOT USED)
PART 3 -- EXECUTION

3.01 DEMOLITION AND REMOVALS

A. The removal of all equipment and piping, and all materials from the demolition of buildings and structure shall, when released by the Owner and Engineer, shall be done by the Contractor and shall become the Contractor's property, unless otherwise noted, for disposition in any manner not contrary to the Contract requirements and shall be removed from the site to the Contractor's own place of disposal.

B. The Electrical Contractor (Subcontractor) specifically, shall de-energize all panelboards, lighting fixtures, switches, circuit breakers, electrical conduits, motors, limit switches, pressure switches, instrumentation such as flow, level and/or other meters, wiring, and similar power equipments prior to removal. Any electric panels or equipment which are to be retained shall be relocated or isolated by the Electrical Contractor (Subcontractor) specifically, prior to the removal of the equipment specified herein.

C. The Contractor shall proceed with the removal of the equipment, piping and appurtenances in a sequence designed to maintain the plant in continuous operation as described in Section 01520, Maintenance of Utility Operations During Construction, and shall proceed only after approval of the Engineer.

D. Any equipment piping and appurtenances removed without proper authorization, which are necessary for the operation of the existing facilities shall be replaced to the satisfaction of the Engineer at no cost to the Owner.

E. Excavation caused by demolitions shall be backfilled with fill free from rubbish and debris.

3.02 PROTECTION

A. Demolition and removal work shall be performed by competent experienced workmen for the various type of demolition and removal work and shall be carried out through to completion with due regard to the safety of Owner employees, workmen on-site and the public. The work shall be performed with as little nuisance as possible.

B. The work shall comply with the applicable provisions and recommendation of ANSI A10.2, Safety Code for Building Construction, all governing codes, and as hereinafter specified.

C. The Contractor shall make such investigations, explorations and probes as are necessary to ascertain any required protective measures before proceeding with demolition and removal. The Contractor shall give particular attention to shoring and bracing requirements so as to prevent any damage to new or existing construction.

D. The Contractor shall provide, erect, and maintain catch platforms, lights, barriers, weather protection, warning signs and other items as required for proper protection of the public, occupants of the building, workmen engaged in demolition operations, and adjacent construction.

E. The Contractor shall provide and maintain weather protection at exterior openings so as to fully protect the interior premises against damage from the elements until such openings are closed by new construction.
F. The Contractor shall provide and maintain temporary protection of the existing structure designated to remain where demolition, removal and new work is being done, connections made, materials handled or equipment moved.

G. The Contractor shall take necessary precautions to prevent dust from rising by wetting demolished masonry, concrete, plaster and similar debris. Unaltered portions of the existing buildings affected by the operations under this Section shall be protected by dust-proof partitions and other adequate means.

H. The Contractor shall provide adequate fire protection in accordance with local Fire Department requirements.

I. The Contractor shall not close or obstruct walkways, passageways, or stairways and shall not store or place materials in passageways, stairs or other means of egress. The Contractor shall conduct operations with minimum traffic interference.

J. The Contractor shall be responsible for any damage to the existing structure or contents by reason of the insufficiency of protection provided.

3.03 WORKMANSHEIP

A. The demolition and removal work shall be performed as described in the Contract Documents. The work required shall be done with care, and shall include all required shoring, bracing, etc. The Contractor shall be responsible for any damage which may be caused by demolition and removal work to any part or parts of existing structures or items designated for reuse or to remain. The Contractor shall perform patching, restoration and new work in accordance with applicable Technical Sections of the Specifications and in accordance with the details shown on the Drawings. Prior to starting of work, the Contractor shall provide a detailed description of methods and equipment to be used for each operation and the sequence thereof for review by the Engineer.

B. All supports, pedestals and anchors shall be removed with the equipment and piping unless otherwise specified or required. Concrete bases, anchor bolts and other supports shall be removed to approximately 1-inch below the surrounding finished area and the recesses shall be patched to match the adjacent areas. Superstructure wall and roof openings shall be closed, and damaged surfaces shall be patched to match the adjacent areas, as specified under applicable Sections of these Specifications, as shown on the Drawings, or as directed by the Engineer. Wall sleeves and castings shall be plugged or blanked off, all openings in concrete shall be closed in a manner meeting the requirements of the appropriate Sections of these Specifications, as shown on the Drawings, and as directed and approved by the Engineer.

C. Materials or items designated to remain the property of the Owner shall be as hereinafter tabulated. Such items shall be removed with care and stored at a location at the site to be designated by the Owner.

D. Where equipment is shown or specified to be removed and relocated, the Contractor shall not proceed with removal of this equipment without specific prior approval of the Engineer. Upon approval, and prior to commencing removal operations, the equipment shall be operated in the presence of representatives of the Contractor, Owner and Engineer. Such items shall be removed with care, under the supervision of the trade responsible for reinstallation and protected and stored until required. Material or items damaged during
removal shall be replaced with similar new material or item. Any equipment that is removed without proper authorization and is required for plant operation shall be replaced at no cost to the Owner.

E. Wherever piping is to be removed for disposition, the piping shall be drained by the Contractor and adjacent pipe and headers that are to remain in service shall be blanked off or plugged and then anchored in an approved manner.

F. Materials or items demolished and not designated to become the property of the Owner or to be reinstalled shall become the property of the Contractor and shall be removed from the property and legally disposed of.

G. The Contractor shall execute the work in a careful and orderly manner, with the least possible disturbance to the public and to the occupants of the building.

H. In general, masonry shall be demolished in small sections, and where necessary to prevent collapse of any construction, the Contractor shall install temporary shores, struts, and bracing.

I. Where alterations occur, or new and old work join, the Contractor shall cut, remove, patch, repair or refinish the adjacent surfaces to the extent required by the construction conditions, so as to leave the altered work in as good a condition as existed prior to the start of the work. The materials and workmanship employed in the alterations, unless otherwise shown on the Drawing or specified, shall comply with that of the various respective trades which normally perform the particular items or work.

J. The Contractor shall finish adjacent existing surfaces to new work to match the specified finish for new work. The Contractor shall clean existing surfaces of dirt, grease, loose paint, etc., before refinishing.

K. The Contractor shall cut out embedded anchorage and attachment items as required to properly provide for patching and repair of the respective finishes.

L. The Contractor shall confine cutting of existing roof areas designated to remain to the limits required for the proper installation of the new work. The Contractor shall cut and remove insulation, etc., and provide temporary weather tight protection as required until new roofing and flashings are installed.

M. The Contractor shall remove temporary work, such as enclosures, signs, guards, and the like when such temporary work is no longer required or when directed at the completion of the work.

3.04 MAINTENANCE

A. The Contractor shall maintain the buildings, structures and public properties free from accumulations of waste, debris and rubbish, caused by the demolition and removal operations.

B. The Contractor shall provide on-site dump containers for collection of waste materials, debris and rubbish, and he shall wet down dry materials to lay down and prevent blowing dust.
C. At reasonable intervals during the progress of the demolition and removal work or as directed by the Engineer, the Contractor shall clean the site and properties, and dispose of waste materials, debris and rubbish.

3.05 EQUIPMENT AND MATERIALS RETAINED BY OWNER

A. The following equipment and materials will be retained by the Owner:

   RO Pilot Plant

B. The equipment and materials shall be moved by the Contractor to storage areas, on the site, to be designated by the Owner.

- END OF SECTION -
SECTION 01560
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Dust Control

1. Contractor shall take all necessary measures to control dust from his operations, and to prevent spillage of excavated materials on public roads.

2. Contractor shall remove all spillage of excavated materials, debris or dust from public roads by methods approved by the Engineer.

3. Contractor shall sprinkle water at locations and in such quantities and at such frequencies as may be required by the Engineer to control dust and prevent it from becoming a nuisance to the surrounding area.

4. Dust control and cleaning measures shall be provided at no additional cost to the Owner.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

- END OF SECTION -
SECTION 01700

PROJECT CLOSEOUT

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Final Cleaning

1. At the completion of the work, the Contractor shall remove all rubbish from and about the site of the work, and all temporary structures, construction signs, tools, scaffolding, materials, supplies and equipment which he or any of his Subcontractors may have used in the performance of the work. Contractor shall broom clean paved surfaces and rake clean other surfaces of grounds.

2. Contractor shall thoroughly clean all materials, equipment and structures; all marred surfaces shall be touched up to match adjacent surfaces; dirty filters and burned out lights replaced as required; all glass surfaces cleaned and floors cleaned and polished so as to leave work in a clean and new appearing condition.

3. Contractor shall maintain cleaning until project, or portion thereof, is occupied by the Owner.

B. Lubrication Survey

1. A lubrication survey, made by a lubricant supply firm, subject to the approval of the Owner shall be provided and paid for by the Contractor.

2. The lubrication survey shall list all equipment, the equipment manufacturer's lubrication recommendations, and an interchangeable lubricants tabulation standardizing and consolidating lubricants whenever possible.

3. The Contractor shall supply all lubricants, applicators and labor for lubricating the equipment, in accordance with manufacturer's recommendations, for field testing and prior to final acceptance. A supply of required lubricants sufficient for start-up and one year of operation shall also be supplied by the Contractor.

4. three (3) copies of the approved lubrication survey shall be furnished to the Engineer prior to final acceptance.

C. Spare Parts and Special Tools

1. As soon as practicable after approval of the list of equipment, the Contractor shall furnish spare parts data for each different item of equipment listed. The data shall include a complete list of parts and supplies, with current unit prices and source or sources of supply.
2. Contractor shall also furnish a list of parts, and supplies that are either normally furnished at no extra cost with the purchase of the equipment or specified to be furnished as part of the Contract and a list of additional items recommended by the manufacturer to assure efficient operation for a period of one-hundred and twenty (120) days for the particular installation.

3. All parts shall be securely boxed and tagged, and clearly marked on the box and individually for identification as to the name of manufacturer or supplier, applicable equipment, part number, description and location in the equipment. All parts shall be protected and packaged for a shelf life of at least ten (10) years.

4. Contractor shall furnish at no additional cost to the Owner with each piece of equipment as a minimum, one (1) complete set, or the number of sets called for in the Technical Specifications, of suitably marked special tools and appliances which may be needed to adjust, operate, maintain, or repair the equipment.

5. Contractor shall submit, for approval by the Engineer, a complete list of the special tools and appliances to be furnished. Such tools and appliances shall be furnished in approved painted steel cases properly labeled and equipped with good grade cylinder locks and duplicate keys.

D. Equipment Start-Up Services

1. Equipment start-up period, for the training of plant personnel, shall begin after satisfactory completion and acceptance of the field tests and coincidentally with the certified date of substantial completion for the part of the work for which the equipment is included. If the equipment is not covered by a certificate of substantial completion for a part of the work, the period shall begin upon substantial completion of the project.

2. During the equipment start-up period the Contractor shall furnish, at no additional cost to the Owner the services of factory trained representatives of the equipment manufacturers for the equipment designated in the Specifications to:

   a. Assist in the start-up and operations of the equipment.

   b. Assist in the training of plant personnel, designated by the Owner in the proper operation and maintenance of the equipment.

3. The Owner shall:

   a. Provide the necessary plant personnel to be instructed in the operation and maintenance of the equipment. The Owner's personnel shall operate all equipment.

   b. Pay for all fuel, power and chemicals consumed beyond quantities specified in the Contract Documents. The Contractor shall pay for fuel, power, and chemicals consumed up to the date of "certified substantial completion" except as otherwise specified herein.

4. Contractor shall be available to promptly repair all work during the start-up period so as to cause minimum disruption to the total plant operation.
5. Upon completion of a minimum of ten (10) consecutive and continuous days of satisfactory operation, or the number of days called for in the Technical Specifications, the Owner will assume operation and operating cost of the equipment. If the equipment malfunctions during this start-up period, the start-up period will be repeated until satisfactory operation is achieved.

6. In the event a system, equipment or component proves defective or is unable to meet specified performance criteria, the Contractor shall replace the defective item and the minimum one (1) year guarantee period, or the guarantee period called for in the Technical Specifications for the item shall start after satisfactory replacement and testing of the item.

E. Final Cleanup; Site Rehabilitation

1. Before finally leaving the site, the Contractor shall wash and clean all exposed surfaces which have become soiled or marked, and shall remove from the site of work all accumulated debris and surplus materials of any kind which result from his operation, including construction equipment, tools, sheds, sanitary enclosures, etc. The Contractor shall leave all equipment, fixtures, and work, which he has installed, in a clean condition. The completed project shall be turned over to the Owner in a neat and orderly condition.

2. The site of the work shall be rehabilitated or developed in accordance with other sections of the Specifications and the Drawings. In the absence of any portion of these requirements, the Contractor shall completely rehabilitate the site to a condition and appearance equal or superior to that which existed just prior to construction, except for those items whose permanent removal or relocation was required in the Contract Documents or ordered by the Owner.

F. Final Inspection

1. Final cleaning and repairing shall be so arranged as to be finished upon completion of the construction work. The Contractor will make his final cleaning and repairing, and any portion of the work finally inspected and accepted by the Engineer shall be kept clean by the Contractor, until the final acceptance of the entire work.

2. When the Contractor has finally cleaned and repaired the whole or any portion of the work, he shall notify the Engineer that he is ready for final inspection of the whole or a portion of the work, and the Engineer will thereupon inspect the work. If the work is not found satisfactory, the Engineer will order further cleaning, repairs, or replacement.

3. When such further cleaning or repairing is completed, the Engineer, upon further notice, will again inspect the work. The "Final Payment" will not be processed until the Contractor has complied with the requirements set forth, and the Engineer has made his final inspection of the entire work and is satisfied that the entire work is properly and satisfactorily constructed in accordance with the requirements of the Contract Documents.

G. Project Close Out
1. As construction of the project enters the final stages of completion, the Contractor shall, in concert with accomplishing the requirements set forth in the Contract Documents, attend to or have already completed the following items as they apply to his contract:

   a. Scheduling equipment manufacturers' visits to site.
   b. Required testing of project components.
   c. Scheduling start-up and initial operation.
   d. Scheduling and furnishing skilled personnel during initial operation.
   e. Correcting or replacing defective work, including completion of items previously overlooked or work which remains incomplete, all as evidenced by the Engineer's "Punch" Lists.
   f. Attend to any other items listed herein or brought to the Contractor's attention by the Engineer.

2. Just before the Engineer's Certificate of Substantial Completion is issued, the Contractor shall accomplish the cleaning and final adjustment of the various chemical containment area components as specified in the Specifications and as follows:

   a. Touch up marks or defects in painted surfaces and touch up any similar defects in factory finished surfaces.

3. In addition, and before the Certificate of Substantial Completion is issued, the Contractor shall submit to the Engineer (or to the Owner if indicated) certain records, certifications, etc., which are specified elsewhere in the Contract Documents. A partial list of such items appears below, but it shall be the Contractor's responsibility to submit any other items which are required in the Contract Documents:

   a. Test results of project components.
   b. Certification of equipment or materials in compliance with Contract Documents.
   c. Operation and maintenance instructions or manuals for equipment.
   d. One set of neatly marked-up record drawings showing as-built changes and additions to the work under his Contract.
   e. Any special guarantees or bonds (Submit to Owner).
4. The Contractor's attention is directed to the fact that required certifications and information under Item 3 above, must actually be submitted earlier in accordance with other Sections of the Specifications.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

- END OF SECTION -
SECTION 02050

DEMOLITION

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish all labor, materials and equipment in accordance with the requirements of Section 01520 - Maintenance of Utility Operations During Construction and Section 01540 - Demolition and Removal of Existing Structures and Equipment.

B. In addition, the Contractor shall demolish and remove all concrete and asphaltic paving, curbs, sidewalk, and miscellaneous yard structures as required and shown on the Contract Drawings during the construction work.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01090 - Reference Standards

B. Section 01520 - Maintenance of Utility Operations During Construction

C. Section 01540 - Demolition and Removal of Existing Structures and Equipment

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. References shall be in accordance with reference standards, codes, and specifications as set forth herein and in Section 02100 - Clearing, Grubbing, and Site Preparation.

PART 2 -- EXECUTION

2.01 DEMOLITION

A. Existing concrete and asphaltic paving, curbs, sidewalk and miscellaneous yard structures within the areas designated for new construction work shall be completely demolished and all debris removed from the site.

B. Excavation caused by demolition shall be backfilled with fill free from rubbish and debris.

C. Work shall be performed in such manner as not to endanger the safety of the workmen or the public or cause damage to nearby structures.

D. Provide all barriers and precautionary measures in accordance with Owner's requirements and other authorities having jurisdiction.

E. Where parts of existing structures are to remain in service, demolish the portions to be removed, repair damage, and leave the structure in proper condition for the intended use. Remove concrete and masonry to the lines designated by drilling, chipping, or other suitable methods. Leave the resulting surfaces reasonably true and even, with sharp straight
corners that will result in neat joints with new construction and be satisfactory for the purpose intended. Where existing reinforcing rods are to extend into new construction, remove the concrete so that the reinforcing is clean and undamaged. Cut off other reinforcing 1/2-inch below the surface and fill with epoxy resin binder flush with the surface.

F. Prior to the execution of the work, the Contractor, Owner and Engineer shall jointly survey the condition of the adjoining and/or nearby structures. Photographs and records shall be made of any prior settlement or cracking of structures, pavements, and the like, that may become the subject of possible damage claims.

2.02 DISPOSAL OF MATERIAL

A. All debris resulting from the demolition and removal work shall be disposed of by the Contractor as part of the work of this Contract. Material designated by the Engineer to be salvaged shall be stored on the construction site as directed. All other material shall be disposed of off site by the Contractor at his expense.

B. Burning of any debris resulting from the demolition will not be permitted at the site.

- END OF SECTION -
SECTION 02100
CLEARING, GRUBBING, AND SITE PREPARATION

PART 1 -- GENERAL

1.01 THE REQUIREMENT
A. Includes all labor, material, equipment and appliances required for the complete execution of any additions, modifications, or alterations to existing building(s) and new construction work as shown on the Drawings and specified herein.

B. Principal items of work include:
   1. Notifying all authorities owning utility lines running to or on the property. Protecting and maintaining all utility lines to remain and capping those that are not required in accordance with instructions of the Utility Companies, and all other authorities having jurisdiction.
   2. Clearing the site within the Contract Limit Lines, including removal of grass, brush, shrubs, trees, loose debris and other encumbrances except for trees marked to remain.
   3. Boxing and protecting all trees, shrubs, lawns and the like within areas to be preserved. Relocating trees and shrubs, so indicated on the Drawings, to designated areas.
   4. Repairing all injury to trees, shrubs, and other plants caused by site preparation operations shall be repaired immediately. Work shall be done by qualified personnel in accordance with standard horticultural practice and as approved by the Engineer.
   5. Removing topsoil to its full depth from designated areas and stockpiling on site where directed by the Engineer for future use.
   6. Disposing from the site all debris resulting from work under this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE
A. Section 02200 - Earthwork

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS
A. N/A

1.04 STREET AND ROAD BLOCKAGE
A. Closing of streets and roads during progress of the work shall be in compliance with the requirements of the Owner and other authorities having jurisdiction. Access shall be provided to all facilities remaining in operation.
1.05 PROTECTION OF PERSONS AND PROPERTY

A. All work shall be performed in such a manner to protect all personnel, workmen, pedestrians and adjacent property and structures from possible injury and damage.

B. All conduits, wires, cables and appurtenances above or below ground shall be protected from damage.

C. Provide warning and barrier fence where shown on the Drawings and as specified herein.

PART 2 — EXECUTION

2.01 CLEARING OF SITE

A. Before removal of topsoil, and start of excavation and grading operations, the areas within the clearing limits shall be cleared and grubbed.

B. Clearing shall consist of cutting, removal, and satisfactory disposal of all trees, fallen timber, brush, bushes, rubbish, sanitary landfill material, fencing, and other perishable and objectionable material within the areas to be excavated or other designated areas. Prior to the start of construction, the Contractor shall survey the entire Contract site and shall prepare a plan which defines the areas to be cleared and grubbed, trees to be pruned, extent of tree pruning, and/or areas which are to be cleared but not grubbed. This plan shall be submitted to the Engineer for approval. Should it become necessary to remove a tree, bush, brush or other plants adjacent to the area to be excavated, the Contractor shall do so only after permission has been granted by the Engineer.

C. Excavation resulting from the removal of trees, roots and the like shall be filled with suitable material, as approved by the Engineer, and thoroughly compacted per the requirements contained in Section 02200, Earthwork.

D. Unless otherwise shown or specified, the Contractor shall clear and grub a strip at least 15 ft. wide along all permanent fence lines installed under this Contract.

E. In temporary construction easement locations, only those trees and shrubs shall be removed which are in actual interference with excavation or grading work under this Contract, and removal shall be subject to approval by the Engineer. However, the Engineer reserves the right to order additional trees and shrubs removed at no additional cost to the Owner, if such, in his opinion, are too close to the work to be maintained or have become damaged due to the Contractor’s operations.

2.02 STRIPPING AND STOCKPILING EXISTING TOPSOIL

A. Existing topsoil and sod on the site within areas designated on the Drawings shall be stripped to whatever depth it may occur, and stored in locations directed by the Engineer.

B. The topsoil shall be free of stones, roots, brush, rubbish, or other unsuitable materials before stockpiling the topsoil.

C. Care shall be taken not to contaminate the stockpiled topsoil with any unsuitable materials.
2.03 GRUBBING

A. Grubbing shall consist of the removal and disposal of all stumps, roots, logs, sticks and other perishable materials to a depth of at least 6-inches below ground surfaces.

B. Large stumps located in areas to be excavated may be removed during grading operations, subject to the approval of the Engineer.

2.04 DISPOSAL OF MATERIAL

A. All debris resulting from the clearing and grubbing work shall be disposed of by the Contractor as part of the work of this Contract. Material designated by the Engineer to be salvaged shall be stored on the construction site as directed by the Engineer for reuse in this Project or removal by others.

B. Burning of any debris resulting from the clearing and grubbing work will not be permitted at the site.

2.05 WARNING AND BARRIER FENCE

A. The fence shall be made of a visible, lightweight, flexible, high strength polyethylene material. The fence shall be MIRASAFE as manufactured by Mirafi, Inc., or equal.

B. Physical Properties

<table>
<thead>
<tr>
<th>Fence:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color: International Orange</td>
</tr>
<tr>
<td>Roll Size: 4' x 164'</td>
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<tr>
<td>Roll weight: 34 lbs</td>
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<tr>
<td>Mesh opening: 1-1/2'' x 3''</td>
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<table>
<thead>
<tr>
<th>Posts:</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM Designation: ASTM 702</td>
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<tr>
<td>Length: 5 feet long (T-Type)</td>
</tr>
<tr>
<td>Weight: 1.25 #/Foot (min)</td>
</tr>
<tr>
<td>Area of Anchor Plate: 14 Sq. In.</td>
</tr>
</tbody>
</table>

C. Drive posts 12 to 18 inches into ground every 10' to 12'. Wrap fence material around first terminal post allowing overlap of one material opening. Use metal tie wire or plastic tie wrap to fasten material to itself at top, middle and bottom. At final post, cut with utility knife or scissors at a point halfway across an opening. Wrap around and tie at final post in the same way as the first post.

D. Use tie wire or tie wrap at intermediate posts and splices as well. Thread ties around a vertical member of the fence material and the post, and bind tightly against the post. For the most secure fastening, tie at top, middle and bottom. Overlap splices a minimum of four fence openings, tie as above, fastening both edges of the fence material splice overlap.

- END OF SECTION -
SECTION 02200

EARTHWORK

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Furnish all labor, equipment and materials required to complete all work associated with excavation, including off-site borrow excavation, dewatering, backfill, drainage layers beneath and around structures, foundation and backfill stone, filter fabric, embankments, stockpiling topsoil and any excess suitable material in designated areas, in place compaction of embankments, backfill and subgrades beneath foundations and roadways, excavation support, disposing from the site all unsuitable materials, providing erosion and sedimentation control grading, site grading and preparation of pavement and structure subgrade, and other related and incidental work as required to complete the work shown on the Drawings and specified herein.

B. All excavations shall be in conformity with the lines, grades, and cross sections shown on the Drawings or established by the Engineer.

C. It is the intent of this Specification that the Contractor conduct the construction activities in such a manner that erosion of disturbed areas and off-site sedimentation be absolutely minimized.

D. All work under this Contract shall be done in conformance with and subject to the limitations of the latest editions of the California Department of Transportation (CalTrans) Standard Specifications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Requirements of related work are included in Division 1 and Division 2 of these Specifications.

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of the other requirements of the Specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced Specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. California Department of Transportation (CalTrans) Standard Specifications.


   ASTM C 127 Test for Specific Gravity and Absorption of Coarse Aggregate.

   ASTM C 136 Test for Sieve Analysis of Fine and Coarse Aggregates.

   ASTM D 422 Particle Size Analysis of Soils.
1.04 SUBSURFACE CONDITIONS

A. Information on subsurface conditions is referenced under Division 1, General Requirements.

B. Attention is directed to the fact that there may be water pipes, storm drains and other utilities located in the area of proposed excavation. Perform all repairs to same in the event that excavation activities disrupt service.

1.05 SUBMITTALS

A. In accordance with the procedures and requirements set forth in Section 01300 - Submittals, the Contractor shall submit the following:

1. Name and location of all material suppliers.

2. Certificate of compliance with the standards specified above for each source of each material.

3. List of disposal sites for waste and unsuitable materials and all required permits for use of those sites.

4. Plans and cross sections of open cut excavations showing side slopes and limits of the excavation at grade.
5. Samples of synthetic filter fabric and reinforced plastic membrane with manufacturer’s certificates or catalog cuts stating the mechanical and physical properties. Samples shall be at least one (1) foot wide and four (4) feet long taken across the roll with the warp direction appropriately marked.

6. Construction drawings and structural calculations for any types of excavation support required. Drawings and calculations shall be sealed by a currently registered Professional Engineer in the State of California.

7. Monitoring plan and pre-construction condition inspection and documentation of all adjacent structures, utilities, and roadways near proposed installation of excavation support systems and near areas where dewatering is required to facilitate construction.

8. Dewatering procedures.

1.06 PRODUCT HANDLING

A. Soil and rock material shall be excavated, transported, placed, and stored in a manner so as to prevent contamination, segregation and excessive wetting. Materials which have become contaminated or segregated will not be permitted in the performance of the work and shall be removed from the site.

PART 2 -- PRODUCTS

2.01 SELECT FILL

A. Soils from the excavations meeting requirements stipulated herein with the exceptions of topsoil and organic material may be used as select fill for backfilling, constructing embankments, reconstructing existing embankments, and as structural subgrade support.

B. Select fill used for embankment construction shall be a silty or clayey soil material with a Maximum Liquid Limit (LL) of 50 and a Plasticity Index (PI) between 7 and 20.

C. Select fill used for backfilling shall either be material as described in Paragraph B above or a granular soil material with a Maximum Plasticity Index (PI) of 6.

D. Regardless of material used as select fill, materials shall be compacted at a moisture content satisfactory to the Engineer, which shall be approximately that required to produce the maximum density except that the moisture content shall not be more than 1% below nor more than 4% above the optimum moisture content for the particular material tested in accordance with the ASTM D698.

E. Select fill used as subgrade support shall be a coarse aggregate material meeting the gradation requirements of #57 or #78 aggregates in accordance with ASTM C-33, or Aggregate Base Course (ABC) as defined in Section 02207 – Aggregate Materials.

F. Where excavated material does not meet requirements for select fill, Contractor shall furnish off-site borrow material meeting the specified requirements herein. Determination of whether the borrow material will be paid for as an extra cost will be made based on Article 4
of the General Conditions, as amended by the Supplementary Conditions. When the excavated material from required excavations is suitable for use as backfill, bedding, or embankments, but is replaced with off-site borrow material for the Contractor's convenience, the costs associated with such work and material shall be borne by the Contractor.

2.02 TOPSOIL

A. Topsoil shall be considered the surface layer of soil and sod, suitable for use in seeding and planting. It shall contain no mixture of refuse or any material toxic to plant growth.

2.03 FOUNDATION DRAINAGE SYSTEMS

A. The Contractor shall provide foundation drainage systems as indicated on the Drawings and specified herein. The materials and placement shall be as indicated under Section 02712 - Foundation Drainage Systems.

2.04 GEOTEXTILES

A. The Contractor shall provide geotextiles as indicated on the Drawings and specified herein. The materials and placement shall be as indicated under Section 02274 - Geotextiles.

PART 3 -- EXECUTION

3.01 STRIPPING OF TOPSOIL

A. In all areas to be excavated, filled, paved, or graveled the topsoil shall be stripped to its full depth and shall be deposited in storage piles on the site, at locations designated by the Engineer, for subsequent reuse. Topsoil shall be kept separated from other excavated materials and shall be piled free of roots and other undesirable materials.

3.02 EXCAVATION

A. All material excavated, regardless of its nature or composition, shall be classified as UNCLASSIFIED EXCAVATION. Excavation shall include the removal of all soil, rock, weathered rock, rocks of all types, boulders, conduits, pipe, and all other obstacles encountered and shown to be removed within the limits of excavation shown on the Drawings or specified herein. The cost of excavation shall be included in the Lump Sum Bid Price and no additional payment will be made for the removal of obstacles encountered within the excavation limits shown on the Drawings and specified herein.

B. All suitable material removed in the excavation shall be used as far as practicable in the formation of embankments, subgrades, and shoulders, and at such other places as may be indicated on the Drawings or indicated by the Engineer. No excavation shall be wasted except as may be permitted by the Engineer. Refer to the drawings for specific location and placement of suitable excavated materials in the formation of embankments, backfill, and structural and roadway foundations. THE ENGINEER AND/OR MATERIALS TESTING CONSULTANT WILL DESIGNATE MATERIALS THAT ARE UNSUITABLE. The Contractor shall furnish off site disposal areas for the unsuitable material. Where suitable materials containing excessive moisture are encountered above grade in cuts, the Contractor shall construct above grade ditch drains prior to the excavation of the cut material when in the
opinion of the Engineer and/or materials testing consultant such measures are necessary to provide proper construction.

C. All excavations shall be made in the dry and in such a manner and to such widths as will give ample room for properly constructing and inspecting the structures and/or piping they are to contain and for such excavation support, pumping and drainage as may be required. Excavation shall be made in accordance with the grades and details shown on the Drawings and as specified herein.

D. Excavation slopes shall be flat enough to avoid slides that will cause disturbance of the subgrade or damage of adjacent areas. Excavation requirements and slopes shall be as indicated in the Drawings. The Contractor shall intercept and collect surface runoff both at the top and bottom of cut slopes. The intersection of slopes with natural ground surfaces, including the beginning and ending of cut slopes, shall be uniformly rounded as shown on the Drawings or as may be indicated by the Engineer. Concurrent with the excavation of cuts the Contractor shall construct intercepting berm ditches or earth berms along and on top of the cut slopes at locations shown on the Drawings or designated by the Engineer. All slopes shall be finished to reasonably uniform surfaces acceptable for seeding and mulching operations. No rock or boulders shall be left in place which protrude more than 1 foot within the typical section cut slope lines, and all rock cuts shall be cleaned of loose and overhanging material. All protruding roots and other objectionable vegetation shall be removed from slopes. The Contractor shall be required to submit plans of open-cut excavation for review by the Engineer before approval is given to proceed.

E. It is the intent of these Specifications that all structures shall bear on an aggregate base, crushed stone or screened gravel bedding placed to the thickness shown on the Drawings, specified in these Specifications, or not less than 6-inches. Bedding for process piping shall be as specified in Section 15000 - Basic Mechanical Requirements, or as shown on the Drawings.

F. The bottom of all excavations for structures and pipes shall be examined by the Engineer and/or materials testing consultant for bearing value and the presence of unsuitable material. If, in the opinion of the Engineer and/or materials testing consultant, additional excavation is required due to the low bearing value of the subgrade material, or if the in-place soils are soft, yielding, pumping and wet, the Contractor shall remove such material to the required width and depth and replace it with thoroughly compacted select fill, and/or crushed stone or screened gravel as indicated by the Engineer. Payment for such additional work ordered by the Engineer shall be made as an extra by a Change Order in accordance with the General Conditions and Division 1. No payment will be made for subgrade disturbance caused by inadequate dewatering or improper construction methods.

G. All cuts shall be brought to the grade and cross section shown on the Drawings, or established by the Engineer, prior to final inspection and acceptance by the Engineer.

H. Slides and overbreaks which occur due to negligence, carelessness or improper construction techniques on the part of the Contractor shall be removed and disposed of by the Contractor as indicated by the Engineer at no additional cost to the Owner. If grading operations are suspended for any reason whatsoever, partially completed cut and fill slopes shall be brought to the required slope and the work of seeding and mulching or other required erosion and sedimentation control operations shall be performed.
I. Where the excavation exposes sludge, sludge contaminated soil or other odorous materials, the Contractor shall cover such material at the end of each workday with a minimum of 6-inches and a maximum of 24-inches of clean fill. The work shall be an odor abatement measure and the material shall be placed to the depth deemed satisfactory by the Engineer for this purpose.

3.03 EXCAVATION SUPPORT

A. The Contractor shall furnish, place, and maintain such excavation support which may be required to support sides of excavation or to protect pipes and structures from possible damage and to provide safe working conditions. If the Engineer is of the opinion that at any point sufficient or proper supports have not been provided, he may order additional supports put in at the expense of the Contractor. The Contractor shall be responsible for the adequacy of all supports used and for all damage resulting from failure of support system or from placing, maintaining and removing it.

B. Selection of and design of any proposed excavation support systems is exclusively the responsibility of the Contractor. Contractor shall submit drawings and calculations on proposed systems sealed by a Professional Engineer currently registered in the State of California.

C. The Contractor shall exercise caution in the installation and removal of supports to insure that excessive or unusual loadings are not transmitted to any new or existing structure. The Contractor shall promptly repair at his expense any and all damage that can be reasonably attributed to installation or removal of excavation support system.

D. Contractor shall monitor movement in the excavation support systems as well as movement at adjacent structures, utilities and roadways near excavation supports. Contractor shall submit a monitoring plan developed by the excavation support design engineer. All pre-construction condition assessment and documentation of adjacent structures on-site and off-site shall be performed by the Contractor. If any sign of distress such as cracking or movement occurs in any adjacent structure, utility or roadway during installation of supports, subsequent excavation, service period of supports, subsequent backfill and construction, or removal of supports, Engineer shall be notified immediately. Contractor shall be exclusively responsible for repair of any damage to any roadway, structure, utility, pipes, etc. both on-site and off-site, as a result of his operations.

E. All excavation supports shall be removed upon completion of the work except as indicated herein. The Engineer may permit supports to be left in place at the request and expense of the Contractor. The Engineer may order certain supports left permanently in place in addition to that required by the Contract. The cost of the materials so ordered left in place, less a reasonable amount for the eliminated expense of the removal work omitted, will be paid as an extra by a Change Order in accordance with the General Conditions and Division 1. Any excavation supports left in place shall be cut off at least two (2) feet below the finished ground surface or as directed by the Engineer.

3.04 PROTECTION OF SUBGRADE

A. To minimize the disturbance of bearing materials and provide a firm foundation, the Contractor shall comply with the following requirements:
1. Use of heavy rubber-tired construction equipment shall not be permitted on the final subgrade unless it can be demonstrated that drawdown of groundwater throughout the entire area of the structure is at least 3 feet below the bottom of the excavation (subgrade). Even then, the use of such equipment shall be prohibited should subgrade disturbance result from concentrated wheel loads.

2. Subgrade soils disturbed through the operations of the Contractor shall be excavated and replaced with compacted select fill or crushed stone at the Contractor's expense as indicated by the Engineer.

3. The Contractor shall provide positive protection against penetration of frost into materials below the bearing level during work in winter months. This protection can consist of a temporary blanket of straw or salt hay covered with a plastic membrane or other acceptable means.

3.05 PROOFROLLING

A. The subgrade of all structures and all areas that will support pavements or select fill shall be proofrolled. After stripping of topsoil, excavation to subgrade and prior to placement of fills, the exposed subgrade shall be carefully inspected by probing and testing as needed. Any topsoil or other organic material still in place, frozen, wet, soft, or loose soil, and other undesirable materials shall be removed. The exposed subgrade shall be proofrolled with a heavily loaded tandem-wheeled dump truck to check for pockets of soft material hidden beneath a thin crust of better soil. Any unsuitable materials thus exposed shall be removed and replaced with an approved compacted material.

3.06 DEWATERING

A. The Contractor shall do all dewatering as required for the completion of the work. Procedures for dewatering proposed by the Contractor shall be submitted to the Engineer for review prior to any earthwork operations. All water removed by dewatering operations shall be disposed of in accordance with the National Pollutant Discharge Elimination System.

B. The dewatering system shall be of sufficient size and capacity as required to control groundwater or seepage to permit proper excavation operations, embankment construction and reconstruction, subgrade preparation, and to allow concrete to be placed in a dry condition. The system shall include a sump system or other equipment, appurtenances and other related earthwork necessary for the required control of water. The Contractor shall drawdown groundwater to at least 3 feet below the bottom of excavations (subgrade) at all times in order to maintain a dry and undisturbed condition.

C. The Contractor shall control, by acceptable means, all water regardless of source. Water shall be controlled and its disposal provided for at each berm, structure, etc. The entire periphery of the excavation areas shall be ditched and diked to prevent water from entering the excavation. The Contractor shall be fully responsible for disposal of the water and shall provide all necessary means at no additional expense to the Owner. The Contractor shall be solely responsible for proper design, installation, proper operation, maintenance, and any failure of any component of the system.

D. The Contractor shall be responsible for and shall repair without cost to the Owner, any damage to work in place and the excavation, including damage to the bottom due to heave and including removal of material and pumping out of the excavated area. The Contractor
shall be responsible for damages to any other area or structure caused by his failure to maintain and operate the dewatering system proposed and installed by the Contractor.

E. The Contractor shall take all the steps that he considers necessary to familiarize himself with the surface and subsurface site conditions, and shall obtain the data that is required to analyze the water and soil environment at the site and to assure that the materials used for the dewatering systems will not erode, deteriorate, or clog to the extent that the dewatering systems will not perform properly during the period of dewatering. Copies of logs of borings and laboratory test results are available to the Contractor. This data is furnished for information only, and it is expressly understood that the Owner and Engineer will not be held responsible for any interpretations or conclusions drawn therefrom by the Contractor.

F. Prior to the execution of the work, the Contractor, Owner and Engineer shall jointly survey the condition of adjoining structures. Photographs and records shall be made of any prior settlement or cracking of structures, pavements, and the like, that may become the subject of possible damage claims.

3.07 EMBANKMENTS

A. The Contractor shall perform the construction of embankments in such a manner that cut and fill slopes will be completed to final slopes and grade in a continuous operation. The operation of removing excavation material from any cut and the placement of embankment in any fill shall be a continuous operation to completion unless otherwise permitted by the Engineer.

B. Surfaces upon which embankments are to be constructed shall be stripped of topsoil, organic material, rubbish and other extraneous materials. After stripping and prior to placing embankment material, the Contractor shall compact the top 12-inches of in place soil as specified under Paragraph 3.09, COMPACTION.

C. Any soft or unsuitable materials revealed before or during the in place compaction shall be removed as indicated by the Engineer and/or materials testing consultant and replaced with select fill.

D. Ground surfaces on which embankment is to be placed, shall be scarified or stepped in a manner which will permit bonding of the embankment with the existing surface. The embankment soils shall be as specified under Part 2 - Products, and shall be deposited and spread in successive, uniform, approximately horizontal layers not exceeding 8-inches in compacted depth for the full width of the cross section, and shall be kept approximately level by the use of effective spreading equipment. Hauling shall be distributed over the full width of the embankment, and in no case will deep ruts be allowed to form during the construction of the embankment. The embankment shall be properly drained at all times. Each layer of the embankment shall be thoroughly compacted to the density specified under Paragraph 3.09, COMPACTION.

E. The embankment or fill material in the layers shall be of the proper moisture content before rolling to obtain the prescribed compaction. Wetting or drying of the material and manipulation when necessary to secure a uniform moisture content throughout the layer shall be required. Should the material be too wet to permit proper compaction or rolling, all work on all portions of the embankment thus affected shall be delayed until the material has dried to the required moisture content. Samples of all embankment materials for testing, both before and after placement and compaction, will be taken at frequent intervals. From
these tests, corrections, adjustments, and modifications of methods, materials, and moisture content will be made to construct the embankment.

F. Where embankments are to be placed and compacted on hillsides, or when new embankment is to be compacted against embankments, or when embankment is built in part widths, the slopes that are steeper than 4:1 shall be loosened or plowed to a minimum depth of 6 inches or, if in the opinion of the Engineer, the nature of the ground is such that greater precautions should be taken to bind the fill to the original ground then benches shall be cut in the existing ground as indicated by Engineer.

G. When rock and other embankment material are excavated at approximately the same time, the rock shall be incorporated into the outer portions of the embankments and the other material which meets the requirements for select fill shall be incorporated into the formation of the embankments. Stones or fragmentary rock larger than 4-inches in their greatest dimension will not be allowed within the top 6-inches of the final grade. Stones, fragmentary rock, or boulders larger than 12-inches in their greatest dimension will not be allowed in any portions of embankments and shall be disposed of by the Contractor as indicated by the Engineer. When rock fragments or stone are used in embankments, the material shall be brought up in layers as specified or directed and every effort shall be exerted to fill the voids with finer material to form a dense, compact mass which meets the densities specified for embankment compaction.

3.08 BACKFILLING

A. All structures and pipes shall be backfilled with the type of materials shown on the Drawings and specified herein. Select fill shall be deposited in successive, uniform, approximately horizontal layers not exceeding 8-inches in compacted depth for the full width. Stones or fragmentary rock larger than 4-inches in their greatest dimension will not be allowed within the top 6-inches of the ground nor within 6 inches of pipes. No stone or fragmentary rock larger than 12-inches in their greatest dimension will be allowed for any portion of backfill. Compaction shall be in accordance with the requirements of Paragraph 3.09, COMPACTION.

B. Where excavation support is used, the Contractor shall take all reasonable measures to prevent loss of support beneath and adjacent to pipes and existing structures when supports are removed. If significant volumes of soil cannot be prevented from clinging to the extracted supports, the voids shall be continuously backfilled as rapidly as possible. The Contractor shall thereafter limit the depth below subgrade that supports will be installed in similar soil conditions or employ other appropriate means to prevent loss of support.

3.09 COMPACTION

A. The Contractor shall compact embankments, backfill, crushed stone, aggregate base, and in place subgrade in accordance with the requirements of this Section. The densities specified herein refer to percentages of maximum density as determined by the noted test methods. Compaction of materials on the project shall be in accordance with the following schedule:

<table>
<thead>
<tr>
<th>Embankments Beneath Structures*</th>
<th>Density % Std. Proctor (D698)</th>
<th>Density % Mod. Proctor (D1557)</th>
<th>Max. Lift Thickness as Compacted Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>98</td>
<td>95</td>
<td>8</td>
</tr>
</tbody>
</table>

20125-003:04/26/2019 02200-9 WRD Calcium Chloride Expansion
<table>
<thead>
<tr>
<th></th>
<th>Density % Std. Proctor (D698)</th>
<th>Density % Mod. Proctor (D1557)</th>
<th>Max. Lift Thickness as Compacted Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other Embankments</td>
<td>95</td>
<td>92</td>
<td>8</td>
</tr>
<tr>
<td>Backfill Around Structures</td>
<td>95</td>
<td>92</td>
<td>8</td>
</tr>
<tr>
<td>Backfill in Pipe Trenches</td>
<td>95</td>
<td>92</td>
<td>8</td>
</tr>
<tr>
<td>Crushed Stone Beneath Structures</td>
<td>**</td>
<td>**</td>
<td>12</td>
</tr>
<tr>
<td>Select Sand</td>
<td>--</td>
<td>98</td>
<td>8</td>
</tr>
<tr>
<td>Aggregate Base Course (ABC) Beneath Pavements and Structures</td>
<td>--</td>
<td>98</td>
<td>8</td>
</tr>
<tr>
<td>Crushed Stone Backfill</td>
<td>**</td>
<td>**</td>
<td>12</td>
</tr>
<tr>
<td>Crushed Stone Pipe Bedding</td>
<td>**</td>
<td>**</td>
<td>12</td>
</tr>
<tr>
<td>In place Subgrade Beneath Structures</td>
<td>98</td>
<td>95</td>
<td>Top 12-inches</td>
</tr>
</tbody>
</table>

* Embankments beneath structures shall be considered to include a zone 10 feet out from the foundation of the structure extending down to the natural ground on a 45° slope.

** The aggregate shall be compacted to a degree acceptable to the Engineer by use of a vibratory compactor and/or crawler tractor.

B. Field density tests will be made by the materials testing consultant to determine if the specified densities have been achieved, and these tests shall be the basis for accepting or rejecting the compaction. In-place density tests will be performed in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 2922. The Engineer in conjunction with the materials testing consultant will be the judge as to which test method will be the most appropriate. Failure to achieve the specified densities shall require the Contractor to re-compact the material or remove it as required. The Contractor shall, if necessary, increase his compactive effort by increasing the number of passes, using heavier or more suitable compaction equipment, or by reducing the thickness of the layers. The Contractor shall adjust the moisture contents of the soils to bring them within the optimum range by drying them or adding water as required.

C. Testing will be performed as frequently as deemed necessary by the Engineer and/or materials testing consultant. As a minimum, one in-place density test shall be performed for each 1000 cubic yards of embankment placed and 500 cubic yards of backfill placed or one test performed each day for either.

3.10 REMOVAL OF EXCESS AND UNSUITABLE MATERIALS

A. The Contractor shall remove and dispose of off-site all unsuitable materials. Within thirty (30) consecutive days after Notice to Proceed, the Contractor shall submit to the Engineer for review all required permits and a list of disposal sites for the unsuitable materials. If the disposal site is located on private property, the submittal shall also include written permission from the owner of record.
B. All unsuitable materials shall be disposed of in locations and under conditions that comply with federal, state and local laws and regulations.

C. The Contractor shall obtain an off-site disposal area prior to beginning demolition or excavation operations.

D. All excess and unsuitable materials shall be hauled in trucks of sufficient capacity and tight construction to prevent spillage. Trucks shall be covered to prevent the propagation of dust.

E. When all excess and unsuitable material disposal operations are completed, the Contractor shall leave the disposal sites in a condition acceptable to the Owner and Owner(s) of the disposal site(s).

3.11 BORROW EXCAVATION

A. Description

The work covered by this section consists of the excavation of approved material from borrow sources and the hauling and utilization of such material as required on the Drawings or directed by the Engineer. It shall also include the removing, stockpiling, and replacement of topsoil on the borrow source; the satisfactory disposition of material from the borrow source which is not suitable for use; and the satisfactory restoration of the borrow source and haul roads to an acceptable condition upon completion of the work.

Borrow excavation shall not be used before all available suitable unclassified excavation has been used for backfill and incorporated into the embankments.

B. Coordination with Seeding Operations

The Contractor shall coordinate the work covered by this section with the construction of embankments so that the requirements of Section 02200 are met.

C. Materials

All material shall meet the requirements of Division 2 shown below:

Borrow Material .........................Section 02200, Subsection 2.01 - Select Fill

D. Construction Methods

1. General

The surface of the borrow area shall be thoroughly cleared and grubbed and cleaned of all unsuitable material including all organics, topsoil, etc., before beginning the excavation. Disposal of material resulting from clearing and grubbing shall be in accordance with Section 02100.

Each borrow operation shall not be allowed to accumulate exposed, erodible slope area in excess of 1 acre at any one given time without the Contractor's beginning permanent seeding and mulching of the borrow source or other erosion control measures as may be approved by the Engineer.
The topsoil shall be removed and stockpiled at locations that will not interfere with the borrow operations and that meet the approval of the Engineer. Temporary erosion control measures shall be installed as may be necessary to prevent the erosion of the stockpile material. Once all borrow has been removed from the source or portion thereof, the stockpiled topsoil shall be spread uniformly over the source.

Where it is necessary to haul borrow material over existing roads, the Contractor shall use all necessary precautions to prevent damage to the existing roads. The Contractor shall also conduct his hauling operations in such a manner as to not interfere with the normal flow of traffic and shall keep the traffic lanes free from spillage at all times.

2. Owner Furnished Sources

Where borrow sources are furnished by the Owner the location of such sources will be as designated on the Drawings or as directed by the Engineer.

The Owner will furnish the necessary haul road right-of-way at locations designated by the Engineer. All haul roads required shall be built, maintained, and when directed by the Engineer, obliterated, at no cost to the Owner. Where the haul road is to be reclaimed for cultivation the Contractor shall plow or scarify the area to a minimum depth of 8 inches.

The borrow sources shall be left in a neat and presentable condition after use. All slopes shall be smoothed, rounded, and constructed not steeper than 3:1. Where the source is to be reclaimed for cultivation the source shall be plowed or scarified to a minimum depth of 8 inches, disc harrowed, and terraces constructed. The source shall be graded to drain such that no water will collect or stand and a functioning drainage system shall be provided.

All sources shall be seeded and mulched in accordance with Section 02910.

3. Contractor Furnished Sources

Prior to the approval of any off-site borrow source(s) developed for use on this project, the Contractor shall obtain certification from the State Historic Preservation Officer of the State Department of Cultural Resources certifying that the removal of the borrow material from the borrow source(s) will have no effect on any known district, site building, structure, or object that is included or eligible for inclusion in the National Register of Historic Places. A copy of this certification shall be furnished to the Engineer prior to performing any work on the proposed borrow source.

The approval of borrow sources furnished by the Contractor shall be subject to the following conditions:

a. The Contractor shall be responsible for acquiring the right to take the material and any rights of access that may be necessary; for locating and developing the source; and any clearing and grubbing and drainage ditches necessary.
Such right shall be in writing and shall include an agreement with the Owner that the borrow source may be dressed, shaped, seeded, mulched, and drained as required by these Specifications after all borrow has been removed.

b. Except where borrow is to be obtained from a commercial source, the Contractor and the property owner shall jointly submit a borrow source development, use, and reclamation plan to the Engineer for his approval prior to engaging in any land disturbing activity on the proposed source other than material sampling that may be necessary. The Contractor's plan shall address the following:

(1) Drainage

The source shall be graded to drain such that no water will collect or stand and a functioning drainage system shall be provided. If drainage is not practical, and the source is to serve as a pond, the minimum average depth below the water table shall be 4 feet or the source graded so as to create wetlands as appropriate.

(2) Slopes

The source shall be dressed and shaped in a continuous manner to contours which are comparable to and blend in with the adjacent topography, but in no case will slopes steeper than 3:1 be permitted.

(3) Erosion Control

The plan shall address the temporary and permanent measures that the Contractor intends to employ during use of the source and as a part of the reclamation. The Contractor's plan shall provide for the use of staged permanent seeding and mulching on a continual basis while the source is in use and the immediate total reclamation of the source when no longer needed.

4. Maintenance

During construction and until final acceptance the Contractor shall use any methods approved by the Engineer which are necessary to maintain the work covered by this section so that the work will not contribute to excessive soil erosion.

- END OF SECTION -
SECTION 02207
AGGREGATE MATERIALS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish all labor, equipment and materials required to complete all work associated with the installation of aggregate material beneath foundations, as backfill and as roadway subgrades and other related and incidental work as required to complete the work shown on the Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01090 - Reference Standards
B. Section 02200 - Earthwork

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the Specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. California Department of Transportation (CalTrans) Standard Specifications for Roads and Structures
2. ASTM C 127 Test for Specific Gravity and Absorption of Coarse Aggregate.
3. ASTM C 136 Test for Sieve Analysis of Fine and Coarse Aggregates.
4. ASTM C 535 Test for Resistance to Degradation of Large Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300, Submittals.

1. Materials gradation and certification.
2. ASTM C127, ASTM C136, and ASTM C535 test results

PART 2 -- PRODUCTS

2.01 CRUSHED STONE, SCREENED GRAVEL and AGGREGATE BASE COURSE (ABC)
A. Crushed stone or screened gravel shall meet the requirements of Class 2 Aggregate as
defined by CalTrans Standard Specifications.

B. ABC shall meet the requirements of ABC as defined by CalTrans Standard Specifications.

2.02 SELECT SAND

A. Select sand shall meet the requirements of the CalTrans Standard Specifications for
materials and gradation. The size used shall be Standard Size No. 2S or 2MS as listed and

PART 3 -- EXECUTION

3.01 CRUSHED STONE, SCREENED GRAVEL AND AGGREGATE BASE COURSE (ABC)

A. Contractor shall install crushed stone, screened gravel and ABC in accordance with the
CalTrans Standard Specifications and as shown on the Drawings and indicated in the
Contract Documents.

1. Unless otherwise stated herein or shown on the Drawings, all mat foundations
(bottom slabs) for the proposed structures shall have a blanket of crushed stone or
ABC 6-inches thick minimum placed directly beneath the proposed mat. The blanket
shall extend a minimum of 12 inches beyond the extremities of the mat.

2. For subgrade preparation at structures and structural fill, the foundation material
shall be ABC where specifically specified on Drawings, otherwise, crushed stone or
screened gravel shall be used.

3. For ground under drains, pipe bedding, and drainage layers beneath structures the
coarse aggregate shall meet the requirements of aggregate standard Size No. 57 or
No. 67, as defined by CalTrans Standard Specifications.

3.02 SELECT SAND

A. Contractor shall install select sand in accordance with the CalTrans Standard Specifications
and as shown on the Drawings and indicated in the Contract Documents.

- END OF SECTION -
SECTION 02500
SURFACE RESTORATION

PART 1 -- GENERAL

1.01 THE REQUIREMENT
A. Provide all labor, equipment, and materials necessary for final grading, topsoil placement, and miscellaneous site work not included under other Sections but required to complete the work as shown on the Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE
A. Section 02200 - Earthwork

PART 2 -- MATERIALS

2.01 TOPSOIL
A. Topsoil shall meet the requirements of Section 02200 – Earthwork.

PART 3 -- EXECUTION

3.01 FINAL GRADING
A. Following approval of rough grading the subgrade shall be prepared as follows:
   1. For riprap, bare soil 24 inches below finish grade or as directed by Engineer.
   2. For topsoil, scarify 2-inches deep at 4 inches below finish grade.

3.02 TOPSOIL PLACEMENT
A. Topsoil shall be placed over all areas disturbed during construction under any contract except those areas which will be paved, graveled or rip rapped.
B. Topsoil shall be spread in place for lawn and road shoulder seed areas at a 4-inch consolidated depth and at a sufficient quantity for plant beds and backfill for shrubs and trees.
C. Topsoil shall not be placed in a frozen or muddy condition.
D. Final surface shall be hand or mechanically raked to an even finished surface to finish grade as shown on Drawings.
E. All stones and roots over 4-inches and rubbish and other deleterious materials shall be removed and disposed of.
- END OF SECTION -
SECTION 02510
PAVING AND SURFACING

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish all labor, equipment and materials and perform all operations in connection with the construction of asphalt concrete pavement, asphalt concrete overlay, reinforced concrete pavement, gravel roads, concrete curb and gutter, repair and reconstruction of existing asphalt concrete pavement, repair of existing gravel roads, and pavement markings complete as specified herein and as detailed on the Drawings.

B. All new roads including the replacement of portions of the existing roads shall be to the limits, grades, thicknesses and types as shown on the Drawings. Patches for pipe crossings and areas damaged during the construction work shall be asphalt and/or gravel, depending upon the material encountered, unless otherwise indicated.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Requirements of related work are included in Division 1, Division 2 and Division 3 of these Specifications.

1.03 RELATED SECTIONS

A. Section 02200 - Earthwork

B. Section 03300 - Cast-In-Place Concrete

1.04 STANDARD SPECIFICATIONS

A. Except as otherwise provided in the Specifications or on the plans, all work shall be in accordance with the California Department of Transportation Standard Specifications for Roads and Structures, latest edition except that any reference to "CalTrans", "Department" or "Unit" shall mean the "Owner".

B. Except with the approval of the Engineer, the placing of concrete or asphalt concrete surface paving shall be subject to the Seasonal and Weather Restrictions set forth in CalTrans

PART 2 -- MATERIALS

2.01 SELECT FILL

A. The Contractor shall place select fill as necessary to complete the embankments, shoulders, subgrade foundation and replacement for removed unsuitable material in accordance with California Department of Transportation Standard Specifications, and Section 02200, Earthwork.
2.02 GRAVEL

A. All work, including materials, associated with gravel shall be in accordance with CalTrans.

2.03 AGGREGATE STABILIZATION

A. All work, including materials, associated with Aggregate Stabilization shall be in accordance with CalTrans.

2.04 AGGREGATE BASE COURSE (ABC)

A. All work, including materials, associated with Aggregate Base Course shall be in accordance with CalTrans.

2.05 ASPHALT BINDER FOR PLANT MIX

A. All work, including materials, associated with asphalt binder shall be in accordance with Section 620, Asphalt Binder for Plant Mix, Grade PG 64-22, of the CalTrans Standard Specifications for Roads and Structures, except Articles 620-4 and 620-5 shall be deleted.

2.06 ASPHALT PAVEMENTS

A. All work, including materials, associated with asphalt pavement shall be in accordance with Section 610, Asphalt Concrete Plant Mix Pavements, of the CalTrans Standard Specifications for Roads and Structures, except Articles 610-15 and 610-16 shall be deleted. Surface Course shall be Superpave S-9.5B, Intermediate Course shall be Superpave I-19.0B, and Base Course shall be Superpave B-25.0C. Asphalt pavement mix designs shall be in accordance with California Department of Transportation Standard Specifications.

B. The job mix formulas shall be delivered to the Engineer at least two (2) weeks prior to beginning paving operations.

2.07 RIGID PORTLAND CEMENT CONCRETE PAVEMENT

A. All work, including materials associated with rigid concrete pavement shall be in accordance with Section 03300, Cast-In-Place Concrete. Class A concrete shall be used. Placement shall be in accordance with Section 03300 and CalTrans.

2.08 RIGID CONCRETE PAVEMENT REINFORCING

A. Reinforcing, if specified, shall be as shown on the Structural Drawings and as specified under Section 03200, Reinforcing Steel.
2.09 CONCRETE CURB AND GUTTERS

A. Concrete shall be Class B in accordance with the requirements of Section 03300, Cast-In-Place Concrete, except that concrete shall be air-entrained to provide an air content of 6% ± 1.5%.

B. Premolded expansion joint filler for expansion joints shall conform to ASTM D 1751 and shall be 1/2-inch thick, minimum.

2.10 ASPHALT TACK COAT

A. All work, including materials, associated with asphalt tack coat shall be in accordance with CalTrans Specifications.

PART 3 -- EXECUTION

3.01 EMBANKMENT

A. The embankment shall be constructed in accordance with Section 02200, Earthwork.

3.02 SUBGRADE

A. The subgrade, where shown on the Drawings, shall be aggregate stabilized by the addition and mixing of coarse aggregate with the top 3-inches of subgrade in accordance with CalTrans Specifications. Aggregate stabilization shall be applied to the subgrade at a rate of 300-pounds per square yard. Following the application of stabilizer aggregate, the subgrade shall be formed true to crown and grade, and shall be compacted with a minimum of four (4) passes of a 15-ton vibratory roller to conform to the maximum densities determined by AASHTO T99 Standard Specifications.

3.03 BASE COURSE

A. The finished base course of all paving shall be ABC and shall be of the thickness shown on the Drawings, formed true to crown and grade. Gravel roads, including repair to existing gravel roads shall be ABC and shall be of the thicknesses shown on the Drawings, formed true to crown and grade. No fill material except new ABC shall be placed on top of existing gravel.

3.04 ASPHALT BASE COURSE (OR INTERMEDIATE COURSE)

A. Asphalt Concrete Base (or Intermediate) Course shall be placed in accordance with California Department of Transportation Standard Specifications, Spreading and Finishing. Asphalt Concrete Base (or Intermediate) Course shall be compacted in accordance with California Department of Transportation Standard Specifications, Compaction. Thicknesses shall be as shown on the Drawings.
3.05 ASPHALT CONCRETE SURFACE COURSE

A. Prior to placement of the asphalt concrete surface course, the base/intermediate course shall be inspected for damage or defects and repaired to the satisfaction of the Engineer. The surface of the base/intermediate course shall be approved by the Engineer.

B. The asphalt tack coat shall be applied to the surface of the approved base/binder course as described in CalTrans. Equipment for applying the tack coat shall be power-oriented pressure spraying or distributing equipment suitable for the materials to be applied and approved by the Engineer.

C. The Asphalt Concrete Surface Course shall be placed and compacted on the base/intermediate course in layers not to exceed 2-inches and at the rate of 110-pounds per square yard per inch. Surface Course shall be compacted in accordance with California Department of Transportation Standard Specifications. Thicknesses shall be as shown on the Drawings.

3.06 RIGID PORTLAND CEMENT CONCRETE

A. The subgrade and base course beneath portland cement concrete pavement shall be prepared in accordance with the applicable Sections of these Specifications and referenced Standard Specifications, except that the Contractor shall use an approved automatically controlled fine grading machine to produce final subgrade and base surfaces meeting the lines, grades, and cross sections (thicknesses) shown on the Drawings or established by the Engineer.

B. The surface of the base shall be damp at the time the concrete is placed. The Contractor shall sprinkle the base when necessary to provide a damp surface. The Contractor shall satisfactorily correct all soft areas in the subgrade or base prior to placing concrete.

C. Hauling over the base course shall not be allowed except where specifically permitted by and in writing by the Engineer. The Engineer may allow equipment dumping concrete to operate on the base to the extent and under the conditions the Engineer deems necessary to facilitate placing and spreading the concrete.

D. Installation of the rigid concrete pavement shall be in accordance with the details shown on the Drawings and Division 3 - Concrete. The rigid concrete pavement shall cure a minimum of ten (10) calendar days and until the concrete has attained a minimum flexural strength of 550 psi as indicated by flexural strength testing. The Contractor shall coordinate and pay for all flexural strength testing with a minimum of four (4) 6-inch by 6-inch by 20-inch beams for every fifty (50) cubic yards of pavement concrete installed.

E. Contraction joints shall be spaced at intervals as shown on the Drawings. Transverse contraction joints shall be formed by an approved joint insert. Expansion joints shall be placed when the pavement abuts a structure using 1-inch expansion joint material (filler) and sealant as specified herein.
3.07 CONCRETE CURB AND GUTTER

A. The expansion joint filler for concrete curb and gutters shall be cut to conform with the cross section of the curb. Expansion joints shall be spaced at intervals of not more than 25-feet. Formed control joints shall be installed at intervals not exceeding 10 feet. Depth of joint shall be 1/3 the thickness. Curved forms shall be used where radii are indicated; straight segments shall not be permitted. Upon removal of the forms, exposed curb faces shall be immediately rubbed down to a smooth and uniform surface. No plastering shall be permitted.

3.08 UNDERGROUND UTILITY LINES

A. Where an underground utility line is beneath the new roadway, the backfilling shall be carried out with special care, and the final consolidation shall be accomplished by a vibratory roller. Construction of the roadway over the trench shall be deferred as long as practicable.

3.09 JUNCTION WITH OTHER PAVING

A. Where new asphalt concrete pavement abuts existing asphalt concrete pavement, the existing pavement shall be cut back to insure obtaining the specified compaction of the new pavement courses and interlocking adjoining courses. Existing subbase courses shall be cut back from the subgrade level of the new pavement on a one-on-one slope into the existing pavement, and the asphalt courses of the existing pavement shall be removed for an additional 6-inches back from the slope. The edge of the existing asphalt courses shall be saw cut straight and true. The faces between new and existing asphalt courses shall receive an application of tack coat.

B. Where new rigid concrete pavement abuts existing rigid concrete or asphalt concrete paving, the existing paving shall be saw cut straight and true. An expansion joint of a 1/2-inch minimum thickness with filler material and sealant shall be placed between the new concrete pavement and the existing rigid concrete or asphalt concrete paving.

3.10 ASPHALT CONCRETE OVERLAY

A. Where asphalt concrete is proposed to be placed over an existing asphalt or rigid concrete surface, the surfaces shall be thoroughly cleaned by power brooming and a tack coat shall be applied in accordance with CalTrans Specifications, prior to installing the overlay. The overlay shall be applied in accordance with Subsections 2.06 and 3.05 and Standard Details shown on the Drawings.

-END OF SECTION-
SECTION 03100
CONCRETE FORMWORK

PART 1 -- GENERAL

1.01 THE REQUIREMENT
A. Provide materials, labor, and equipment required for the design and construction of all concrete formwork, bracing, shoring and supports in accordance with the provisions of the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE
A. Section 03200 - Reinforcing Steel
B. Section 03250 - Concrete Accessories
C. Section 03290 - Joints in Concrete
D. Section 03300 - Cast-in-Place Concrete

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS
A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.
1. California Building Code
2. ACI 318 - Building Code Requirements for Structural Concrete
3. ACI 301 - Specifications for Structural Concrete for Buildings
4. ACI 347 - Recommended Practice for Concrete Formwork
5. U.S. Product Standard for Concrete Forms, Class I, PS 1
6. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials

1.04 SUBMITTALS
A. Submit the following in accordance with Section 01300, Submittals.
1. Manufacturer’s data on proposed form release agent
2. Manufacturer’s data on proposed formwork system including form ties
1.05 QUALITY ASSURANCE

A. Concrete formwork shall be in accordance with ACI 301, ACI 318, and ACI 347.

PART 2 -- PRODUCTS

2.01 FORMS AND FALSEWORK

A. All forms shall be smooth surface forms unless otherwise specified.

B. Wood materials for concrete forms and falsework shall conform to the following requirements:

1. Lumber for bracing, shoring, or supporting forms shall be Douglas Fir or Southern Pine, construction grade or better, in conformance with U.S. Product Standard PS20. All lumber used for forms, shoring or bracing shall be new material.

2. Plywood for concrete formwork shall be new, waterproof, synthetic resin bonded, exterior type Douglas Fir or Southern Pine high density overlaid (HDO) plywood manufactured especially for concrete formwork and shall conform to the requirements of PS1 for Concrete Forms, Class I, and shall be edge sealed. Thickness shall be as required to support concrete at the rate it is placed, but not less than 5/8-inch thick.

C. Other form materials such as metal, fiberglass, or other acceptable material that will not adversely affect the concrete and will facilitate placement of concrete to the shape, form, line and grade indicated may be submitted to the Engineer for approval, but only materials that will produce a smooth form finish equal or better than the wood materials specified will be considered.

2.02 FORMWORK ACCESSORIES

A. Form ties shall be provided with a plastic cone or other suitable means for forming a conical hole to insure that the form tie may be broken off back of the face of the concrete. The maximum diameter of removable cones for rod ties, or of other removable form-tie fasteners having a circular cross-section, shall not exceed 7/8-inch, and all such fasteners shall be such as to leave holes of regular shape for reaming.

B. Form ties for water-retaining structures shall have integral waterstops. Removable taper ties may be used when acceptable to the Engineer. A preformed mechanical EPDM rubber plug shall be used to seal the hole left after the removal of the taper tie. Plug shall be X-Plug by the Greenstreak Group, Inc., or approved equal. Friction fit plugs shall not be used.

C. Form release agent shall be a blend of natural and synthetic chemicals that employs a chemical reaction to provide quick, easy and clean release of concrete from forms. It shall not stain the concrete and shall leave the concrete with a paintable surface. Formulation of the form release agent shall be such that it would minimize formation of "bug holes" in cast-in-place concrete.
PART 3 -- EXECUTION

3.01 FORM DESIGN

A. Forms and falsework shall be designed for total dead load, plus all construction live load as outlined in ACI 347. Design and engineering of formwork and safety considerations during construction shall be the responsibility of the Contractor.

B. Forms shall be of sufficient strength and rigidity to maintain their position and shape under the loads and operations incident to placing and vibrating the concrete. The maximum deflection of facing materials reflected in concrete surfaces exposed to view shall be 1/240 of the span between structural members.

C. All forms shall be designed for predetermined placing rates per hour, considering expected air temperatures and setting rates.

3.02 CONSTRUCTION

A. The type, size, quality, and strength of all materials from which forms are made shall be subject to the approval of the Engineer. No falsework or forms shall be used which are not clean and suitable. Deformed, broken or defective falsework and forms shall be removed from the work.

B. Forms shall be smooth and free from surface irregularities. Suitable and effective means shall be provided on all forms for holding adjacent edges and ends of panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets, or similar surface defects in the finished concrete. Joints between the forms shall be sealed to eliminate any irregularities. The arrangement of the facing material shall be orderly and symmetrical, with the number of seams kept to a practical minimum.

C. Forms shall be true to line and grade, and shall be sufficiently rigid to prevent displacement and sagging between supports. Curved forms shall be used for curved and circular structures. Straight panels joined at angles will not be acceptable for forming curved structures. Forms shall be properly braced or tied together to maintain their position and shape under a load of freshly-placed concrete. Facing material shall be supported with studs or other backing which shall prevent both visible deflection marks in the concrete and deflections beyond the tolerances specified.

D. Forms shall be mortar tight so as to prevent the loss of water, cement and fines during placing and vibrating of the concrete. Specifically, the bottom of wall forms that rest on concrete footings or slabs shall be provided with a gasket to prevent loss of fines and paste during placement and vibration of concrete. Such gasket may be a 1 to 1-1/2 inch diameter polyethylene rod held in position to the underside of the wall form.

E. All vertical surfaces of concrete members shall be formed, and side forms shall be provided for all footings, slab edges and grade beams, except where placement of the concrete against the ground is called for on the Drawings. Not less than 1-inch of concrete shall be added to the thickness of the concrete member as shown where concrete is permitted to be placed against trimmed ground in lieu of forms. Such permission will be granted only for members of comparatively limited height and where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing until the concrete has been placed.
F. All forms shall be constructed in such a manner that they can be removed without hammering or prying against the concrete. Wood forms shall be constructed for wall openings to facilitate loosening and to counteract swelling of the forms.

G. Adequate clean-out holes shall be provided at the bottom of each lift of forms. Temporary openings shall be provided at the base of column forms and wall forms and at other points to facilitate cleaning and observation immediately before the concrete is deposited. The size, number and location of such clean-outs shall be as acceptable to the Engineer.

H. Construction joints shall not be permitted at locations other than those shown or specified, except as may be acceptable to the Engineer. When a second lift is placed on hardened concrete, special precautions shall be taken in the way of the number, location and tightening of ties at the top of the old lift and bottom of the new to prevent any unsatisfactory effect whatsoever on the concrete. For flush surfaces at construction joints exposed to view, the contact surface of the form sheathing over the hardened concrete in the previous placement shall be lapped by not more than 1 inch. Forms shall be held against hardened concrete to prevent offset or loss of mortar at construction joints and to maintain a true surface.

I. The formwork shall be cambered to compensate for anticipated deflections in the formwork due to the weight and pressure of the fresh concrete and due to construction loads. Set forms and intermediate screed strips for slabs accurately to produce the designated elevations and contours of the finished surface. Ensure that edge forms and screed strips are sufficiently strong to support vibrating screeds or roller pipe screeds if the nature of the finish specified requires the use of such equipment. When formwork is cambered, set screeds to a like camber to maintain the proper concrete thickness.

J. Positive means of adjustment (wedges or jacks) for shores and struts shall be provided and all settlement shall be taken up during concrete placing operation. Shores and struts shall be securely braced against lateral deflections. Wedges shall be fastened firmly in place after final adjustment of forms prior to concrete placement. Formwork shall be anchored to shores or other supporting surfaces or members to prevent upward or lateral movement of any part of the formwork system during concrete placement. If adequate foundation for shores cannot be secured, trussed supports shall be provided.

K. Runways shall be provided for moving equipment with struts or legs. Runways shall be supported directly on the formwork or structural member without resting on the reinforcing steel.

3.03 TOLERANCES

A. Unless otherwise indicated in the Contract Documents, formwork shall be constructed so that the concrete surfaces will conform to the tolerance limits listed in ACI 117.

B. Structural framing of reinforced concrete around elevators and stairways shall be accurately plumbed and located within 1/4 in. tolerance from established dimensions.
C. The Contractor shall establish and maintain in an undisturbed condition and until final completion and acceptance of the project, sufficient control points and bench marks to be used for reference purposes to check tolerances. Plumb and string lines shall be installed before concrete placement and shall be maintained during placement. Such lines shall be used by Contractor's personnel and by the Engineer and shall be in sufficient number and properly installed. During concrete placement, the Contractor shall continually monitor plumb and string line form positions and immediately correct deficiencies.

D. Regardless of the tolerances specified, no portion of the building shall extend beyond the legal boundary of the building.

3.04 FORM ACCESSORIES

A. Suitable moldings shall be placed to bevel or round all exposed corners and edges of beams, columns, walls, slabs, and equipment pads. Chamfers shall be 3/4 inch unless otherwise noted.

B. Form ties shall be so constructed that the ends, or end fasteners, can be removed without causing appreciable spalling at the faces of the concrete. After ends, or end fasteners of form ties have been removed, the embedded portion of the ties shall terminate not less than 2 inches from the formed face of the concrete that is exposed to water or enclosed surfaces above the water surface, and not less than 1 inch from the formed face of all other concrete. Holes left by the removal of form tie cones shall be reamed with suitable toothed reamers so as to leave the surface of the holes clean and rough before being filled with mortar as specified in Section 03350 - Concrete Finishing. No form-tying device or part thereof, other than metal, shall be left embedded in the concrete. Ties shall not be removed in such manner as to leave a hole extending through the interior of the concrete member. The use of snap-ties which cause spalling of the concrete upon form stripping or tie removal will not be permitted. No snap ties shall be broken off until the concrete is at least three days old. If steel panel forms are used, rubber grommets shall be provided where the ties pass through the form in order to prevent loss of cement paste.

3.05 APPLICATION - FORM RELEASE AGENT

A. Forms for concrete surfaces that will not be subsequently waterproofed shall be coated with a form release agent. Form release agent shall be applied on formwork in accordance with manufacturer's recommendations.

3.06 INSERTS AND EMBEDDED ITEMS

A. Sleeves, pipe stubs, inserts, anchors, expansion joint material, waterstops, and other embedded items shall be positioned accurately and supported against displacement prior to concreting. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable material to prevent the entry of concrete into the voids.

3.07 FORM CLEANING AND REUSE

A. The inner faces of all forms shall be thoroughly cleaned prior to concreting. Forms may be reused only if in good condition and only if acceptable to the Engineer. Light sanding between uses will be required wherever necessary to obtain uniform surface texture. Unused tie rod holes in forms shall be covered with metal caps or shall be filled by other methods acceptable to the Engineer.
3.08 FORM REMOVAL AND SHORING

A. Forms shall not be disturbed until the concrete has attained sufficient strength. Sufficient strength shall be demonstrated by structural analysis considering proposed loads, strength of forming and shoring system, and concrete strength data. Shoring shall not be removed until the supported member has acquired sufficient strength to support its weight and the load upon it. Members subject to additional loads during construction shall be adequately shored to sustain all resulting stresses. Forms shall be removed in such manner as not to impair safety and serviceability of the structure. All concrete to be exposed by form removal shall have sufficient strength not to be damaged thereby.

B. Provided the strength requirements specified above have been met and subject to the Engineer's approval, forms may be removed at the following minimum times. The Contractor shall assume full responsibility for the strength of all such components from which forms are removed prior to the concrete attaining its full design compressive strength. Shoring may be required at the option of the Engineer beyond these periods.

<table>
<thead>
<tr>
<th>Ambient Temperature (°F.) During Concrete Placement</th>
<th>Over 95°</th>
<th>70°-95°</th>
<th>60°-70°</th>
<th>50°-60°</th>
<th>Below 50°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walls</td>
<td>5 days</td>
<td>2 days</td>
<td>2 days</td>
<td>3 days</td>
<td>Do not remove until directed by Engineer (7 days minimum)</td>
</tr>
<tr>
<td>Columns</td>
<td>7 days</td>
<td>2 days</td>
<td>3 days</td>
<td>4 days</td>
<td></td>
</tr>
<tr>
<td>Beam Soffits</td>
<td>10 days</td>
<td>7 days</td>
<td>7 days</td>
<td>7 days</td>
<td></td>
</tr>
<tr>
<td>Elevated Slabs</td>
<td>12 days</td>
<td>7 days</td>
<td>7 days</td>
<td>7 days</td>
<td></td>
</tr>
</tbody>
</table>

C. When, in the opinion of the Engineer, conditions of the work or weather justify, forms may be required to remain in place for longer periods of time.

D. An accurate record shall be maintained by the Contractor of the dates of concrete placings and the exact location thereof and the dates of removal of forms. These records shall be available for inspection at all times at the site, and two copies shall be furnished the Engineer upon completion of the concrete work.

3.09 RESHORING

A. When reshoring is permitted or required the operations shall be planned in advance and subjected to approval by the Engineer.

B. Reshores shall be placed after stripping operations are complete but in no case later than the end of the working day on which stripping occurs.

C. Reshoring for the purpose of early form removal shall be performed so that at no time will large areas of new construction be required to support their own weight. While reshoring is under way, no construction or live loads shall be permitted on the new construction. Reshores shall be tightened to carry their required loads but they shall not be overtightened so that the new construction is overstressed. Reshores shall remain in place until the concrete has reached its specified 28-day strength, unless otherwise specified.
D. For floors supporting shores under newly placed concrete, the original supporting shores shall remain in place or reshores shall be placed. The shoring or reshoring system shall have a capacity sufficient to resist the anticipated loads and in all cases shall have a capacity equal to at least one-half of the capacity of the shoring system above. Reshores shall be located directly under a reshore position above unless other locations are permitted.

E. In multi-story buildings, reshoring shall extend over a sufficient number of stories to distribute the weight of newly placed concrete, forms, and construction live loads so the design superimposed loads of the floors supporting shores are not exceeded.

- END OF SECTION -
PART 1 -- GENERAL

1.01 THE REQUIREMENTS

A. Provide all concrete reinforcing including all cutting, bending, fastening and any special work necessary to hold the reinforcing steel in place and protect it from injury and corrosion in accordance with the requirements of this section.

B. Provide deformed reinforcing bars to be grouted into reinforced concrete masonry walls.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03100 - Concrete Formwork

B. Section 03250 - Concrete Accessories

C. Section 03300 - Cast-in-Place Concrete

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. California Building Code
2. CRSI - Concrete Reinforcing Institute Manual of Standard Practice
3. ACI SP66 - ACI Detailing Manual
4. ACI 315 - Details and Detailing of Concrete Reinforcing
5. ACI 318 - Building Code Requirements for Structural Concrete
6. ICC-ES AC193 - Acceptance Criteria for Expansion and Screw Anchors (Concrete)
8. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcing
9. ASTM A 1064 - Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300, Submittals.

1. Detailed placing and shop fabricating drawings, prepared in accordance with ACI 315 and ACI Detailing Manual - (SP66), shall be furnished for all concrete reinforcing. These drawings shall be made to such a scale as to clearly show joint locations, openings, and the arrangement, spacing and splicing of the bars.

2. Mill test certificates - 3 copies of each.

3. Description of the reinforcing steel manufacturer's marking pattern.

4. Requests to relocate any bars that cause interferences or that cause placing tolerances to be violated.

5. Proposed supports for each type of reinforcing.

6. Request to use splices not shown on the Drawings.

7. Request to use mechanical couplers along with manufacturer's literature on mechanical couplers with instructions for installation, and certified test reports on the couplers’ capacity.

8. Request for placement of column dowels without the use of templates.

9. Request and procedure to field bend or straighten partially embedded reinforcing.


11. Certification that all installers of dowel adhesive are certified as Adhesive Anchor Installers in accordance with the ACI-CRSI Anchor Installer Certification Program.

12. Adhesive dowel testing plan.

1.05 QUALITY ASSURANCE

A. If requested by the Engineer, the Contractor shall provide samples from each load of reinforcing steel delivered in a quantity adequate for testing. Costs of initial tests will be paid by the Owner. Costs of additional tests due to material failing initial tests shall be paid by the Contractor.

B. Provide a list of names of all installers who are trained by the Manufacturer’s Field Representative on this jobsite prior to installation of products. Record must include the installer name, date of training, products included in the training and trainer name and contact information.

C. Provide a copy of the current ACI/CIRSI “Adhesive Anchor Installer” certification cards for all installers who will be installing adhesive anchors in the horizontal to vertically overhead orientation.
D. Special inspections for adhesive dowels shall be conducted in accordance with the manufacturer's instructions and Specification Section 01450. Downward installations require periodic inspection and horizontal and overhead installations require continuous inspection.

PART 2 -- PRODUCTS

2.01 REINFORCING STEEL

A. Bar reinforcing shall conform to the requirements of ASTM A 615 for Grade 60 Billet Steel reinforcing. All reinforcing steel shall be from domestic mills and shall have the manufacturer's mill marking rolled into the bar which shall indicate the producer, size, type and grade. All reinforcing bars shall be deformed bars. Smooth reinforcing bars shall not be used unless specifically called for on Drawings.

B. Welded wire fabric reinforcing shall conform to the requirements of ASTM A 1064 and the details shown on the Drawings.

C. A certified copy of the mill test on each load of reinforcing steel delivered showing physical and chemical analysis shall be provided, prior to shipment. The Engineer reserves the right to require the Contractor to obtain separate test results from an independent testing laboratory in the event of any questionable steel. When such tests are necessary because of failure to comply with this Specification, such as improper identification, the cost of such tests shall be borne by the Contractor.

D. Field welding of reinforcing steel will not be allowed.

E. Use of coiled reinforcing steel will not be allowed.

2.02 ACCESSORIES

A. Accessories shall include all necessary chairs, slab bolsters, concrete blocks, tie wires, dips, supports, spacers and other devices to position reinforcing during concrete placement. Wire bar supports shall be plastic protected (CRSI Class 1).

B. Concrete blocks (dobies), used to support and position bottom reinforcing steel, shall have the same or higher compressive strength as specified for the concrete in which it is located.
2.03 MECHANICAL COUPLERS

A. Mechanical couplers shall develop a tensile strength which exceeds 100 percent of the ultimate tensile strength and 125 percent of the yield strength of the reinforcing bars being spliced. The reinforcing steel and coupler used shall be compatible for obtaining the required strength of the connection.

B. Where the type of coupler used is composed of more than one component, all components required for a complete splice shall be supplied.

C. Hot forged sleeve type couplers shall not be used. Acceptable mechanical couplers are Dayton Superior Dowel Bar Splicer System by Dayton Superior, Dayton, Ohio, or approved equal. Mechanical couplers shall only be used where shown on the Drawings or where specifically approved by the Engineer.

D. Where the threaded rebar to be inserted into the coupler reduces the diameter of the bar, the threaded rebar piece shall be provided by the coupler manufacturer.

2.04 DOWEL ADHESIVE SYSTEM

A. Where shown on the Drawings, reinforcing bars anchored into hardened concrete with a dowel adhesive system shall use a two-component adhesive mix which shall be injected with a static mixing nozzle following manufacturer’s instructions.

B. All holes shall be drilled in accordance with the manufacturer’s instructions except that core drilled holes shall not be permitted unless specifically allowed by the Engineer. Cored holes, if allowed by the manufacturer and approved by the Engineer, shall be roughened in accordance with manufacturer’s requirements.

C. Thoroughly clean drill holes of all debris, drill dust, and water in accordance with manufacturer’s instructions prior to installation of adhesive and reinforcing bar.

D. Degree of hole dampness shall be in strict accordance with manufacturer recommendations. Installation conditions shall be either dry or water-saturated. Water filled or submerged holes shall not be permitted unless specifically approved by the Engineer.

E. Injection of adhesive into the hole shall be performed in a manner to minimize the formation of air pockets in accordance with the manufacturer’s instructions.

F. Embedment Depth:

1. The embedment depth of the bar shall be as shown on the Drawings. Although all manufacturers listed below are permitted, the embedment depth shown on the Drawings is based on “HIT-HY 200 Adhesive Anchoring System” as manufactured by Hilti, Inc. If the Contractor submits one of the other named dowel adhesives from the list below, the Engineer shall evaluate the required embedment and the Contractor shall provide the required embedment depth stipulated by the Engineer specific to the approved dowel adhesive.

2. Where the embedment depth is not shown on the Drawings, the embedment depth shall be determined to provide the minimum allowable bond strength equal to the tensile strength of the rebar according to the manufacturer’s ICC-ES ESR.
3. The embedment depth shall be determined using the actual concrete compressive strength, a cracked concrete state, maximum long term temperature of 110 degrees F, and maximum short term temperature of 140 degrees F. In no case shall the embedment depth be less than the minimum, or more than the maximum, embedment depths stated in the manufacturer’s ICC-ES ESR.

G. Engineer’s approval is required for use of this system in locations other than those shown on the Drawings.

H. The adhesive system shall be IBC compliant for use in both cracked and uncracked concrete in all Seismic Design Categories and shall be "Epcon C6+ Adhesive Anchoring System" as manufactured by ITW Redhead, "HIT-HY 200 Adhesive Anchoring System" as manufactured by Hilti, Inc. “SET-XP Epoxy Adhesive Anchors” as manufactured by Simpson Strong-Tie Co. or “Pure 110+ Epoxy Adhesive Anchor System” by DeWalt. Fast-set epoxy formulations shall not be acceptable. No or equal products will be considered, unless pre-qualified and approved.

I. All individuals installing dowel adhesive system shall be certified as an Adhesive Anchor Installer in accordance with the ACI-CRSI Anchor Installation Certification Program.

PART 3 – EXECUTION

3.01 TEMPERATURE REINFORCING

A. Unless otherwise shown on the Drawings or in the absence of the concrete reinforcing being shown, the minimum cross sectional area of horizontal and vertical concrete reinforcing in walls shall be 0.0033 times the gross concrete area and the minimum cross sectional area of reinforcing perpendicular to the principal reinforcing in slabs shall be 0.0020 times the gross concrete area. Temperature reinforcing shall not be spaced further apart than five times the slab or wall thickness, nor more than 18 inches.

3.02 FABRICATION

A. Reinforcing steel shall be accurately formed to the dimensions and shapes shown on the Drawings and the fabricating details shall be prepared in accordance with ACI 315 and ACI 318, except as modified by the Drawings.

B. The Contractor shall fabricate reinforcing bars for structures in accordance with the bending diagrams, placing lists and placing Drawings.

C. No fabrication shall commence until approval of Shop Drawings has been obtained. All reinforcing bars shall be shop fabricated unless approved to be bent in the field. Reinforcing bars shall not be straightened or rebent in a manner that will injure the material. Heating of bars will not be permitted.

D. Welded wire fabric with longitudinal wire of W9.5 size or smaller shall be either furnished in flat sheets or in rolls with a core diameter of not less than 10 inches. Welded wire fabric with longitudinal wires larger than W9.5 size shall be furnished in flat sheets only.

3.03 DELIVERY, STORAGE AND HANDLING
A. All reinforcing shall be neatly bundled and tagged for placement when delivered to the job site. Bundles shall be properly identified for coordination with mill test reports.

B. Reinforcing steel shall be stored above ground on platforms or other supports and shall be protected from the weather at all times by suitable covering. It shall be stored in an orderly manner and plainly marked to facilitate identification.

C. Reinforcing steel shall at all times be protected from conditions conducive to corrosion until concrete is placed around it.

D. The surfaces of all reinforcing steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar and other foreign substances immediately before the concrete is placed. Where there is delay in depositing concrete, reinforcing shall be reinspected and if necessary recleaned.

3.04 PLACING

A. Reinforcing steel shall be accurately positioned as shown on the Drawings and shall be supported and wired together to prevent displacement, using annealed iron wire ties or suitable clips at intersections. All reinforcing steel shall be supported by concrete, plastic or plastic protected (CRSI Class 1) metal supports, spacers or metal hangers which are strong and rigid enough to prevent any displacement of the reinforcing steel. Where concrete is to be placed on the ground, supporting concrete blocks (or dobies) shall be used in sufficient numbers to support the reinforcing bars without settlement. In no case shall concrete block supports be continuous.

B. The portions of all accessories in contact with the formwork shall be made of plastic or steel coated with a 1/8 inch minimum thickness of plastic which extends at least 1/2 inch from the concrete surface. Plastic shall be gray in color.

C. Tie wires shall be bent away from the forms in order to provide the specified concrete coverage.

D. Reinforcing bars additional to those shown on the Drawings, which may be found necessary or desirable by the Contractor for the purpose of securing reinforcing in position, shall be provided by the Contractor at no additional cost to the Owner.

E. Reinforcing placing, spacing, and protection tolerances shall be within the limits specified in ACI 318 except where in conflict with the Building Code, unless otherwise specified.

F. Reinforcing bars may be moved within one bar diameter as necessary to avoid interference with other concrete reinforcing, conduits, or embedded items. If bars are moved more than one bar diameter, or enough to exceed placing tolerances, the resulting arrangement of bars shall be as acceptable to the Engineer.

G. Welded wire fabric shall be supported on slab bolsters spaced not less than 30 inches on centers, extending continuously across the entire width of the reinforcing mat and supporting the reinforcing mat in the plane shown on the Drawings.
H. Reinforcing shall not be straightened or rebent unless specifically shown on the drawings. Bars with kinks or bends not shown on the Drawings shall not be used. Coiled reinforcement shall not be used.

I. Dowel Adhesive System shall be installed in strict conformance with the manufacturer’s recommendations and as required in Article 2.04 above. A representative of the manufacturer must be on site prior to adhesive dowel installation to provide instruction on proper installation procedures for all adhesive dowel installers. Testing of adhesive dowels shall be as indicated below. If the dowels have a hook at the end to be embedded in subsequent work, an approved mechanical coupler shall be provided at a convenient distance from the face of existing concrete to facilitate adhesive dowel testing while maintaining required hook embedment in subsequent work.

J. All adhesive dowel installations in the horizontal or overhead orientation shall be conducted by a certified Adhesive Anchor Installer as certified by ACI/CSRI per ACI 318-11 9.2.2. Current AAI Certificated must be submitted to the Engineer of Record for approval prior to commencement of any adhesive anchor installations.

K. Adhesive Dowel Testing

1. At all locations where adhesive dowels are shown on the Drawings, at least 25 percent of all adhesive dowels installed shall be tested to the value indicated on the Drawings, with a minimum of one tested dowel per group. If no test value is indicated on the Drawings but the installed dowel is under direct tension, the Contractor shall notify the Engineer to verify the required test value.

2. Contractor shall submit a plan and schedule indicating locations of dowels to be tested, load test values and proposed dowel testing procedure (including a diagram of the testing equipment proposed for use) prior to conducting any testing. The testing equipment shall have a minimum of three support points and shall be of sufficient size to locate the edge of supports no closer than two times the anchor embedment depth from the center of the anchor.

3. Where Contract Documents indicate adhesive dowel design is the Contractor’s responsibility, the Contractor shall submit a plan and schedule indicating locations of dowels to be tested and load test values, sealed by a Professional Engineer currently registered in the State of California. The Contractor shall also submit documentation indicating the Contractor’s testing procedures have been reviewed and the proposed procedures are acceptable.

4. Adhesive Dowel shall have no visible indications of displacement or damage during or after the proof test. Concrete cracking in the vicinity of the dowel after loading shall be considered a failure. Dowels exhibiting damage shall be removed and replaced. If more than 5 percent of tested dowels fail, then 100 percent of dowels shall be proof tested.

5. Proof testing of adhesive dowels shall be performed by an independent testing laboratory hired directly by the Contractor. The Contractor shall be responsible for costs of all testing, including additional testing required due to previously failed tests.

3.05 SPlicing
A. Reinforcing bar splices shall only be used at locations shown on the Drawings. When it is necessary to splice reinforcing at points other than where shown, the splice shall be as acceptable to the Engineer.

B. The length of lap for reinforcing bars, unless otherwise shown on the Drawings shall be in accordance with ACI 318 for a class B splice.

C. Laps of welded wire fabric shall be in accordance with ACI 318. Adjoining sheets shall be securely tied together with No. 14 tie wire, one tie for each 2 running feet. Wires shall be staggered and tied in such a manner that they cannot slip.

D. Mechanical splices shall be used only where shown on the drawings or when approved by the Engineer.

E. Couplers which are located at a joint face shall be a type which can be set either flush or recessed from the face as shown on the Drawings. The couplers shall be sealed during concrete placement to completely eliminate concrete or cement paste from entering. After the concrete is placed, couplers intended for future connections shall be plugged and sealed to prevent any contact with water or other corrosive materials. Threaded couplers shall be plugged with plastic plugs which have an O-ring seal.

3.06 INSPECTION

A. The Contractor shall advise the Engineer of his intentions to place concrete and shall allow him adequate time to inspect all reinforcing steel before concrete is placed.

B. The Contractor shall advise the Engineer of his intentions to place grout in masonry walls and shall allow him adequate time to inspect all reinforcing steel before grout is placed.

3.07 CUTTING OF EMBEDDED REBAR

A. The Contractor shall not cut embedded rebar cast into structural concrete without prior approval.

-END OF SECTION-
SECTION 03250

CONCRETE ACCESSORIES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Furnish all materials, labor and equipment required to provide all concrete accessories including waterstops, expansion joint material, joint sealants, expansion joint seals, contraction joint inserts, and epoxy bonding agent.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03100 - Concrete Formwork
B. Section 03290 - Joints in Concrete
C. Section 03300 - Cast-in-Place Concrete
D. Section 07900 - Joint Fillers, Sealants, and Caulking

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. ASTM C881 Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
2. ASTM D412 Standard Tests for Rubber Properties in Tension
3. ASTM D 624 Standard Test method for Rubber Property - Tear Resistance
5. ASTM D1751 Standard Specifications for Preformed Expansion Joint fillers for Concrete Paving and Structural Construction (nonextruding and resilient bituminous types)
6. ASTM D 1752 Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
7. ASTM D 1171 Standard Test Method for Ozone Resistance at 500 ppbm
8. ASTM D 471 Standard Test Method for Rubber Properties
1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300, Submittals.

1. Manufacturer's literature on all products specified herein including material certifications.
2. Proposed system for supporting PVC waterstops in position during concrete placement
3. Samples of products if requested by the Engineer.

PART 2 -- PRODUCTS

2.01 POLYVINYL CHLORIDE (PVC) WATERSTOPS

A. PVC waterstops for construction joints shall be flat ribbed type, 6 inches wide with a minimum thickness at any point of 3/8 inches.

B. Waterstops for expansion joints shall be ribbed with a center bulb. They shall be 9 inches wide with a minimum thickness at any point of 3/8 inch unless shown or specified otherwise. The center bulb shall have a minimum outside diameter of 1 inch and a minimum inside diameter of 1/2 inch.

C. The waterstops shall be manufactured from virgin polyvinyl chloride plastic compound and shall not contain any scrap or reclaimed material or pigment whatsoever. The properties of the polyvinyl chloride compound used, as well as the physical properties of the waterstops, shall exceed the requirements of the U.S. Army Corps. of Engineers’ Specification CRD-C572. The waterstop material shall have an off-white, milky color.

D. The required minimum physical characteristics for this material are:

1. Tensile strength - 1,750 psi (ASTM D-638).
2. Ultimate elongation - not less than 280% (ASTM D-638).

E. No reclaimed PVC shall be used for the manufacturing of the waterstops. The Contractor shall furnish certification that the proposed waterstops meet the above requirements.

F. PVC waterstops shall be as manufactured by BoMetals, Inc., DuraJoint Concrete Accessories, or Sika Greenstreak.

G. All waterstop intersections, both vertical and horizontal, shall be made from factory fabricated corners and transitions. Only straight butt joint splices shall be made in field.

2.02 RETROFIT WATERSTOPS

A. Retrofit waterstops shall be used where specifically shown on Drawings for sealing joints between existing concrete construction and new construction.

B. Retrofit waterstops shall be PVC waterstops fabricated from material as described in Section 2.01 of this Specification.
C. Retrofit waterstop shall be attached to existing concrete surface as shown on Drawings.

D. Use of split waterstop in lieu of specially fabricated retrofit waterstop will not be acceptable.

E. Retrofit Waterstop manufacturer must provide a complete system including all Waterstop, stainless steel anchoring hardware, and epoxy for installation.

F. For construction joints, retrofit waterstop shall be style number 609 by Sika Greenstreak, RF-638 by BoMetals, Inc., Type 18 kit by DuraJoint Concrete Accessories, or approved equal. For expansion joints, retrofit waterstop shall be style number 667 by Sika Greenstreak, RF-912 by BoMetals, Inc., Type 18-9 kit by DuraJoint Concrete Accessories, or approved equal.

2.03 CHEMICAL RESISTANT WATERSTOPS

A. Where specifically noted on Contract Drawings, chemical resistant waterstops shall be used instead of PVC waterstops.

B. Chemical resistant waterstops for construction joints shall be ribbed with a center bulb. They shall be 6 inches wide with a minimum thickness at any point of 3/16 inches.

C. Chemical resistant waterstops for expansion joints shall be ribbed tear web. They shall be 9 inches wide with a tear web designed to accommodate 1 inch of free movement minimum.

D. Chemical resistant retrofit waterstop shall be a minimum of 2½" wide along the ribbed side and a minimum 5" wide along the side attached to the existing concrete surface. Retrofit waterstop shall include a centerbulb and shall have a minimum thickness of 3/16". Retrofit waterstop manufacturer shall provide a complete system including waterstop, stainless steel anchoring hardware and epoxy for installation.

E. Chemical resistant waterstops shall be manufactured from a fully crosslinked thermoplastic vulcanizate rubber.

F. Waterstops shall be TPER by BoMetals, Inc., Earth Shield TPV/TPE-R by JP Specialties, Inc., Westec TPER by Westec Barrier Technologies, or TPE-R by DuraJoint Concrete Accessories.

2.04 HYPALON RUBBER WATERSTOPS

A. Hypalon rubber waterstops shall be Sikadur Combiflex by Sika Corporation or approved equal. Minimum width of waterstop material shall be twelve (12) inches unless shown otherwise on Contract Drawings.

2.05 EXPANDING RUBBER WATERSTOP

A. Expanding rubber shall be designed to expand under hydrostatic conditions. Waterstops shall be Adeka Ultra Seal MC-2010MN by Adeka Ultra Seal/OCM, Inc., or Hydrotite CJ-1020-2K by Sika Greenstreak, for concrete thickness greater than nine inches. For thicknesses less than nine inches, Adeka Ultra Seal KBA-1510FF or Hydrotite CJ-1020-2K shall be used.
B. Waterstop shall be a chemically modified natural rubber product with a hydrophilic agent.

C. Waterstop has a stainless steel mesh or coextrusion of non-hydrophilic rubber to direct expansion in the thickness direction and restrict the expansion in the longitudinal direction.

2.06 WATERSTOP ADHESIVE

A. Adhesive between waterstops and existing concrete shall be 20+F Contact Cement by Miracle Adhesives Corporation, Neoprene Adhesive 77-198 by JGF Adhesives, Sikadur 31 Hi-Mod Gel by Sika Corporation, DP-605 NS Urethane Adhesive by 3M Adhesive Systems.

B. Hydrophilic, non-bentonite water swelling elastic sealant shall be used to bond expanding rubber waterstops to rough surfaces. Hydrophilic elastic sealant shall be P-201 by Adeka Ultra Seal/OCM, Inc., Leakmaster LV-1 by Sika Greenstreak, or approved equal.

2.07 JOINT SEALANTS

A. Joint sealants shall comply with Section 07900, Joint Fillers, Sealants, and Caulking.

2.08 EXPANSION JOINT MATERIAL

A. Preformed expansion joint material shall be non-extruding, and shall be of the following types:

1. Type I - Sponge rubber, conforming to ASTM D1752, Type I.
2. Type II - Cork, conforming to ASTM D1752, Type II.
3. Type III - Self-expanding cork, conforming to ASTM D1752, Type III.
4. Type IV - Bituminous fiber, conforming to ASTM Designation D1751.

2.09 EXPANSION JOINT SEAL

A. Expansion Joint Seal System shall consist of a preformed neoprene profile, installed using the same dimensions as the joint gap, bonded with a two-component epoxy adhesive and pressurized during the adhesive cure time.

B. The expansion joint system shall be Hydrozo/Jeene Structural Sealing joint system by Hydrozo/Jeene, Inc.

2.10 CONTRACTION JOINT INSERTS

A. Contraction joint inserts shall be Zip-Cap by Greenstreak Plastic Products, Zip-Joint by BoMetals, Inc. control joint formers.

2.11 EPOXY BONDING AGENT

A. Epoxy bonding agent shall conform to ASTM C881 and shall be Sikadur 32 Hi-Mod, Sika Corporation, Lyndhurst, N.J.; Euco #452 Epoxy System, Euclid Chemical Company, Cleveland, OH, MasterInject 1500 by BASF Master Builder Solutions (BASF).

2.12 EPOXY RESIN BINDER
A. Epoxy resin binder shall conform to the requirements of ASTM C-881, Type III, Grade 3, Class B and C for epoxy resin binder and shall be Sikadur 23, Low-Mod-Gel, manufactured by the Sika Corporation, Lyndhurst, N.J., Flexocrete Gel manufactured by DuraJoint Concrete Accessories or Euco #352 Gel, Euclid Chemical Company, MasterEmaco ADH 327 or 327 RS by BASF Master Builder Solutions.

PART 3 -- EXECUTION

3.01 PVC AND CHEMICAL RESISTANT WATERSTOPs

A. PVC and chemical resistant waterstops shall be provided in all construction and expansion joints in water bearing structures and at other such locations as required by the Drawings.

B. Waterstops shall be carefully positioned so that they are embedded to an equal depth in concrete on both sides of the joint. They shall be kept free from oil, grease, mortar or other foreign matter. To ensure proper placement, all waterstops shall be secured in correct position at 12" on center along the length of the waterstop on each side, prior to placing concrete. Such method of support shall be submitted to the Engineer for review and approval. Grommets or small pre-punched holes as close to the edges as possible will be acceptable for securing waterstops.

C. Splices in PVC waterstops and chemical resistant waterstops shall be made with a thermostatically controlled heating element. Only straight butt joint splices will be allowed in the field. Factory fabricated corners and transitions shall be used at all intersections. Splices shall be made in strict accordance with the manufacturer's recommended instructions and procedures. At least three satisfactory sample splices shall be made on the site. The Engineer may require tests on these splices by an approved laboratory. The splices shall exhibit not less than 80 percent of the strength of the unspliced material.

D. All splices in waterstops will be subject to rigid review for misalignment, bubbles, inadequate bond, porosity, cracks, offsets, discoloration, charring, and other defects which would reduce the potential resistance of the material to water pressure at any point. All defective joints shall be replaced with material which will pass said review and all faulty material shall be removed from the site and disposed of by the Contractor at no additional cost to the Owner.

E. Retrofit waterstops shall be installed as shown on Contract Drawings using approved waterstop adhesive and Type 316 stainless steel batten bars and expansion anchors.

F. Waterstop installation and splicing defects which are unacceptable include, but are not limited to the following:

1. Tensile strength not less than 80 percent of parent material.


3. Misalignment of Waterstop geometry at any point greater than 1/16 inch.

4. Visible porosity or charred or burnt material in weld area.

5. Visible signs of splice separation when splice (24 hours or greater) is bent by hand at sharp angle.
3.02 HYPALON RUBBER AND EXPANDING RUBBER WATERSTOPS

A. Waterstops shall be installed only where shown on the Drawings.

B. Waterstops shall be installed in strict accordance with manufacturer's recommendations.

3.03 WATERSTOP ADHESIVE

A. Adhesive shall be applied to both contact surfaces in strict accordance with manufacturer's recommendations.

B. Adhesive shall be used where waterstops are attached to existing concrete surfaces.

3.04 INSTALLATION OF EXPANSION JOINT MATERIAL AND SEALANTS

A. Type I, II, or III shall be used in all expansion joints in structures and concrete pavements unless specifically shown otherwise on the Drawings. Type IV shall be used in sidewalk and curbing and other locations specifically shown on the Drawings.

B. All expansion joints exposed in the finish work, exterior and interior, shall be sealed with the specified joint sealant. Expansion joint material and sealants shall be installed in accordance with manufacturer's recommended procedures and as shown on the Drawings.

C. Expansion joint material that will be exposed after removal of forms shall be cut and trimmed to ensure a neat appearance and shall completely fill the joint except for the space required for the sealant. The material shall be held securely in place and no concrete shall be allowed to enter the joint or the space for the sealant and destroy the proper functions of the joint.

D. A bond breaker shall be used between expansion joint material and sealant. The joint shall be thoroughly clean and free from dirt and debris before the primer and the sealant are applied. Where the finished joint will be visible, masking of the adjoining surfaces shall be carried out to avoid their discoloration. The sealant shall be neatly tooled into place and its finished surfaces shall present a clean and even appearance.

E. Type 1 joint sealant shall be used in all expansion and contraction joints in concrete, except where Type 7 or Type 8 is required as stated below, and wherever else specified or shown on the Drawings. It shall be furnished in pour grade or gun grade depending on installation requirements. Primers shall be used as required by the manufacturer. The sealant shall be furnished in colors as directed by the Engineer.

F. Type 8 joint sealant shall be used in all concrete pavements and floors subject to heavy traffic and wherever else specified or shown on the Drawings.

G. Type 7 joint sealant shall be used for all joints in chlorine contact tanks and wherever specified or shown on the Drawings.

3.05 EXPANSION JOINT SEAL

A. The expansion joint seal system shall be installed as shown on the Drawings in strict accordance with the manufacturer's recommendations.
3.06 CONTRACTION JOINT INSERTS

A. For contraction joints in slabs, inserts shall be floated in fresh concrete during finishing.

B. For contraction joints in walls, inserts shall be secured in place prior to casting wall.

C. Inserts shall be installed true to line at the locations of all contraction joints as shown on the Drawings.

D. Inserts shall extend into concrete sufficient depth as indicated on the Drawings or specified in Section 03290, Joints in Concrete.

E. Inserts shall not be removed from concrete until concrete has cured sufficiently to prevent chipping or spalling of joint edges due to inadequate concrete strength.

3.07 EPOXY BONDING AGENT

A. The Contractor shall use an epoxy bonding agent for bonding fresh concrete to existing concrete as shown on the Drawings.

B. Bonding surface shall be clean, sound and free of all dust, laitance, grease, form release agents, curing compounds, and any other foreign particles.

C. Application of bonding agent shall be in strict accordance with manufacturer's recommendations.

D. Fresh concrete shall not be placed against existing concrete if epoxy bonding agent has lost its tackiness.

3.08 EPOXY RESIN BINDER

A. Epoxy resin binder shall be used to seal all existing rebar cut and burned off during demolition operations. Exposed rebar shall be burned back 1/2-inch minimum into existing concrete and the resulting void filled with epoxy resin binder.

-END OF SECTION-
SECTION 03290

JOINTS IN CONCRETE

PART 1 -- GENERAL

1.01 THE REQUIREMENTS

A. Provide all materials, labor and equipment required for the construction of all joints in concrete specified herein and shown on the Drawings.

B. Types of joints in concrete shall be as follows:

1. Construction Joints - Joints between adjacent concrete placements continuously connected with reinforcement.

2. Expansion Joints - Joints in concrete which allow thermal expansion and contraction of concrete. Reinforcement terminates within concrete on each side of joint.

3. Contraction Joints - Joints formed in concrete to provide a weakened plane in concrete section to control formation of shrinkage cracks.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03100 - Concrete Formwork

B. Section 03250 - Concrete Accessories

C. Section 03300 - Cast-in-Place Concrete

D. Section 07900 - Joint Fillers, Sealants and Caulking

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. ACI 301 - Specifications for Structural Concrete for Buildings

2. ACI 318 - Building Code Requirements for Structural Concrete

3. ACI 350 – Code Requirements for Environmental Engineering Concrete Structures

4. ACI 224.3 – Joints in Concrete Construction

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300, Submittals.
1. Layout drawings showing location and type of all joints to be placed in each structure.

2. Details of proposed joints in each structure.

3. For sawcut contraction joints submit documentation indicating the following:
   a. Proposed method of sawcutting indicating early entry or conventional sawing.
   b. Description of how work is to be performed including equipment to be utilized, size of crew performing the work and curing methods.
   c. Description of alternate method in case of time constraint issues or failure of equipment.

PART 2 -- MATERIALS

2.01 MATERIALS

   A. All materials required for joint construction shall comply with Section 03250 - Concrete Accessories, and Section 07900 - Joint Fillers, Sealants and Caulking.

PART 3 -- EXECUTION

3.01 CONSTRUCTION JOINTS

   A. Construction joints shall be as shown on the Drawings. Otherwise, Contractor shall submit description of the joint and its location to Engineer for approval.

   B. Unless noted otherwise on the Drawings, construction joints shall be located near the middle of the spans of slabs, beams, and girders unless a beam intersects a girder at this point. In this case, the joints in the girders shall be offset a distance equal to twice the width of the beam. Joints in walls and columns shall be at the underside of floors, slabs, beams, or girders and the top of footings or floor slabs unless noted otherwise on Drawings. Beams, girders, brackets, column capitals, haunches, and drop panels shall be placed at the same time as slabs. Joints shall be perpendicular to the main reinforcement.

   C. Maximum distance between horizontal joints in slabs and vertical joints in walls shall be 45'-0". For exposed walls with fluid or earth on the opposite side, the spacing between vertical and horizontal joints shall be a maximum of 25'-0".

   D. All corners shall be part of a continuous placement, and should a construction joint be required, the joint shall not be located closer than five feet from a corner.

   E. All reinforcing steel and welded wire fabric shall be continued across construction joints. Keys and inclined dowels shall be provided as shown on the Drawings or as directed by the Engineer. Longitudinal keys shall be provided in all joints in walls and between walls and slabs or footings, except as specifically noted otherwise on the Drawings. Size of keys shall be as shown on the Drawings.
F. All joints in water bearing structures shall have a waterstop. All joints below grade in walls or slabs which enclose an accessible area shall have a waterstop.

3.02 EXPANSION JOINTS

A. Size and location of expansion joints shall be as shown on the Drawings.

B. All expansion joints in water-bearing structures shall have a center-bulb type waterstop. All expansion joints below grade in walls or slabs which enclose an accessible area shall have a center-bulb type waterstop. Waterstop shall be as shown on Drawings and specified in Section 03250, Concrete Accessories.

3.03 CONTRACTION JOINTS

A. Location of contraction joints shall be as shown on the Drawings.

B. Contraction joints shall be formed either by sawcutting or with contraction joint inserts as specified in Section 03250, Concrete Accessories. Sawcutting of joints will not be permitted unless specifically approved by the Engineer.

C. If approved by the Engineer, sawcutting of contraction joints in lieu of forming shall conform to the following requirements:

1. Joints shall be sawed as soon as the concrete can support foot traffic without leaving any impression, normally the same day as concrete is placed and in no case longer than 24 hours after concrete is placed.

2. Curing shall be performed using wet curing methods as indicated in Section 03370 – Concrete Curing. Curing mats, fabrics or sheeting materials shall remain in place to the extent possible while cutting of joint is being performed. Curing materials shall only be removed as required and shall be immediately reinstalled once cutting of the joint has been completed.

3. Depth of joint shall be as shown on the drawings or noted in these specifications. At locations where the joint cannot be installed to full depth due to curbs or other stopping points hand tools shall be used to complete joints.

4. Saw cut joints shall meet the requirements of ACI 224.3, Section 2.8, Jointing Practice.

D. Unless noted otherwise on Drawings, depth of contraction joints shall be 1-1/2 inches in reinforced concrete and 1/3 of concrete thickness in unreinforced concrete.

3.04 JOINT PREPARATION

A. No concrete shall be allowed to enter the joint or the space for the sealant and destroy the proper functions of the joint.

B. The surface of the concrete at all joints shall be thoroughly cleaned and all laitance removed by wire brushing, air or light sand blasting.
C. The joint shall be thoroughly clean and free from dirt and debris before the primer and the sealant are applied. Where the finished joint will be visible, masking of the adjoining surfaces shall be carried out to avoid their discoloration. The sealant shall be neatly tooled into place and its finished surface shall present a clean and even appearance.

D. All joints shall be sealed as shown on the Drawings and specified in Section 03250, Concrete Accessories.

- END OF SECTION -
SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Provide all labor, equipment, materials and services necessary for the manufacture, transportation and placement of all plain and reinforced concrete work, as shown on the Drawings or as ordered by the Engineer.

B. The requirements in this section shall apply to the following types of concrete:

1. Class A1 Concrete: Normal weight structural concrete to be used in all structures qualifying as environmental concrete structures that are designed in accordance with ACI 350 including pump stations, tanks, basins, process structures, and any structures containing fluid or process chemicals or other materials used in treatment process.

2. Class B Concrete: Normal weight structural concrete used for duct bank encasements, catch basins, fence and guard post embedment, concrete fill, and other areas where specifically noted on Contract Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03100 - Concrete Formwork
B. Section 03200 - Reinforcing Steel
C. Section 03250 - Concrete Accessories
D. Section 03290 - Joints in Concrete
E. Section 03350 - Concrete Finishes
F. Section 03370 - Concrete Curing
G. Section 03600 - Grout

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the Specifications, all work herein shall conform to or exceed the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. California Building Code
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<td>ASTM C 31</td>
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<td>Standard Practice for Sampling Freshly Mixed Concrete</td>
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<td>22</td>
<td>ASTM C 192</td>
<td>Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory</td>
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</table>
23. ASTM C 231 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
25. ASTM C 295 Standard Guide for Petrographic Examination of Aggregates for Concrete
27. ASTM C 494 Standard Specification for Chemical Admixtures for Concrete
29. ASTM C 618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
30. ASTM C 989 Standard Specification for Slag Cement for Use in Concrete and Mortars
32. ASTM C 1260 Test Method for Potential Alkali Reactivity of Aggregates (Mortar Bar Method)
34. ASTM C 1602 Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
35. ASTM C 1778 Reducing the Risk of Deleterious Alkali – Aggregate Reaction in Concrete

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300, Submittals.

1. Sources of all materials and certifications of compliance with specifications for all materials.

2. Certified current (less than 1 year old) chemical analysis of the Portland Cement or Blended Cement to be used.

3. Certified current (less than 1 year old) chemical analysis of fly ash or slag cement to be used.
4. Aggregate test results showing compliance with required standards, i.e., sieve analysis, potential reactivity, aggregate soundness tests, petrographic analysis, mortar bar expansion testing, etc.

5. Manufacturer's data on all admixtures stating compliance with required standards.

6. Concrete mix design for each class of concrete specified herein.

7. Field experience records and/or trial mix data for the proposed concrete mixes for each class of concrete specified herein.

1.05 QUALITY ASSURANCE

A. Tests on materials used in the production of concrete shall be required as specified in PART 2 -- PRODUCTS. These tests shall be performed by an independent testing laboratory approved by the Engineer at no additional cost to the Owner.

B. Trial concrete mixes shall be tested when required in accordance with Article 3.01 at no additional cost to the Owner.

C. Field quality control tests, as specified in Article 3.10, unless otherwise stated, will be performed by a materials testing consultant employed by the Owner. However, the Contractor shall be charged for the cost of any additional tests and investigation on work performed which does not meet the Specifications. Any individual who samples and tests concrete to determine if the concrete is being produced in accordance with this Specification shall be certified as a Concrete Field Testing Technician, Grade I, in accordance with ACI CP-2. Testing laboratory shall conform to requirements of ASTM C-1077.

1.06 CONCRETE COORDINATION CONFERENCE

A. Unless waived by the Engineer, prior to any concrete submittals and at least 35 days prior to the start of the concrete construction schedule, the Contractor shall conduct a meeting at the site. The purpose of the meeting is to review the proposed concrete mix designs, to discuss the proposed approaches and procedures for mixing, transporting, placing, testing, finishing, and curing of all aspects of concrete work to ensure the concrete construction is performed in accordance with the Specifications, and to clarify roles of the parties involved. The Contractor shall send a concrete coordination conference agenda to all attendees 20 days prior to a mutually agreed upon date for the conference.

B. As a minimum the agenda shall include:

1. Concrete Materials and Mix Designs
2. Inspection Responsibilities
3. Concrete Sampling and Testing Specification Requirements
4. Cylinder Storage and Transportation
5. Acceptance/Rejection Responsibility and Authority for Fresh Concrete
6. Concrete finishing
7. Concrete Curing

8. Test Report Distribution

9. Miscellaneous Items

C. The Contractor shall require responsible representatives of every party who is concerned with the concrete work to attend the conference, including but not limited to the following:

1. Contractor’s superintendent

2. Engineer

3. Owner’s representative (if he chooses to attend)

4. Laboratory retained for trial batching and construction quality control testing for the concrete.

5. Any subcontractors involved in placing, finishing, and curing of concrete

6. Concrete supplier

7. Concrete pumping subcontractor (if pumping is being proposed)

D. Minutes of the meeting shall be recorded, typed, and printed by the Contractor and distributed to all attendees and any other concerned parties within five days of the meeting.

PART 2 -- PRODUCTS

2.01 HYDRAULIC CEMENT

A. Portland Cement

1. Portland Cement shall be Type II conforming to ASTM C 150. Type I cement may be used provided either fly ash or slag cement is also included in the mix in accordance with Articles 2.02 or 2.03 respectively.

2. When potentially reactive aggregates as defined in Article 2.05 are to be used in concrete mix, cement shall meet the following requirements:

   a. For concrete mixed with only Portland Cement, the total alkalies in the cement (calculated as the percentage of \( \text{Na}_2\text{O} \) plus 0.658 times the percentage of \( \text{K}_2\text{O} \)) shall not exceed 0.40%.

   b. For concrete mixed with Portland Cement and an appropriate amount of fly ash (Article 2.02) or slag cement (Article 2.03) the total alkalies in the Portland Cement (calculated as the percentage of \( \text{Na}_2\text{O} \) plus 0.658 times the percentage of \( \text{K}_2\text{O} \)) shall not exceed 0.85%.

3. When non-reactive aggregates as defined in Article 2.05 are used in concrete mix, total alkalies in the cement shall not exceed 1.0%.
4. The proposed Portland Cement shall not contain more than 8% tricalcium aluminate and more than 12% tetracalcium aluminoferrite.

B. Blended Cement

1. Blended cements shall be Type IP (Portland Fly Ash Cement) or Type IS (Portland Slag Cement) conforming to ASTM C 595.

2. Type IP cement shall be an interground blend of Portland Cement and fly ash in which the fly ash constituent is between 15% and 25% of the weight of the total blend.

3. Type IS cement shall be an interground blend of Portland Cement and slag cement in which the slag constituent is between 35% and 50% of the weight of the total blend.

4. Fly ash and slag cement used in the production of blended cements shall meet the requirements of Articles 2.02 and 2.03, respectively.

5. When reactive aggregates as defined in Article 2.05 are used in concrete mix, the total alkalies in the Portland Cement (calculated as the percentage of Na₂O plus 0.658 times the percentage of K₂O) shall not exceed 0.85%. The percentage of fly ash or slag cement shall be set to meet provisions of Article 2.05.G.2.

C. Different types of cement shall not be mixed nor shall they be used alternately except when authorized in writing by the Engineer. Different brands of cement or the same brand from different mills may be used alternately. A resubmittal will be required if different cements are proposed during the Project.

D. Cement shall be stored in a suitable weather-tight building so as to prevent deterioration or contamination. Cement which has become caked, partially hydrated, or otherwise damaged will be rejected.

2.02 FLY ASH

A. Fly ash shall meet the requirements of ASTM C 618 for Class F, except that the loss on ignition shall not exceed 4%. Fly ash shall also meet the optional physical requirements for uniformity as shown in Table 3 of ASTM C 618.

B. For fly ash to be used in the production of type IP cement, the Pozzolan Activity Index shall be greater than 75% as specified in Table 3 of ASTM C 595.

C. Where reactive aggregates as defined in Article 2.05 are used in concrete mix, the fly ash constituent shall be between 15% and 25% of the total weight of the combined Portland Cement and fly ash. The percentage of fly ash shall be set to meet the mean mortar bar expansion requirements in provisions of Article 2.05.G.2.

D. For Type A1 concrete as required for use in environmental concrete structures, i.e. process structures or fluid containing structures, inclusion of fly ash or slag cement in the concrete mix, is mandatory.
E. Additional fly ash shall not be included in concrete mixed with Type IS or IP cement.

2.03 SLAG CEMENT

A. Slag cement shall meet the requirements of ASTM C 989 including tests for effectiveness of slag in preventing excessive expansion due to alkali-aggregate reactivity as described in Appendix X-3 of ASTM C 989.

B. Where reactive aggregates as defined in Article 2.05 are used in concrete mix, the slag cement constituent shall be between 35% and 40% of the total weight of the combined Portland Cement and slag. The percentage of slag cement shall be set to meet the mean mortar bar expansion requirements in provisions of Article 2.05.G.2.

C. For Type A1 concrete as required for use in environmental concrete structures, i.e. process structures or fluid containing structures, inclusion of fly ash or slag cement in the concrete mix, is mandatory.

D. Additional slag cement shall not be included in concrete mixed with type IS or IP cement.

2.04 WATER

A. Water used for mixing concrete shall be clear, potable and free from deleterious substances such as objectionable quantities of silty organic matter, alkali, salts and other impurities.

B. Water shall not contain more than 100 PPM chloride.

C. Water shall not contain more than 500 PPM dissolved solids.

D. Water shall have a pH in the range of 4.5 to 8.5.

E. Water shall meet requirements of ASTM C 1602.

2.05 AGGREGATES

A. All aggregates used in normal weight concrete shall conform to ASTM C 33.

B. Fine Aggregate (Sand) in the various concrete mixes shall consist of natural or manufactured siliceous sand, clean and free from deleterious substances, and graded within the limits of ASTM C 33.

C. Coarse aggregates shall consist of hard, clean, durable gravel, crushed gravel or crushed rock. Coarse aggregate shall be size #57 or #67 as graded within the limits given in ASTM C 33 unless otherwise specified.

D. Aggregates shall be tested for gradation by sieve analysis tests in conformance with ASTM C 136.

E. Aggregates shall be tested for soundness in accordance with ASTM C 88. The loss resulting after five cycles shall not exceed 10 percent for fine or coarse aggregate when using either magnesium sulfate or sodium sulfate.
F. All aggregates shall be evaluated in accordance with ASTM C 1778 to determine potential reactivity. All aggregates shall be considered reactive unless they meet the requirements below for non-reactive aggregates. Aggregates with a lithology essentially similar to sources in the same region found to be reactive in service shall be considered reactive regardless of the results of the tests above.

1. Non-reactive aggregates shall meet the following requirements:
   
   A petrographic analysis in accordance with ASTM C295 shall be performed to identify the constituents of the fine and coarse aggregate. Non-reactive aggregates shall meet the following limitations:
   
   (a) Optically strained, microfractured, or microcrystalline quartz, 5.0%, maximum.
   (b) Chert or chalcedony, 3.0%, maximum.
   (c) Tridymite or cristobalite, 1.0%, maximum.
   (d) Opal, 0.5%, maximum.
   (e) Natural volcanic glass in volcanic rocks, 3.0%, maximum.

2. Concrete mixed with reactive aggregates shall meet the following requirements:
   
   (a) If aggregates are deemed potentially reactive as per ASTM C-1778 and fly ash or slag cement is included in proposed concrete mix design, proposed concrete mix including proposed aggregates shall be evaluated by ASTM C-1567. Mean mortar bar expansions at 16 days shall be less than 0.08%. Tests shall be made using exact proportion of all materials proposed for use on the job in design mix submitted.
   (b) If aggregates are deemed potentially reactive as per ASTM C-1778 and a straight cement mix without fly ash or slag cement is proposed for concrete mix design, aggregates shall be evaluated by ASTM C-1260. Mean mortar bar expansions at 16 days shall be less than 0.08%.

H. Contractor shall submit a new trial mix to the Engineer for approval whenever a different aggregate or gradation is proposed.

2.06 STRUCTURAL MACRO FIBERS

A. Not used

2.07 ADMIXTURES

A. Air entraining agent shall be added to all concrete unless noted otherwise. The agent shall consist of a neutralized vinsol resin solution or a purified hydrocarbon with a cement catalyst which will provide entrained air in the concrete in accordance with ASTM C 260. The admixture proposed shall be selected in advance so that adequate samples may be obtained and the required tests made. Air content of concrete, when placed, shall be within the ranges given in the concrete mix design.
B. The following admixtures are required or used for water reduction, slump increase, and/or adjustment of initial set. Admixtures permitted shall confirm to the requirements of ASTM C 494. Admixtures shall be non-toxic after 30 days and shall be compatible with and made by the same manufacturer as the air-entraining admixtures.

1. Water reducing admixture shall conform to ASTM C 494, Type A and shall contain no more than 0.05% chloride ions. Acceptable products are “Eucon Series” by the Euclid Chemical Company, “Master Pozzolith Series” by BASF, and “Plastocrete Series” by Sika Corporation.

2. High range water reducer shall be sulfonated polymer conforming to ASTM C 494, Type F or G. The high range water reducer shall be added to the concrete at either the batch plant or at the job site and may be used in conjunction with a water reducing admixture. The high range water reducer shall be accurately measured and pressure injected into the mixer as a single dose by an experienced technician. A standby system shall be provided and tested prior to each day’s operation of the job site system. Concrete shall be mixed at mixing speed for a minimum of 100 mixer revolutions after the addition of the high range water reducer. Acceptable products are “Eucon 37” or Plastol 5000 by the Euclid Chemical Company, “Master Rheobuild 1000 or Master Glenium Series” by BASF, and “Daracem 100 or Advaflow Series” by W.R. Grace.

3. A non-chloride, non-corrosive accelerating admixture may be used where specifically approved by the Engineer. The admixture shall conform to ASTM C 494, Type C or E, and shall not contain more chloride ions than are present in municipal drinking water. The admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory (of at least a year’s duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures. Acceptable products are "Accelguard 80/90 or NCA" by the Euclid Chemical Company and “Daraset” by W.R. Grace.

4. A water reducing retarding admixture may be used where specifically approved by the Engineer. The admixture shall conform to ASTM C494, Type D and shall not contain more than 0.05% chloride ions. Acceptable products are “Eucon NR or Eucon Retarder 100” by the Euclid Chemical Company, “Pozzolith Retarder” by BASF, and “Plastiment” by Sika Corporation.

C. Admixtures containing calcium chloride, thiocyanate or more than 0.05 percent chloride ions are not permitted. The addition of admixtures to prevent freezing is not permitted.

D. The Contractor shall submit manufacturer's data including the chloride ion content of each admixture and certification from the admixture manufacturer that all admixtures utilized in the design mix are compatible with one another and properly proportioned prior to mix design review.

2.08 CONCRETE MIX DESIGN

A. The proportions of cement, aggregates, admixtures and water used in the concrete mixes shall be based on the results of field experience or preferably laboratory trial mixes in conformance with Section 5.3. "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318 and ACI 350. When trial mixes are used they shall also conform to
Article 3.01 of this Section of the Specifications. If field experience records are used, concrete strength results shall be from concrete mixed with all of the ingredients proposed for use on job used in similar proportions to mix proposed for use on job. Contractor shall submit verification confirming this stipulation has been followed. Field experience records and/or trial mix data used as the basis for the proposed concrete mix design shall be submitted to the Engineer along with the proposed mix.

B. Structural concrete shall conform to the following requirements. Cementitious materials refer to the total combined weight of all cement, fly ash, and slag cement contained in the mix.

1. Compressive Strength (28-Day)
   a. Concrete Class A1 4,500 psi (minimum)
   b. Concrete Class B 3,000 psi (minimum)

2. Water/cementitious materials ratio, by weight
   Maximum Minimum
   a. Concrete Class A1 0.42 0.39
   b. Concrete Class B 0.50 0.39

3. Slump range 4" nominal unless high range water reducing admixture is used.
   8" max if high range water reducing admixture is used.

4. Air Content
   a. Class A1 5% ±1%
   b. Class B 3% Max (non air-entrained)

PART 3 -- EXECUTION

3.01 TRIAL MIXES

A. When trial mixes are used to confirm the quality of a proposed concrete mix in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318 and ACI 350, an independent qualified testing laboratory designated and retained by the Contractor shall test a trial batch of each of the preliminary concrete mixes submitted by the Contractor. The trial batches shall be prepared using the aggregates, cement and admixtures proposed for the project. The trial batch materials shall be of a quantity such that the testing laboratory can obtain enough samples to satisfy requirements stated below. Tests on individual materials stated in PART 2 -- PRODUCTS should already be performed before any trial mix is done. The cost of laboratory trial batch tests for each specified concrete mix will be borne by the Contractor and the Contractor shall furnish and deliver the materials to the testing laboratory at no cost to the Owner.
B. The independent testing laboratory shall prepare a minimum of fifteen (15) standard test cylinders in accordance with ASTM C 31 in addition to conducting slump (ASTM C 143), air content (C 231) and unit weight (C 138) tests. Compressive strength test on the cylinders shall subsequently be performed by the same laboratory in accordance with ASTM C 39 as follows: Test 3 cylinders at age 7 days; test 3 cylinders at age 21 days; test 3 cylinders at age 28 days and test 3 cylinders at 56 days. The cylinders shall be carefully identified as “Trial Mix, Contract No. ______, Product ______.” If the average 28-day compressive strength of the trial mix is less than that specified, or if any single cylinder falls below the required strength by more than 500 psi, the mix shall be corrected, another trial batch prepared, test cylinders taken, and new tests performed as before. Any such additional trial batch testing required shall be performed at no additional cost to the Owner. Adjustments to the mix shall be considered refinements to the mix design and shall not be the basis for extra compensation to the Contractor.

3.02 PRODUCTION OF CONCRETE

A. All concrete shall be machine mixed. Hand mixing of concrete will not be permitted. The Contractor may supply concrete from a ready mix plant or from a site mixed plant. In selecting the source for concrete production the Contractor shall carefully consider its capability for providing quality concrete at a rate commensurate with the requirements of the placements so that well bonded, homogenous concrete, free of cold joints, is assured.

B. Ready-Mixed Concrete

1. At the Contractor’s option, ready-mixed concrete may be used meeting the requirements for materials, batching, mixing, transporting, and placing as specified herein and in accordance with ASTM C 94.

2. Truck mixers shall be equipped with electrically-actuated counters by which the number of revolutions of the drum or blades may be readily verified. The counter shall be of the resettable, recording type, and shall be mounted in the driver’s cab. The counters shall be actuated at the time of starting mixers at mixing speeds.

3. Each batch of concrete shall be mixed in a truck mixer for not less than 100 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of equipment. Additional mixing, if any, shall be at the speed designated by the manufacturer of the equipment as agitating speed. All materials including mixing water shall be in the mixer drum before actuating the revolution counter for determining the number of revolutions of mixing.

4. Truck mixers and their operation shall be such that the concrete throughout the mixed batch, as discharged, is within acceptable limits of uniformity with respect to consistency, mix and grading. If slump tests taken at approximately the 1/4 and 3/4 points of the load during discharge give slumps differing by more than one inch when the specified slump is 3 inches or less, or if they differ by more than 2 inches when the specified slump is more than 3 inches, the mixer shall not be used on the work unless the causing condition is corrected and satisfactory performance is verified by additional slump tests. All mechanical details of the mixer, such as water measuring and discharge apparatus, condition of the blades, speed of rotation, general mechanical condition of the unit and clearance of the drum, shall be checked before a further attempt to use the unit will be permitted.
5. Ready-mixed concrete shall be delivered to the site for the work and discharge shall be completed before the drum has been revolved 300 revolutions and within the time requirements stated in Article 3.03 of this Section.

6. Each and every concrete delivery shall be accompanied by a delivery ticket containing at least the following information:

a. Date and truck number
b. Ticket number
c. Mix designation of concrete
d. Cubic yards of concrete
e. Cement brand, type and weight in pounds
f. Weight in pounds of fine aggregate (sand)
g. Weight in pounds of coarse aggregate (stone)
h. Air entraining agent, brand, and weight in pounds and ounces
i. Other admixtures, brand, and weight in pounds and ounces
j. Water, in gallons, stored in attached tank
k. Water, in gallons, maximum that can be added without exceeding design water/cementitious materials ratio
l. Water, in gallons, actually used (by truck driver)
m. Time of loading
n. Time of delivery to job (by truck driver)

7. Any truck delivering concrete to the job site, which is not accompanied by a delivery ticket showing the above information will be rejected and such truck shall immediately depart from the job site.

8. The use of non-agitating equipment for transporting ready-mixed concrete will not be permitted. Combination truck and trailer equipment for transporting ready-mixed concrete will not be permitted. The quality and quantity of materials used in ready-mixed concrete and in batch aggregates shall be subject to continuous inspection at the batching plant by the Engineer.

C. Site Mixed Concrete

1. Scales for weighing concrete ingredients shall be accurate when in use within ±0.4 percent of their total capacities. Standard test weights shall be available to permit checking scale accuracy.

2. Operation of batching equipment shall be such that the concrete ingredients are consistently measured within the following tolerances:

   a. Cement, fly ash, or slag cement ± 1 percent
   b. Water ± 1 percent
   c. Aggregates ± 2 percent
   d. Admixtures ± 3 percent

3. Each batch shall be so charged into the mixer that some water will enter in advance of the cement and aggregates. Water shall continue for a period which may extend to the end of the first 25 percent of the specified mixing time. Controls shall be provided to prevent batched ingredients from entering the mixer before the previous batch has been completely discharged.
4. The concrete shall be mixed in a batch mixer capable of thoroughly combining the aggregates, cement, and water into a uniform mass within the specified mixing time, and of discharging the concrete without harmful segregation. The mixer shall bear a manufacturer's rating plate indicating the rate capacity and the recommended revolutions per minute and shall be operated in accordance therewith.

5. Mixers with a rate capacity of 1 cu. yd. or larger shall conform to the requirements of the Plant Mixer Manufacturers' Division of the Concrete Plant Manufacturers' Bureau.

6. Except as provided below, batches of 1 cu. yd. or less shall be mixed for not less than 1 minute. The mixing time shall be increased 15 seconds for each cubic yard or fraction thereof of additional capacity.

7. Shorter mixing time may be permitted provided performance tests made in accordance with of ASTM C 94 indicate that the time is sufficient to produce uniform concrete.

8. Controls shall be provided to insure that the batch cannot be discharged until the required mixing time has elapsed. At least three-quarters of the required mixing time shall take place after the last of the mixing water has been added.

9. The interior of the mixer shall be free of accumulations that will interfere with mixing action. Mixer blades shall be replaced when they have lost 10 percent of their original height.

10. Air-entraining admixtures and other chemical admixtures shall be charged into the mixer as solutions and shall be measured by means of an approved mechanical dispensing device. The liquid shall be considered a part of the mixing water. Admixtures that cannot be added in solution may be weighed or may be measured by volume if so recommended by the manufacturer.

11. If two or more admixtures are used in the concrete, they shall be added separately to avoid possible interaction that might interfere with the efficiency of either admixture or adversely affect the concrete.

12. Addition of retarding admixtures shall be completed within 1 minute after addition of water to the cement has been completed, or prior to the beginning of the last three-quarters of the required mixing, whichever occurs first. Retarding admixtures shall not be used unless approved by the Engineer.

13. Concrete shall be mixed only in quantities for immediate use and within the time and mixing requirements of ASTM C 94.

3.03 CONCRETE PLACEMENT

A. No concrete shall be placed prior to approval of the concrete mix design. Concrete placement shall conform to the recommendations of ACI 304.

B. Prior to concrete placement, all reinforcement shall be securely and properly fastened in its correct position. Formwork shall be clean, oiled and form ties at construction joints shall be
retightened. All bucks, sleeves, castings, hangers, pipe, conduits, bolts, anchors, wire, and any other fixtures required to be embedded therein shall be in place. Forms for openings to be left in the concrete shall be in place and anchored by the Contractor. All loose debris in bottoms of forms or in keyways shall be removed and all debris, water, snow, ice and foreign matter shall be removed from the space to be occupied by the concrete. The Contractor shall notify the Engineer in advance of placement, allowing sufficient time for a concurrent inspection and for any corrective measures which are subsequently required.

C. On horizontal joints where concrete is to be placed on hardened concrete, flowing concrete containing a high range water reducing admixture or cement grout shall be placed with a slump not less than 8 inches for the initial placement at the base of the wall. Concrete or cement grout shall meet all strength and service requirements specified herein for applicable class of concrete. This concrete shall be worked well into the irregularities of the hard surface.

D. All concrete shall be placed during the daylight hours except with the consent of the Engineer. If special permission is obtained to carry on work during the night, adequate lighting must be provided.

E. When concrete arrives at the project with slump below that suitable for placing, as indicated by the Specifications, water may be added to bring the concrete within the specified slump range provided that the design water-cementitious materials ratio is not exceeded. The water shall be incorporated by additional mixing equal to at least half of the total mixing required. Water may be added only to full trucks. On-site tempering shall not relieve the Contractor from furnishing a concrete mix that meets all specified requirements.

F. Concrete shall be conveyed as rapidly as practicable to the point of deposit by methods which prevent the separation or loss of the ingredients. It shall be so deposited that rehandling will be unnecessary. Discharge of the concrete to its point of deposit shall be completed within 90 minutes after the addition of the cement to the aggregates. In hot weather, or under conditions contributing to quick stiffening of the concrete, the time between the introduction of the cement to the aggregates and discharge shall not exceed the requirements stated in Article 3.09 of this Section.

G. Where concrete is conveyed to position by chutes, a practically continuous flow in the chute shall be maintained. The angle and discharge arrangement of the chute shall be such as to prevent segregation of the concrete ingredients. The delivery end of the chute shall be as close as possible to the point of deposit and in no case shall the free pour from the delivery end of the chute exceed five feet, unless approved otherwise.

H. Special care must be exercised to prevent splashing of forms or reinforcement with concrete, and any such splashes or accumulations of hardened or partially hardened concrete on the forms or reinforcement above the general level of the concrete already in place must be removed before the work proceeds. Concrete shall be placed in all forms in such way as to prevent any segregation.

I. Placing of concrete shall be so regulated that the pressure caused by the wet concrete shall not exceed that used in the design of the forms.

J. All concrete for walls shall be placed through openings in the form spaced at frequent intervals or through tremies (heavy duct canvas, rubber, etc.), equipped with suitable hopper heads. Tremies shall be of variable lengths so the free fall shall not exceed five (5) feet and
a sufficient number shall be placed in the form to ensure the concrete is kept level at all times.

K. When placing concrete which is to be exposed, sufficient illumination shall be provided in the interior of the forms so the concrete, at places of deposit, is visible from deck and runways.

L. Concrete shall be placed so as to thoroughly embed all reinforcement, inserts, and fixtures.

M. When forms are removed, surfaces shall be even and dense, free from aggregate pockets or honeycomb. To achieve this, concrete shall be consolidated using mechanical vibration, supplemented by forking and spading by hand in the corners and angle of forms and along form surfaces while the concrete is plastic under the vibratory action. Consolidation shall conform to ACI 309.

N. Mechanical vibration shall be applied directly to the concrete, unless otherwise approved by the Engineer. The bottom of vibrators used on floor slabs must not be permitted to ride the form supporting the slab. Vibration shall be applied at the point of deposit and in the area of freshly placed concrete by a vertical penetration of the vibrator. Vibrators shall not be used to move concrete laterally within the forms.

O. The intensity of vibration shall be sufficient to cause settlement of the concrete into place and to produce monolithic joining with the preceding layer. It shall be of sufficient duration to accomplish thorough compaction and complete embedment of reinforcement and fixtures with a vibrator transmitting not less than 7,500 impulses per minute. Since the duration of vibration per square foot of surface is dependent on the frequency (impulses per minute), size of vibrator, and slump of concrete, the length of time must therefore be determined in the field. Vibration, however, shall not be continued in any one location to the extent that pools of grout are formed.

P. Care shall be taken to prevent cold joints when placing concrete in any portion of the work. The concrete placing rate shall be such as to ensure that each layer is placed while the previous layer is soft or plastic, so that the two layers can be made monolithic by penetration of the vibrators. Maximum thickness of concrete layers shall be 18 inches. The surface of the concrete shall be level whenever a run of concrete is stopped.

Q. To prevent featheredges, construction joints located at the tops of horizontal lifts near sloping exposed concrete surfaces shall be inclined near the exposed surface, so the angle between such inclined surface and the exposed concrete surface will be not less than 50°.

R. In placing unformed concrete on slopes, the concrete shall be placed ahead of a non-vibrated slip-form screed extending approximately 2-1/2 feet back from its leading edge. The method of placement shall provide a uniform finished surface with the deviation from the straight line less than 1/8 inch in any concrete placement. Concrete ahead of the slip-form screed shall be consolidated by internal vibrators so as to ensure complete filling under the slip-form. Prior to placement of concrete on sloped walls or slabs, the Contractor shall submit a plan specifically detailing methods and sequence of placements, proposed concrete screed equipment, location of construction joints and waterstops, and/or any proposed deviations from the aforementioned to the Engineer for review and approval.

S. Concrete shall not be placed during rains sufficiently heavy or prolonged to wash mortar from coarse aggregate on the forward slopes of the placement. Once placement of concrete
has commenced in a block, placement shall not be interrupted by diverting the placing
equipment to other uses.

3.04 PLACING FLOOR SLABS ON GRADE

A. The subgrade for slabs on ground shall be well drained and of adequate and uniform
loadbearing nature. The in-place density of the subgrade soils shall be at least the minimum
required by the specifications. No foundation, slab, or pavement concrete shall be placed
until the depth and character of the foundation soils have been inspected and approved by
the materials testing consultant.

B. The subgrade shall be free of frost before concrete placing begins. If the temperature inside
a building where concrete is to be placed is below freezing it shall be raised and maintained
above 50° long enough to remove all frost from the subgrade.

C. The subgrade shall be moist at the time of concreting. If necessary, it shall be dampened
with water in advance of concreting, but there shall be no free water standing on the
subgrade nor any muddy or soft spots when the concrete is placed.

D. Thirty-pound felt paper shall be provided between edges of slab-on-grade and vertical and
horizontal concrete surfaces, unless otherwise indicated on the Drawings.

E. Contraction joints shall be provided in slabs-on-grade at locations indicated on the Drawings.
Contraction joints shall be installed as per Section 03290 - Joints in Concrete.

F. Floor slabs shall be screeded level or pitched to drain as indicated on the Drawings.
Finishes shall conform with requirements of Section 03350 - Concrete Finishes. Interior
floor slabs shall be placed with non-air-entrained concrete (Class A3) if a steel troweled or
hardened finish is required.

3.05 PLACING CONCRETE UNDERWATER (CLASS A5 CONCRETE)

A. Not used

3.06 PLACING CONCRETE UNDER PRESSURE

A. Where concrete is conveyed and placed by mechanically applied pressure, the equipment
shall have the capacity for the operation. The operation of the pump shall be such that a
continuous stream of concrete without air pockets is produced. To obtain the least line
resistance, the layout of the pipeline system shall contain a minimum number of bends with
no change in pipe size. If two sizes of pipe must be used, the smaller diameter should be
used at the pump end and the larger at the discharge end. When pumping is completed, the
concrete remaining in the pipelines, if it is to be used, shall be ejected in such a manner that
there will be no contamination of the concrete or separation of the ingredients.

B. Priming of the concrete pumping equipment shall be with cement grout only. Use of
specialty mix pump primers or pumping aids will not be allowed.

C. No aluminum parts shall be in contact with the concrete during the entire placing of concrete
under pressure at any time.
D. Prior to placing concrete under pressure, the Contractor shall submit the concrete mix design together with test results from a materials testing consultant proving the proposed mix meets all requirements. In addition, an actual pumping test under field conditions is required prior to acceptance of the mix. This test requires a duplication of anticipated site conditions from beginning to end. The batching and truck mixing shall be the same as will be used; the same pump and operator shall be present and the pipe and pipe layouts will reflect the maximum height and distance contemplated. All submissions shall be subject to approval by the Engineer.

E. If the pumped concrete does not produce satisfactory end results, the Contractor shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.

F. The pumping equipment must have two cylinders and be designed to operate with one cylinder only in case the other one is not functioning. In lieu of this requirement, the Contractor may have a standby pump on the site during pumping.

G. The minimum diameter of the hose (conduits) shall be four inches.

H. Pumping equipment and hoses (conduits) that are not functioning properly shall be replaced.

I. Concrete samples for quality control in accordance with Article 3.10 will be taken at the placement (discharge) end of the line.

3.07 ORDER OF PLACING CONCRETE

A. In order to minimize the effects of shrinkage, the concrete shall be placed in units as bounded by construction joints shown on the Drawings and maximum lengths as indicated on Drawings. Where required on the Drawings and wherever else practical, the placing of such units shall be done in a strip pattern in accordance with ACI 302.1. A minimum of 72 hours shall pass prior to placing concrete directly adjacent to previously placed concrete.

3.08 CONCRETE WORK IN COLD WEATHER

A. Cold weather concreting procedures shall conform to the requirements of ACI 306.

B. The Engineer may prohibit the placing of concrete at any time when air temperature is 40°F. or lower. If concrete work is permitted, the concrete shall have a minimum temperature, as placed, of 55°F. for placements less than 12" thick, 50°F. for placements 12" to 36" thick, and 45°F. for placements greater than 36" thick. The temperature of the concrete as placed shall not exceed the aforementioned minimum values by more than 20°F, unless otherwise approved by the Engineer.

C. All aggregate and water shall be preheated. Precautions shall be taken to avoid the possibility of flash set when aggregate or water are heated to a temperature in excess of 100°F. in order to meet concrete temperature requirements. The addition of admixtures to the concrete to prevent freezing is not permitted. All reinforcement, forms, and concrete accessories with which the concrete is to come in contact shall be defrosted by an approved method. No concrete shall be placed on frozen ground.

3.09 CONCRETE WORK IN HOT WEATHER
A. Hot weather concreting procedures shall conform to the requirements of ACI 305.

B. When air temperatures exceed 85°F., or when extremely dry conditions exist even at lower temperatures, particularly if accompanied by high winds, the Contractor and his concrete supplier shall exercise special and precautionary measures in preparing, delivering, placing, finishing, curing and protecting the concrete mix. The Contractor shall consult with the Engineer regarding such measures prior to each day's placing operation and the Engineer reserves the right to modify the proposed measures consistent with the requirements of this Section of the Specifications. All necessary materials and equipment shall be on hand an in position prior to each placing operation.

C. Preparatory work at the job site shall include thorough wetting of all forms, reinforcing steel and, in the case of slab pours on ground or subgrade, spraying the ground surface on the preceding evening and again just prior to placing. No standing puddles of water shall be permitted in those areas which are to receive the concrete.

D. The temperature of the concrete mix when placed shall not exceed 90°F.

E. Temperature of mixing water and aggregates shall be carefully controlled and monitored at the supplier's plant, with haul distance to the job site being taken into account. Stockpiled aggregates shall, if necessary, be shaded from the sun and sprinkled intermittently with water. If ice is used in the mixing water for cooling purposes, it must be entirely melted prior to addition of the water to the dry mix.

F. Delivery schedules shall be carefully planned in advance so that concrete is placed as soon as practical after it is properly mixed. For hot weather concrete work (air temperature greater than 85°F), discharge of the concrete to its point of deposit shall be completed within 60 minutes from the time the concrete is batched.

G. The Contractor shall arrange for an ample work force to be on hand to accomplish transporting, vibrating, finishing, and covering of the fresh concrete as rapidly as possible.

3.10 QUALITY CONTROL

A. Field Testing of Concrete

1. The Contractor shall coordinate with the Engineer's project representative the on-site scheduling of the materials testing consultant personnel as required for concrete testing.

2. Concrete for testing shall be supplied by the Contractor at no additional cost to the Owner, and the Contractor shall provide assistance to the materials testing consultant in obtaining samples. The Contractor shall dispose of and clean up all excess material.

B. Consistency

1. The consistency of the concrete will be checked by the materials testing consultant by standard slump cone tests. The Contractor shall make any necessary adjustments in the mix as the Engineer and/or the materials testing consultant may direct and shall upon written order suspend all placing operations in the event the
consistency does not meet the intent of the specifications. No payment shall be made for any delays, material or labor costs due to such eventualities.

2. Slump tests shall be made in accordance with ASTM C 143. Slump tests will be performed as deemed necessary by the materials testing consultant and each time compressive strength samples are taken.

3. Concrete with a specified nominal slump shall be placed having a slump within 1” (higher or lower) of the specified slump. Concrete with a specified maximum slump shall be placed having a slump less than the specified slump.

C. Unit Weight

1. Samples of freshly mixed concrete shall be tested for unit weight by the materials testing consultant in accordance with ASTM C 138.

2. Unit weight tests will be performed as deemed necessary by the Engineer and each time compressive strength samples are taken.

D. Air Content

1. Samples of freshly mixed concrete will be tested for entrained air content by the materials testing consultant in accordance with ASTM C 231.

2. Air content tests will be performed as deemed necessary by the materials testing consultant and each time compressive strength samples are taken.

3. In the event test results are outside the limits specified, additional testing shall occur. Admixture quantity adjustments shall be made immediately upon discovery of incorrect air entrainment.

E. Compressive Strength

1. Samples of freshly mixed concrete will be taken by the materials testing consultant and tested for compressive strength in accordance with ASTM C 172, C 31 and C 39, except as modified herein.

2. In general, one sampling shall be taken for each placement in excess of five (5) cubic yards, with a minimum of one (1) sampling for each day of concrete placement operations, or for each one hundred (100) cubic yards of concrete, or for each 5,000 square feet of surface area for slabs or walls, whichever is greater.

3. Each sampling shall consist of at least five (5) 6x12 cylinders or (8) 4x8 cylinders. Each cylinder shall be identified by a tag, which shall be hooked or wired to the side of the container. The materials testing consultant will fill out the required information on the tag, and the Contractor shall satisfy himself that such information shown is correct.

4. The Contractor shall be required to furnish labor to the Owner for assisting in preparing test cylinders for testing. The Contractor shall provide approved curing boxes for storage of cylinders on site. The insulated curing box shall be of sufficient size and strength to contain all the specimens made in any four consecutive working
days and to protect the specimens from falling over, being jarred or otherwise disturbed during the period of initial curing. The box shall be erected, furnished and maintained by the Contractor. Such box shall be equipped to provide the moisture and to regulate the temperature necessary to maintain the proper curing conditions required by ASTM C 31. Such box shall be located in an area free from vibration such as pile driving and traffic of all kinds and such that all specimen are shielded from direct sunlight and/or radiant heating sources. No concrete requiring inspection shall be delivered to the site until such storage curing box has been provided. Specimens shall remain undisturbed in the curing box until ready for delivery to the testing laboratory but not less than sixteen hours.

5. The Contractor shall be responsible for maintaining the temperatures of the curing box during the initial curing of test specimens with the temperature preserved between 60°F and 80°F as measured by a maximum-minimum thermometer. The Contractor shall maintain a written record of curing box temperatures for each day curing box contains test specimens. Temperature shall be recorded a minimum of three times a day with one recording at the start of the work day and one recording at the end of the work day.

6. When transported, the cylinders shall not be thrown, dropped, allowed to roll, or be damaged in any way.

7. Compression tests shall be performed in accordance with ASTM C 39. For 6x12 cylinders, two test cylinders will be tested at seven days and two at 28 days. For 4x8 cylinders, three test cylinders will be tested at seven days, three at 28 days. The remaining cylinders will be held to verify test results, if needed.

F. Evaluation and Acceptance of Concrete

1. Evaluation and acceptance of the compressive strength of concrete shall be according to the requirements of ACI 214, ACI 318, and ACI 350.

2. The strength level of concrete will be considered satisfactory if all of the following conditions are satisfied.

   a. Every arithmetic average of any three consecutive strength tests equals or exceeds the minimum specified 28-day compressive strength for the mix (see Article 2.08).

   b. No individual compressive strength test results falls below the minimum specified strength by more than 500 psi.

3. In the event any of the conditions listed above are not met, the mix proportions shall be corrected for the next concrete placing operation.

4. In the event that condition 2B is not met, additional tests in accordance with Article 3.10, paragraph H shall be performed.

5. When a ratio between 7-day and 28-day strengths has been established by these tests, the 7-day strengths shall subsequently be taken as a preliminary indication of
the 28-day strengths. Should the 7-day test strength from any sampling be more than 10% below the established minimum strength, the Contractor shall:

a. Immediately provide additional periods of curing in the affected area from which the deficient test cylinders were taken.

b. Maintain or add temporary structural support as required.

c. Correct the mix for the next concrete placement operation, if required to remedy the situation.

6. All concrete which fails to meet the ACI requirements and these specifications is subject to removal and replacement at no additional cost to the Owner.

G. When non-compliant concrete is identified, test reports shall be sent immediately to the Engineer for review.

H. Additional Tests

1. When ordered by the Engineer, additional tests on in-place concrete shall be provided and paid for by the Contractor.

2. In the event the 28-day test cylinders fail to meet the minimum strength requirements as outlined in Article 3.10, paragraph F, the Contractor shall have concrete core specimens obtained and tested from the affected area immediately.

a. Three cores shall be taken for each sample in which the strength requirements were not met.

b. The drilled cores shall be obtained and tested in conformance with ASTM C 42. The tests shall be conducted by a materials testing consultant approved by the Engineer.

c. The location from which each core is taken shall be approved by the Engineer. Each core specimen shall be located, when possible, so its axis is perpendicular to the concrete surface and not near formed joints or obvious edges of a unit of deposit.

d. The core specimens shall be taken, if possible, so no reinforcing steel is within the confines of the core.

e. The diameter of core specimens should be at least 3 times the maximum nominal size of the course aggregate used in the concrete, but must be at least 2-inches in diameter.

f. The length of specimen, when capped, shall be at least twice the diameter of the specimen.

g. The core specimens shall be taken to the laboratory and when transported, shall not be thrown, dropped, allowed to roll, or damaged in any way.
h. Two (2) copies of test results shall be mailed directly to the Engineer. The concrete in question will be considered acceptable if the average compressive strength of a minimum of three test core specimens taken from a given area equal or exceed 85% of the specified 28-day strength and if the lowest core strength is greater than 75% of the specified 28-day strength.

3. In the event that concrete placed by the Contractor is suspected of not having proper air content, the Contractor shall engage a materials testing consultant approved by the Engineer, to obtain and test samples for air content in accordance with ASTM Specification C 457.

3.11 CARE AND REPAIR OF CONCRETE

A. The Contractor shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance by the Owner. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Care shall be exercised to avoid jarring forms or placing any strain on the ends of projecting reinforcing bars. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed work, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete at no additional cost to the Owner.

B. Areas of honeycomb shall be chipped back to sound concrete and repaired as directed.

C. Concrete formwork blowouts or unacceptable deviations in tolerances for formed surfaces due to improperly constructed or misaligned formwork shall be repaired as directed. Bulging or protruding areas, which result from slipping or deflecting forms shall be ground flush or chipped out and redressed as directed.

D. Areas of concrete in which cracking, spalling, or other signs of deterioration develop prior to final acceptance shall be removed and replaced, or repaired as directed. This stipulation includes concrete that has experienced cracking due to drying or thermal shrinkage of the concrete. Structural cracks shall be repaired using an approved epoxy injection system. Non-structural cracks shall be repaired using an approved hydrophilic resin pressure injected grout system, unless other means of repair are deemed necessary and approved. All repair work shall be performed at no additional cost to the Owner.

E. Concrete which fails to meet the strength requirements as outlined in Article 3.10, paragraph F, will be analyzed as to its adequacy based upon loading conditions, resultant stresses and exposure conditions for the particular area of concrete in question. If the concrete in question is found unacceptable based upon this analysis, that portion of the structure shall be strengthened or replaced by the Contractor at no additional cost to the Owner. The method of strengthening or extent of replacement shall be as directed by the Engineer.

- END OF SECTION -
PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Furnish all materials, labor, and equipment required to provide finishes of all concrete surfaces specified herein and shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03100 – Concrete Formwork
B. Section 03300 – Cast-in-Place Concrete
C. Section 03600 – Grout

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. ACI 301 – Specifications for Structural Concrete for Buildings
2. ACI 318 – Building Code Requirements for Structural Concrete

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300 – Submittals.

1. Manufacturer’s literature on all products specified herein.

PART 2 -- PRODUCTS

2.01 CONCRETE FLOOR SEALER

A. Floor sealer shall be Diamond Clear VOX or Super Diamond Clear VOX by the Euclid Chemical Company, MasterKure CC 300 SB by BASF Master Builder Solutions.
2.02 CONCRETE LIQUID DENSIFIER AND SEALANT

A. Concrete liquid densifier and sealant shall be a high performance, deeply penetrating concrete densifier and sealant. Product shall be odorless, colorless, VOC-compliant, non-yellowing silicate-based solution designed to harden, dustproof and protect concrete floors subjected to heavy vehicular traffic and to resist black rubber tire marks on concrete surfaces. The product must contain a minimum solids content of 20% of which 50% is silicate. Acceptable products are Diamond Hard by the Euclid Chemical Company, Seal Hard by L&M Construction Chemicals and MasterKure HD 210 WB by BASF Master Builder Solutions.

2.03 NON-METALLIC FLOOR HARDENER

A. The specified non-metallic mineral aggregate hardener shall be formulated, processed, and packaged under stringent quality control at the manufacturer's owned and controlled factory. The hardener shall be a factory-blended mixture of specifically processed graded mineral aggregate, selected Portland cement, and necessary plasticizing agents. Acceptable products shall be "Surflex" by the Euclid Chemical Company, "Harcol" by Sonneborn, "Maximent" by BASF, and "Mastercon" by BASF.

2.04 NON-OXIDIZING HEAVY DUTY METALLIC FLOOR HARDENER

A. Non-oxidizing heavy duty metallic floor hardener shall be formulated, processed, and packaged under stringent quality control at the manufacturer's owned and controlled factory. The hardener shall be a mixture of specifically processed non-rusting aggregate, selected Portland cement, and necessary plasticizing agents. Product shall be "Diamond-Plate" by the Euclid Chemical Company, or Masterplate by BASF Construction Chemicals.

2.05 NON-SLIP FLOORING ADDITIVE

A. Non-slip flooring additives for slip resistant floors shall be non-metallic. Non-slip flooring additives shall be Frictex NS by BASF Construction Chemicals, A-H Alox by Anti-Hydro, or Euco Grip by the Euclid Chemical Company.

PART 3 -- EXECUTION

3.01 FINISHES ON FORMED CONCRETE SURFACES

A. After removal of forms, the finishes described below shall be applied in accordance with Article 3.05 - Concrete Finish Schedule. Unless the finish schedule specifies otherwise, all surfaces shall receive at least a Type I finish. The Engineer shall be the sole judge of acceptability of all concrete finish work.

1. Type I - Rough: All fins, burrs, offsets, marks and all other projections left by the forms shall be removed. Projections, depressions, etc. below finished grade required to be removed will only be those greater than ¼-inch. All holes left by removal of ends of ties, and all other holes, depressions, bugs, air/blow holes or voids shall be filled solid with cement grout after first being thoroughly wetted and then struck off flush. The only holes below grade to be filled will be tie holes and any other holes larger than ¼-inch in any dimension. Honeycombs shall be chipped back to solid concrete and repaired as directed by the Engineer. All holes shall be
filled with tools, such as sponge floats and trowels, that will permit packing the hole solidly with cement grout. Cement grout shall consist of one part cement to three parts sand, epoxy bonding agent (for tie holes only) and the amount of mixing water shall be as little as consistent with the requirements of handling and placing. Color of cement grout shall match the adjacent wall surface.

2. Type II - Grout Cleaned: Where this finish is required, it shall be applied after completion of Type I finish. After the concrete has been predampened, a slurry consisting of one part cement (including an appropriate quantity of white cement in order to produce a color matching the surrounding concrete) and 1-1/2 parts sand passing the No. 16 sieve, by damp loose volume, shall be spread over the surface with clean burlap pads or sponge rubber floats. Mix proportions shall be submitted to the Engineer after a sample of the work is established and accepted. Any surplus shall be removed by scraping and then rubbing with clean burlap.

3. Type III - Smooth Rubbed: Where this finish is required, it shall be applied after the completion of the Type II finish. No rubbing shall be done before the concrete is thoroughly hardened and the mortar used for patching is firmly set. A smooth, uniform surface shall be obtained by wetting the surface and rubbing it with a carborundum stone to eliminate irregularities. Unless the nature of the irregularities requires it, the general surface of the concrete shall not be cut into. Corners and edges shall be slightly rounded by the use of the carborundum stone. Brush finishing or painting with grout or neat cement will not be permitted. A 100 square foot example shall be established at the beginning of the project to establish acceptability.

3.02 SLAB AND FLOOR FINISHES

A. The finishes described below shall be applied to floors, slabs, flow channels and top of walls in accordance with Article 3.05 - Concrete Finish Schedule. The Engineer shall be the sole judge of acceptability of all such finish work.

1. Type "A" - Screeded: This finish shall be obtained by placing screeds at frequent intervals and striking off to the surface elevation required. When a Type "F" finish is subsequently to be applied, the surface of the screeded concrete shall be roughened with a concrete rake to 1/2” minimum deep grooves prior to final set.

2. Type "B" - Wood or Magnesium Floated: This finish shall be obtained after completion of a Type "A" finish by working a previously screeded surface with a wood or magnesium float or until the desired texture is reached. Floating shall begin when the water sheen has disappeared and when the concrete has sufficiently hardened so that a person’s foot leaves only a slight imprint. If wet spots occur, water shall be removed with a squeegee. Care shall be taken to prevent the formation of laitance and excess water on the finished surface. All edges shall be edged with an 1/8-inch tool as directed by the Engineer. The finished surface shall be true, even, and free from blemishes and any other irregularities.

3. Type "C" - Cork Floated: This finish shall be similar to Type "B" but slightly smoother than that obtained with a wood float. It shall be obtained by power or band floating with cork floats.
4. **Type "D" - Steel Troweled:** This finish shall be obtained after completion of a Type "B" finish. When the concrete has hardened sufficiently to prevent excess fine material from working to the surface, the surface shall be compacted and smoothed with not less than two thorough and complete steel troweling operations. In areas which are to receive a floor covering such as tile, resilient flooring, or carpeting, the applicable Specification Sections and Contract Drawings shall be reviewed for the required finishes and degree of flatness. In areas that are intermittently wet such as pump rooms, only one troweling operation is required to provide some trowel marks for slip resistance. All edges shall be edged with an 1/8-inch tool as directed by the Engineer. The finish shall be brought to a smooth, dense surface, free from defects and blemishes.

5. **Type "E" - Broom or Belt:** This finish shall provide the surface with a transverse scored texture by drawing a broom or burlap belt across the surface immediately after completion of a Type "B" finish. All edges shall be edged with an 1/8-inch tool as directed by the Engineer.

6. **Type "F" - Swept in Grout Topping:** This finish shall be applied after a completion of a Type "A" finish. The concrete surface shall be properly cleaned, washed, and coated with a mixture of water and Portland Cement. Cement grout in accordance with Section 03600 shall then be plowed and swept into neat conformance with the blades or arms of the apparatus by turning or rotating the previously positioned mechanical equipment. Special attention shall be paid to true grades, shapes and tolerances as specified by the manufacturer of the equipment. Before beginning this finish, the Contractor shall notify the Engineer and the equipment manufacturer of the details of the operation and obtain approval and recommendations.

7. **Type "G" Hardened Finish:** This finish shall be applied after completion of a Type "B" or Type "C" finish and prior to application of a Type "D" finish. Hardeners shall be applied in strict accordance with the manufacturer's requirements. Hardeners shall be applied using a mechanical spreader. The hardener shall be applied in two shakes with the first shake comprising 2/3 of the total amount. Type "D" finish shall be applied following completion of application of the hardener.
   
   a. Non-metallic floor hardener shall be applied where specifically required on the Contract Drawings at the rate of 1.0 pounds/ft.².
   
   b. Non-oxidizing heavy duty metallic floor hardener shall be applied at the loading docks and where specifically required on the Contract Drawings or specified herein at the rate of 1.5 pounds/ft.².

8. **Type "H" - Non-Slip Finish:** This finish shall be provided by applying a non-slip flooring additive concurrently with the application of a Type "D" finish and/or installation of floor sealants. Application procedure shall be in accordance with manufacturer's instructions. Finish shall be applied where specifically required on the Contract Drawings or specified herein.

9. **Type "J" - Raked Finish:** This finish shall be provided by raking the surface as soon as the condition of the concrete permits by making depressions of ±1/4 inch.
3.03 CONCRETE SEALERS

A. Concrete sealers shall be applied where specifically required on the Contract Drawings or specified herein.

B. Sealers shall be applied after installation of all equipment, piping, etc. and after completion of any other related construction activities. Application of sealers shall be in strict accordance with manufacturer's requirements.

C. Sealers shall be applied to all floor slabs not painted and not intended to be immersed.

D. Floor slabs subjected to vehicular traffic shall be sealed with the concrete liquid densifier and sealer.

E. All other floor slabs to receive sealer shall be sealed with concrete floor sealer.

3.04 FINISHES ON EQUIPMENT PADS

A. Formed surfaces of equipment pads shall receive a Type III finish.

B. Top surfaces of equipment pads, except those surfaces subsequently required to receive grout and support equipment bases, shall receive a Type "D" finish, unless otherwise noted. Surfaces which will later receive grout shall, before the concrete takes its final set, be made rough by removing the sand and cement that accumulates on the top to the extent that the aggregate will be exposed with irregular indentations in the surface up to 1/2 inch deep.

3.05 CONCRETE FINISH SCHEDULE

<table>
<thead>
<tr>
<th>Item</th>
<th>Type of Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete surfaces indicated to receive textured coating (as noted on Drawings and in Section 09800, Special Coatings)</td>
<td>I</td>
</tr>
<tr>
<td>Inner face of walls of tanks, flow channels, wet wells, perimeter walls, and miscellaneous concrete structures: From 1 feet below water surface to bottom of wall</td>
<td>I</td>
</tr>
<tr>
<td>From top of wall to 1 feet below water surface</td>
<td>II</td>
</tr>
<tr>
<td>Exterior concrete walls below grade</td>
<td>I</td>
</tr>
<tr>
<td>Exterior exposed concrete walls, ceilings, beams, manholes, handholes, miscellaneous structures and columns (including top of wall) to one foot below grade. All other exposed concrete surfaces not specified elsewhere</td>
<td>II</td>
</tr>
<tr>
<td>All interior exposed concrete walls and vertical surfaces</td>
<td>III</td>
</tr>
<tr>
<td>Interior exposed ceiling, including beams</td>
<td>III</td>
</tr>
<tr>
<td>Floors of process equipment tanks or basins, wetwells, flow channels and slabs to receive roofing material or waterproof membranes</td>
<td>B</td>
</tr>
<tr>
<td>Item</td>
<td>Type of Finish</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>All interior finish floors of buildings and structures which are not continuously or intermittently wet</td>
<td>D</td>
</tr>
<tr>
<td>Exterior concrete sidewalks, steps, ramps, decks, slabs on grade and landings exposed to weather</td>
<td>E</td>
</tr>
<tr>
<td>Floors of process equipment tanks indicated on Drawings to receive grout topping</td>
<td>F</td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 03370

CONCRETE CURING

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Protect all freshly deposited concrete from premature drying and from the weather elements. The concrete shall be maintained with minimal moisture loss at a relatively constant temperature for a period of time necessary for the hydration of the cement and proper hardening of the concrete in accordance with the requirements specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03100 – Concrete Formwork
B. Section 03300 – Cast-In-Place Concrete
C. Section 03350 – Concrete Finishes

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. ACI 301 – Specifications for Structural Concrete for Buildings
2. ACI 304 – Guide for Measuring, Mixing, Transporting, and Placing Concrete
3. ACI 305 – Hot Weather Concreting
4. ACI 306 – Cold Weather Concreting
5. ACI 308 – Standard Practice for Curing Concrete
6. ASTM C171 – Standard Specifications for Sheet Materials for Curing Concrete
7. ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
8. ASTM C1315 – Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300, Submittals.
1. Proposed procedures for protection of concrete under wet weather placement conditions.

2. Proposed normal procedures for protection and curing of concrete.

3. Proposed special procedures for protection and curing of concrete under hot and cold weather conditions.


5. Manufacturer's literature and material certification for proposed curing compounds.

**PART 2 -- PRODUCTS**

2.01 LIQUID MEMBRANE-FORMING CURING COMPOUND

   A. Clear curing and sealing compound shall be a clear styrene acrylate type complying with ASTM C 1315, Type 1, Class A with a minimum solids content of 30%. Moisture loss shall not be greater than 0.40 kg/m² when applied at 300 sq.ft./gal. Manufacturer's certification is required. Acceptable products are Super Diamond Clear VOX by the Euclid Chemical Company, MasteKure CC 300 SB by BASF Master Builder Solutions, and Cure & Seal 30 Plus by Symons Corporation.

   B. Where specifically approved by Engineer, on slabs to receive subsequent applied finishes, compound shall conform to ASTM C 309. Acceptable products are “Kurez DR VOX” or “Kurez W VOX” by the Euclid Chemical Company. Install in strict accordance with manufacturer's requirements.

2.02 EVAPORATION REDUCER

   A. Evaporation reducer shall be BASF, "MasterKure ER 50", or Euclid Chemical "Euco-Bar".

**PART 3 -- EXECUTION**

3.01 PROTECTION AND CURING

   A. All freshly placed concrete shall be protected from the elements, flowing water and from defacement of any nature during construction operations.

   B. As soon as the concrete has been placed and horizontal top surfaces have received their required finish, provision shall be made for maintaining the concrete in a moist condition for at least a 5-day period thereafter except for high early strength concrete, for which the period shall be at least the first three days after placement. Horizontal surfaces shall be kept covered, and intermittent, localized drying will not be permitted.

   C. Walls that will be exposed on one side with either fluid or earth backfill on the opposite side shall be continuously wet cured for a minimum of five days. Use of a curing compound will not be acceptable for applications of this type.
D. The Contractor shall use one of the following methods to ensure that the concrete remains in a moist condition for the minimum period stated above.

1. Ponding or continuous fogging or sprinkling.
2. Application of mats or fabric kept continuously wet.
3. Continuous application of steam (under 150°F).
5. If approved by the Engineer, application of a curing compound in accordance with Article 3.04.

E. The Contractor shall keep absorbent wood forms wet until they are removed. After form removal, the concrete shall be cured by one of the methods in paragraph D.

F. Any of the curing procedures used in Paragraph 3.01-D may be replaced by one of the other curing procedures listed in Paragraph 3.01-D after the concrete is one-day old. However, the concrete surface shall not be permitted to become dry at any time.

3.02 CURING CONCRETE UNDER COLD WEATHER CONDITIONS

A. Suitable means shall be provided for a minimum of 72 hours after placing concrete to maintain it at or above the minimum as placed temperatures specified in Section 03300, Cast-In-Place Concrete, for concrete work in cold weather. During the 72-hour period, the concrete surface shall not be exposed to air more than 20°F above the minimum as placed temperatures.

B. Stripping time for forms and supports shall be increased as necessary to allow for retardation in concrete strength caused by colder temperatures. This retardation is magnified when using concrete made with blended cements or containing fly ash or ground granulated blast furnace slag. Therefore, curing times and stripping times shall be further increased as necessary when using these types of concrete.

C. The methods of protecting the concrete shall be approved by the Engineer and shall be such as will prevent local drying. Equipment and materials approved for this purpose shall be on the site in sufficient quantity before the work begins. The Contractor shall assist the Engineer by providing holes in the forms and the concrete in which thermometers can be placed to determine the adequacy of heating and protection. All such thermometers shall be furnished by the Contractor in quantity and type which the Engineer directs.

D. Curing procedures during cold weather conditions shall conform to the requirements of ACI 306.

3.03 CURING CONCRETE UNDER HOT WEATHER CONDITIONS

A. When air temperatures exceed 85°F, the Contractor shall take extra care in placing and finishing techniques to avoid formation of cold joints and plastic shrinkage cracking. If ordered by the Engineer, temporary sun shades and/or windbreakers shall be erected to guard against such developments, including generous use of wet burlap coverings and fog sprays to prevent drying out of the exposed concrete surfaces.
B. Immediately after screeding, horizontal surfaces shall receive an application of evaporation reducer. Apply in accordance with manufacturer's instructions. Final finish work shall begin as soon as the mix has stiffened sufficiently to support the workmen.

C. Curing and protection of the concrete shall begin immediately after completion of the finishing operation. Continuous moist-curing consisting of method 1 or 2 listed in paragraph 3.01D is mandatory for at least the first 24 hours. Method 2 may be used only if the finished surface is not marred or blemished during contact with the coverings.

D. At the end of the initial 24-hour period, curing and protection of the concrete shall continue for at least six (6) additional days using one of the methods listed in paragraph 3.01D.

E. Curing procedures during hot weather conditions shall conform to the requirements of ACI 305.

3.04 USE OF CURING COMPOUND

A. Curing compound shall be used only where specifically approved by the Engineer. Curing compound shall never be used for curing exposed walls with fluid or earth backfill on the opposite side. A continuous wet cure for a minimum of five days is required for these applications. Curing compound shall not be used on surfaces exposed to water in potable water storage tanks and treatment plants unless curing compound is certified in accordance with ANSI/NSF Standard 61.

B. When permitted, the curing compound shall maintain the concrete in a moist condition for the required time period, and the subsequent appearance of the concrete surface shall not be affected.

C. The compound shall be applied in accordance with the manufacturer's recommendations after water sheen has disappeared from the concrete surface and after finishing operations. Maximum coverage for the curing and sealing compound shall be 300 square feet per gallon for trowel finishes and 200 square feet per gallon for floated or broom surfaces. Maximum coverage for compounds placed where subsequent finishes will be applied shall be 200 square feet per gallon. For rough surfaces, apply in two directions at right angles to each other.

3.05 EARLY TERMINATION OF CURING

A. Moisture retention measures may be terminated earlier than the specified times only when at least one of the following conditions is met:

1. The strength of the concrete reaches 85 percent of the specified 28-day compressive strength in laboratory-cured cylinders representative of the concrete in place, and the temperature of the in-place concrete has been constantly maintained at 50 degrees Fahrenheit or higher.

2. The strength of concrete reaches the specified 28-day compressive strength as determined by accepted nondestructive methods or laboratory-cured cylinder test results.
SECTION 03400

PRECAST CONCRETE

PART 1 -- GENERAL

1.01 REQUIREMENTS

A. The Contractor shall construct all precast concrete items as required in the Contract Documents, including all appurtenances necessary to make a complete installation.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03200 - Reinforcing Steel
B. Section 03300 - Cast-in-Place Concrete
C. Section 03350 - Concrete Finishes
D. Section 03370 - Concrete Curing
E. Section 03600 - Grout
F. Section 05010 - Metal Materials
G. Section 05035 - Galvanizing
H. Section 05050 - Metal Fastening

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of other requirements of these Specifications, all work specified herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the end of the Bid.

1. California Building Code
2. ACI 318-Building Code Requirements for Structural Concrete
3. PCI Standard MNL-116 - Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products
4. PCI Design Handbook

1.04 SUBMITTALS

A. The Contractor shall submit the following for review in accordance with Section 01300, Submittals.
1. Shop drawings for all precast concrete items showing all dimensions, locations, and type of lifting inserts, and details of reinforcement and joints.

2. A list of the design criteria used by the manufacturer for all manufactured, precast items.

3. Design calculations, showing at least the design loads and stresses on the item, shall be submitted. Calculations shall be signed and sealed by a Professional Engineer registered in the State of California.

4. Certified reports for all lifting inserts, indicating allowable design loads.

5. Information on lifting and erection procedures.

1.05 QUALITY ASSURANCE

A. All manufactured precast concrete units shall be produced by an experienced manufacturer regularly engaged in the production of such items. All manufactured precast concrete and site-cast units shall be free of defects, spalls, and cracks. Care shall be taken in the mixing of materials, casting, curing and shipping to avoid any of the above. The Engineer may elect to examine the units at the casting yard or upon arrival of the same at the site. The Engineer shall have the option of rejecting any or all of the precast work if it does not meet with the requirements specified herein or on the Drawings. All rejected work shall be replaced at no additional cost to the Owner.

B. Manufacturer Qualifications

The precast concrete manufacturing plant shall be certified by the Prestressed Concrete Institute, Plant Certification Program, prior to the start of production. Certification is only required for plants providing prestressed structural members such as hollow core planks, double-T members, etc.

C. Plant production and engineering must be under direct supervision and control of an Engineer who possesses a minimum of five years experience in precast concrete work.

PART 2 -- PRODUCTS

2.01 CONCRETE

A. Concrete materials including portland cement, aggregates, water, and admixtures shall conform to Section 03300, Cast-in-Place Concrete.

B. For prestressed concrete items, minimum compressive strength of concrete at 28 days shall be 5,000 psi unless otherwise specified. Minimum compressive strength of concrete at transfer of prestressing force shall be 3,500 psi unless otherwise specified.

C. For non-prestressed concrete items, minimum compressive strength of concrete at 28 days shall be 4000 psi unless otherwise specified.

2.02 GROUT
A. Grout for joints between panels shall be a cement grout in conformance with Section 03600, Grout.

B. Minimum compressive strength of grout at 7 days shall be 3,000 psi.

2.03 REINFORCING STEEL

A. Reinforcing steel used for precast concrete construction shall conform to Section 03200, Reinforcing Steel.

2.04 PRESTRESSING STRANDS

A. Not used

2.05 STEEL INSERTS

A. Steel inserts shall be in accordance with Section 05010, Metal Materials.

B. All steel inserts protruding from or occurring at the surface of precast units shall be galvanized in accordance with Section 05035, Galvanizing.

2.06 WELDING

A. Welding shall conform to Section 05050, Metal Fastening.

2.07 BEARING PADS

A. Neoprene bearing pads shall conform to Section 05830, Bearing Devices and Anchors.

B. Plastic bearing pads shall be multi-monomer plastic strips which are non-leaching and support construction loads with no visible overall expansion, manufactured specifically for the purpose of bearing precast concrete.

PART 3 -- EXECUTION

3.01 FABRICATION AND CASTING

A. All precast members shall be fabricated and cast to the shapes, dimensions and lengths shown on the Drawings and in compliance with PCI MNL-116. Precast members shall be straight, true and free from dimensional distortions, except for camber and tolerances permitted later in this clause. All integral appurtenances, reinforcing, openings, etc., shall be accurately located and secured in position with the form work system. Form materials shall be steel and the systems free from leakage during the casting operation.

B. All cover of reinforcing shall be the same as detailed on the Drawings.

C. Because of the critical nature of the bond development length in prestressed concrete panel construction, if the transfer of stress is by burning of the fully tensioned strands at the ends of the member, each strand shall first be burned at the ends of the bed and then at each end of each member before proceeding to the next strand in the burning pattern.
D. The Contractor shall coordinate the communication of all necessary information concerning openings, sleeves, or inserts to the manufacturer of the precast members.

E. Concrete shall be finished in accordance with Section 03350, Concrete Finishes. Grout all recesses due to cut tendons which will not otherwise be grouted during erection.

F. Curing of precast members shall be in accordance with Section 03370, Concrete Curing. Use of a membrane curing compound will not be allowed.

G. The manufacturer shall provide lifting inserts or other approved means of lifting members.

3.02 HANDLING, TRANSPORTING AND STORING

A. Precast members shall not be transported away from the casting yard until the concrete has reached the minimum required 28 day compressive strength and a period of at least 5 days has elapsed since casting, unless otherwise permitted by the Engineer.

B. No precast member shall be transported from the plant to the job site prior to approval of that member by the plant inspector. This approval will be stamped on the member by the plant inspector.

C. During handling, transporting, and storing, precast concrete members shall be lifted and supported only at the lifting or supporting points as indicated on the shop drawings.

D. All precast members shall be stored on solid, unyielding, storage blocks in a manner to prevent torsion, objectionable bending, and contact with the ground.

E. Precast concrete members shall not be used as storage areas for other materials or equipment.

F. Precast members damaged while being handled or transported will be rejected or shall be repaired in a manner approved by the Engineer.

3.03 ERECTION

A. Erection shall be carried out by the manufacturer or under his supervision using labor, equipment, tools and materials required for proper execution of the work.

B. Contractor shall prepare all bearing surfaces to a true and level line prior to erection. All supports of the precast members shall be accurately located and of required size and bearing materials.

C. Installation of the precast members shall be made by leveling the top surface of the assembled units keeping the units tight and at right angles to the bearing surface.

D. Connections which require welding shall be properly made in accordance with Section 05050, Metal Fastening.

E. Grouting between adjacent precast members and along the edges of the assembled precast members shall be accomplished as indicated on the drawings, care being taken to solidly pack such spaces and to prevent leakage or droppings of grout through the assembled
precast members. Any grout which seeps through the precast members shall be removed before it hardens.

F. In no case shall concentrated construction loads, or construction loads exceeding the design loads, be placed on the precast members. In no case shall loads be placed on the precast members prior to the welding operations associated with erection, and prior to placing of topping (if required).

G. No Contractor, Subcontractor or any of his employees shall arbitrarily cut, drill, punch or otherwise tamper with the precast members.

H. Precast members damaged while being erected will be rejected or shall be repaired in a manner approved by the Engineer.

- END OF SECTION -
PART 1 -- GENERAL

1.01 THE REQUIREMENT
   A. Furnish all materials, labor, and equipment required to provide all grout used in concrete work and as bearing surfaces for base plates, in accordance with the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE
   A. Requirements of related work are included in Division 1 and Division 2 of these Specifications.

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS
   A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. CRD-C 621 Corps of Engineers Specification for Non-shrink Grout
2. ASTM C 109 Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch or 50 mm cube Specimens)
3. ASTM C 531 Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts and Monolithic Surfacings
4. ASTM C 579 Test Method for Compressive Strength of Chemical-Resistant Mortars and Monolithic Surfacings
5. ASTM C 827 Standard Test Method for Early Volume Change of Cementitious Mixtures
6. ASTM C 144 Standard Specification for Aggregate for Masonry Mortar

1.04 SUBMITTALS
   A. Submit the following in accordance with Section 01300 - Submittals.

   1. Certified test results verifying the compressive strength and shrinkage and expansion requirements specified herein.
2. Manufacturer’s literature containing instructions and recommendations on the mixing, handling, placement and appropriate uses for each type of grout used in the work.

1.05 QUALITY ASSURANCE

A. Field Tests

1. Compression test specimens will be taken during construction from the first placement of each type of grout and at intervals thereafter as selected by the Engineer to insure continued compliance with these Specifications. The specimens will be made by the Engineer or its representative.

   a. Compression tests and fabrication of specimens for cement grout and non-shrink grout will be performed as specified in ASTM C 109 at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at seven days, 28 days and any additional time period as appropriate.

   b. Compression tests and fabrication of specimens for epoxy grout will be performed as specified in ASTM C 579, Method B, at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at seven days and any other time period as appropriate.

2. The cost of all laboratory tests on grout will be borne by the Owner, but the Contractor shall assist the Engineer in obtaining specimens for testing. The Contractor shall be charged for the cost of any additional tests and investigation on work performed which does not meet the specifications. The Contractor shall supply all materials necessary for fabricating the test specimens, at no additional cost to the Owner.

3. All grout, already placed, which fails to meet the requirements of these Specifications, is subject to removal and replacement at no additional cost to the Owner.

PART 2 -- PRODUCTS

2.01 MATERIALS

A. Cement Grout

1. Cement grout shall be composed of Portland Cement and sand in the proportion specified in the Contract Documents and the minimum amount of water necessary to obtain the desired consistency. If no proportion is indicated, cement grout shall consist of one part Portland Cement to three parts sand. Water amount shall be as required to achieve desired consistency without compromising strength requirements. White Portland Cement shall be mixed with the Portland Cement as required to match color of adjacent concrete.

2. The minimum compressive strength at 28 days shall be 4000 psi.
3. For beds thicker than 1-1/2 inch and/or where free passage of grout will not be obstructed by coarse aggregate, 1-1/2 parts of coarse aggregate having a top size of 3/8 inch should be added. This stipulation does not apply for grout being swept in by a mechanism. These applications shall use a plain cement grout without coarse aggregate regardless of bed thickness.

4. Sand shall conform to the requirements of ASTM C144.

B. Non-Shrink Grout

1. Non-shrink grout shall conform to CRD-C 621 and ASTM C 1107, Grade B or C when tested at a max. fluid consistency of 30 seconds per CDC 611/ASTM C939 at temperature extremes of 45°F and 90°F and an extended working time of 15 minutes. Grout shall have a min. 28-day strength of 7,000 psi. Non-shrink grout shall be, "Euco N-S" by the Euclid Chemical Company, "Sikagruot 212" by Sika Corporation, "Conspec 100 Non-Shrink Non-Metallic Grout" by Conspec, "Masterflow 555 Grout" by BASF Master Builder Solutions.

C. Epoxy Grout

1. Epoxy grout shall be "Sikadur 32 Hi-Mod" by Sika Corporation, "Duralcrete LV" by Tamms Industries, or "Euco #452 Series" by Euclid Chemical, “MasterEmaco ADH 1090 RS” by BASF Master Builder Solutions.

2. Epoxy grout shall be modified as required for each particular application with aggregate per manufacturer's instructions.

D. Epoxy Base Plate Grout

1. Epoxy base plate grout shall be “Sikadur 42, Grout-Pak” by Sika Corporation, or “Masterflow 648” by BASF Master Builder Solutions.

2.02 CURING MATERIALS

A. Curing materials shall be as specified in Section 03370, Concrete Curing for cement grout and as recommended by the manufacturer for prepackaged grouts.

PART 3 -- EXECUTION

3.01 GENERAL

A. The different types of grout shall be used for the applications stated below unless noted otherwise in the Contract Documents. Where grout is called for in the Contract Documents which does not fall under any of the applications stated below, non-shrink grout shall be used unless another type is specifically referenced.

1. Cement grout shall be used for grout toppings and for patching of fresh concrete.

2. Non-shrink grout shall be used for grouting beneath base plates of structural metal framing.
3. Epoxy grout shall be used for bonding new concrete to hardened concrete.

4. Epoxy base plate grout shall be used for precision seating of base plates including base plates for all equipment such as engines, mixers, pumps, vibratory and heavy impact machinery, etc.

B. New concrete surfaces to receive cement grout shall be as specified in Section 03350, Concrete Finishes, and shall be cleaned of all dirt, grease and oil-like films. Existing concrete surfaces shall likewise be cleaned of all similar contamination and debris, including chipping or roughening the surface if a laitance or poor concrete is evident. The finish of the grout surface shall match that of the adjacent concrete. Curing and protection of cement grout shall be as specified in Section 03370, Concrete Curing.

C. All mixing, surface preparation, handling, placing, consolidation, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.

D. The Contractor, through the manufacturer of a non-shrink grout and epoxy grout, shall provide on-site technical assistance upon request, at no additional cost to the Owner.

3.02 CONSISTENCY

A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow.

3.03 MEASUREMENT OF INGREDIENTS

A. Measurements for cement grout shall be made accurately by volume using containers. Shovel measurement shall not be allowed.

B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

3.04 GROUT INSTALLATION

A. Grout shall be placed quickly and continuously, shall completely fill the space to be grouted and be thoroughly compacted and free of air pockets. The grout may be poured in place, pressure grouted by gravity, or pumped. The use of pneumatic pressure or dry-packed grouting requires approval of the Engineer. For grouting beneath base plates, grout shall be poured from one side only and thence flow across to the open side to avoid air-entrapment.

-END OF SECTION-
SECTION 03732
CONCRETE REPAIRS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish all materials, labor, equipment, tools, etc., required for the repair, renovation, and replacement of concrete and/or reinforcing steel as indicated on the Drawings, specified herein, and determined by field survey.

The Contractor, in conjunction with the Engineer, shall determine the extent of cracked or deteriorated concrete to be rehabilitated and/or resurfaced. A summary of the work to be performed shall be submitted to the Engineer for review, and such summary shall be approved by the Engineer prior to commencement of the Work.

B. Concrete repairs include the following:

1. Repair surfaces of concrete walls and slabs of existing chemical containment structure as required as it relates to the construction of new chemical storage area and pipe trench.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Division 1 - General Requirements

B. Division 3 - Concrete

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Shall be as specified in Section 01090, Reference Standards.

B. ICRI CSP International Concrete Repair Institute Concrete Surface Profile.

1.04 SUBCONTRACTOR/APPLICATOR QUALIFICATIONS

The Contractor shall furnish the name of all subcontractors/applicators which he proposes to use for this work, including necessary evidence and/or experience records to ascertain their qualifications in the application of epoxy, urethane, and polymer-modified repair materials. Approved applicator qualifications shall include:

A. A minimum of 5 years experience in applying epoxy, urethane, and polymer-modified and cement-based repair materials similar to those specified in this Section.

B. A letter from the manufacturer of the specified materials, on the manufacturer's letterhead, signed by an officer of the company, stating that the Subcontractor/applicator has been trained in the proper techniques for applying the product, including surface preparation and...
mixing, placing, curing, and caring for the manufacturer’s products. This letter shall further state that the Subcontractor/applicator is on the manufacturer's approved list of Contractors.

1.05 SUBMITTALS

A. Material certifications and technical data sheets on all grouts, mortars, epoxy resins, aggregates and repair products specified in this Section.

B. Subcontractor/Applicator qualifications as specified in Section 1.04.

C. Shop Drawings detailing any planned deviation from the proposed construction sequence and/or method of repair.

D. The Contractor, based on their experience in their profession, and/or recommendation from product manufacturers, may submit to the Engineer for approval, alternative materials and/or methods of work to assure the durability and watertight integrity of the repair work performed.

E. Detailed repair procedures for each repair type.

F. Letter from repair material manufacturer(s) certifying that all repair materials to be used to create single repairs are compatible for use together.

1.06 ADDITIONAL GUARANTEE

A. The Contractor shall guarantee all repair work performed under this Contract against defects in workmanship resulting in leakage and/or failure of concrete bond for a period of three (3) years from the date of the Certificate of Substantial Completion.

PART 2 -- MATERIALS

2.01 WATER

A. The water used for mixing concrete repair products shall be clear, potable, and free of deleterious substances.

2.02 AGGREGATE

A. All aggregate shall conform to ASTM C-33. The aggregate supplier shall submit to the Engineer documentation that the proposed aggregates comply with ASTM C-33 and the requirements listed below:

B. Pea Gravel - Pea gravel shall meet the gradation and material requirements of Standard Size 14 as defined by ASTM C-33. Pea gravel shall be clean and free from deleterious matter and shall contain no limestone.

2.03 EPOXY BONDING AGENT

A. Epoxy bonding agent shall conform to ASTM C-881 Type I, II, IV or V; Grade 2 for epoxy resin adhesives, depending on the application. The class of epoxy bonding agent shall be
suitable for all ambient and substrate temperatures. The epoxy resin shall be "Sikadur Hi-Mod Series" as manufactured by the Sika Corp, Lyndhurst, NJ, "Duralbond" as manufactured by Euclid Chemical Company, Cleveland, OH, “Euco #452 Series” by the Euclid Chemical Company, or “MasterEmaco ADH series” by BASF Master Builder Solutions.

2.04 ANTI-CORROSION REBAR COATING

A. Anti-corrosive coating shall be a two-component, polymer-modified cementitious material such as "Sika Armatec 110 EpoCem " manufactured by Sika Corp., Lyndhurst, NJ, “Duralprep A.C.” by the Euclid Chemical Company, or “MasterEmaco P 124” by BASF Master Builder Solutions.

2.05 EPOXY INJECTION CRACK REPAIR

A. Structural Crack Repair – Epoxy Injection Crack Repair shall be a two-component, 100% solids, high-modulus, low viscosity, moisture insensitive epoxy adhesive designed for structural repair. The epoxy adhesive shall be "Sikadur 52" manufactured by Sika Corp., Lyndhurst, NJ, "Duralcrete LV" manufactured by Euclid Chemical Company, Cleveland, OH, “Eucopoxy Injection Resin” by the Euclid Chemical Company, or “ MasterInject 1500” by BASF Master Builder Solutions.

2.06 SPALL REPAIR PATCHING MATERIAL

A. All spall repairs not requiring formwork shall be repaired using a one- or two-component, polymer-modified non-shrink cementitious mortar and shall have a minimum 28-day compressive strength of 7,000 psi. Spall repair mortar for use in horizontal applications shall be "Sikatop 122 Plus" manufactured by Sika Corp., Lyndhurst, NJ, “Eucocrete Supreme” or “Duraltop Flowable Mortar” by the Euclid Chemical Company, or "MasterEmaco T-302” or “Emaco R310” by BASF Construction Chemicals. Spall repair mortar for use in vertical and overhead applications shall be "Sikatop 123 Plus" manufactured by Sika Corp., Lyndhurst, NJ, “Verticoat or Verticoat Supreme” by the Euclid Chemical Company, or “MasterEmaco N 425” or “MasterEmaco N 400” by BASF Master Builder Solutions.

B. All spall repairs requiring formwork shall be repaired using a two-component, polymer-modified cementitious mortar/pea gravel mixture and shall have a minimum 28-day compressive strength of 7,000 psi. Spall repair mortar shall be "SikaTop 111 PLUS" manufactured by Sika Corp., Lyndhurst, NJ, "Eucocrete Supreme” manufactured by Euclid Chemical Company, Cleveland, OH, or “MasterEmaco T 310 CI” by BASF Master Builder Solutions.

2.07 EXPANSION JOINT MEMBRANE REPAIR SYSTEM

A. Expansion joint repair system shall be a hypalon sealing strip secured to the concrete substrate with an epoxy adhesive. System shall be provided by a single manufacturer, installed per manufacturer's recommendations, and shall be "Sikadur Combiflex" manufactured by Sika Corp., Lyndhurst, NJ or Engineer approved equal. Minimum width of waterproof membrane patch shall be twelve (12) inches unless shown otherwise on Contract Drawings.

2.08 WATERSTOP REPAIR SYSTEM
A. Waterstop repair system shall consist of a continuous, watertight, structural sealing compression joint system capable of withstanding 25% tension, 50% compression and 2-inches total movement while functioning as a watertight seal between concrete substrate headers. Waterstop Repair System shall be provided by a single manufacturer and shall be either:

1. Preformed, impermeable, closed cell, low-density, UV stable foam sealing strip system secured to concrete with a bonding agent. System shall be “CEVA 100 System” as manufactured by Chase Construction Products, “Wabo Evazote System”, or approved equal. Foam sealing strip and epoxy bonding agent shall be provided by the same manufacturer as a system and shall consist of “Phyzite 380” foam sealing strip with either “EVA-POX BONDER #1”, “EVA-POX UNDERWATER BONDER #47”, or “EVA-POX COLD CURE #41” bonding agent, or Evazote UV foam sealing strip with “Wabo Evazote Bonder” or “Wabo Evazote Cold Cure Bonder. Bonding agent shall be as recommended by the manufacturer based on substrate conditions at the time of installation.


2.09 STORAGE OF MATERIALS

A. The Contractor shall provide an area for repair material storage free from exposure to moisture in any form, before, during, and after delivery to the site. Manufactured materials shall be delivered in unbroken containers labeled with the manufacturer's name and product type. All mortar products shall be stored on raised platforms. Materials susceptible to damage by freezing shall be stored in a dry, heated, insulated area. Any material that has hardened, partially set, become caked and/or has been contaminated or deteriorated shall be rejected. All aggregates shall be stored in clean bins, scows or platforms.

PART 3 -- INSTALLATION

3.01 GENERAL REQUIREMENTS

A. No repair work shall be undertaken when ambient temperatures are below manufacturer's safe recommendations. No admixtures, except those required by the manufacturer, shall be used in the repairs specified herein.

B. All products shall be applied in strict accordance with manufacturer's recommendations. The Contractor shall furnish and install safe scaffolding and ladders for the Engineer's prework inspection, the repair work activities, and the Engineer's final inspection.

C. Sandblast or waterblast (3,000-5,000 psi waterjet) or use low impact hand chipping tools to clean deteriorated areas and remove all loose concrete, existing coatings, unsound material, debris, and laitance. All surfaces shall be clean, free of dirt, grease, loose particles, and deleterious substances and shall be prepared according to manufacturer's requirements.
3.02 EPOXY BONDING AGENT

A. An epoxy bonding agent shall be used when applying fresh concrete to previously placed concrete unless otherwise recommended by the manufacturer.

B. Existing concrete surfaces shall be roughened (1/16" or CSP 5 minimum profile) unless otherwise recommended by the manufacturer prior to application of bonding agent. Concrete surface shall be clean and sound, free of all foreign particles and laitance. Repair material shall be placed while bonding agent is still tacky. If bonding agent cures prior to placement of repair material, bonding agent shall be reapplied.

C. Repairing concrete with epoxy mortars shall conform to all the requirements of ACI 503.4 "Standard Specification for Repairing Concrete with Epoxy Mortars" (latest edition), except as modified herein.

3.03 ANTI-CORROSION REBAR COATING

A. Reinforcing steel cut or exposed during demolition and/or repair operations shall be sandblasted and cleaned prior to coating with an anti-corrosive coating. Anti-corrosive coating shall be applied as soon as the reinforcement is exposed and cleaned. Coating shall thoroughly cover all exposed parts of the steel and shall be applied according to manufacturer's recommendations.

3.04 STRUCTURAL CRACK REPAIR – EPOXY INJECTION

A. Vertical and Overhead Surfaces

1. Where indicated on the Drawings, or as directed by the Engineer, existing structural cracks 1/4" wide or narrower shall be repaired by pressure injecting Crack Repair material into the prepared crack. Seal crack surface using epoxy resin binder and install injection ports per manufacturer's recommendations. Holes drilled for injection ports shall not cut rebar. If rebar is encountered during drilling, the hole shall be abandoned and relocated, and the abandoned hole shall be patched immediately with non-shrink grout flush with the surface of the existing concrete. Once the surface sealing material has fully cured, inject crack with Crack Repair material using standard pressure injection equipment as directed by the manufacturer.

B. Horizontal Surfaces

1. Where indicated on the Drawings, or as directed by the Engineer, existing structural cracks 1/4" wide or narrower shall be repaired using Crack Repair by pressure injecting Crack Repair material into the prepared crack. Seal crack surface using epoxy resin binder and install injection ports per manufacturer's recommendations. Holes drilled for injection ports shall not cut rebar. If rebar is encountered during drilling, the hole shall be abandoned and relocated, and the abandoned hole shall be patched immediately with non-shrink grout flush with the surface of the existing concrete. Once the surface sealing material has fully cured, inject crack with Crack Repair material using standard pressure injection equipment as directed by the manufacturer.
2. Where indicated on the Drawings, or as directed by the Engineer, existing structural cracks wider than 1/4" shall be repaired by gravity feeding Crack Repair material into the prepared crack. First rout the concrete surface to form a 1/4" wide by 1/4" deep V-notch and clean the crack to remove all loose and foreign particles. Fill the crack with clean, dry sand and then pour structural crack repair binder into V-notch, completely filling crack. As binder penetrates into crack, additional binder shall be applied to the V-notch.

3.05 SPALL REPAIR PATCHING MATERIAL

   A. All voids or spalled areas to be repaired shall be chipped back to sound concrete a minimum 1/8" deep, with a minimum surface profile of CSP-5, cleaned and repaired with spall repair patching material according to manufacturer's recommendations. All patching shall provide a final finished surface which is flat, level and even with the existing concrete surface. Repair mortar shall not be feathered to meet existing concrete surface. Prior to commencing repair surface preparation, saw cut or grind a 1/2" deep groove around the perimeter around the repair area, perpendicular to the finished concrete surface to provide a square shoulder to the repair area. Repair areas shall be formed using clean, straight rectangular edges where possible. Final patching on horizontal surfaces shall receive a broom finish consistent with the finish on the existing structure.

3.06 EXPANSION JOINT REPAIR SYSTEM

   A. Thoroughly clean the concrete substrate and apply Expansion Joint Repair System according to the manufacturer’s recommendations.

3.07 WATERSTOP REPAIR SYSTEM

   A. Remove all existing expansion joint sealant, backer rod, and expansion joint filler material as required to install the waterstop repair system.

   B. Prepare existing concrete surfaces as required by the manufacturer.

   B. Apply bonding agent to existing concrete and foam sealing strip or neoprene profile, and insert into expansion joint, as required by the manufacturer.

3.08 CURING

   A. All repair products shall be cured in strict accordance with manufacturer recommendations. Wet curing is preferred where possible.

3.09 WORK IN CONFINED SPACES

   A. The Contractor shall provide and maintain safe working conditions for all employees and Subcontractors. Fresh air shall be supplied continuously to confined spaces through the combined use of existing openings, forced-draft fans and temporary ducts to the outside, or by direct air supply to individual workers. Fumes shall be exhausted to the outside from the lowest level of the confined space. Electrical fan motors shall be explosion-proof if in contact with fumes. No smoking or open fires shall be permitted in or near areas where volatile fumes may accumulate.
- END OF SECTION -
SECTION 05010

METAL MATERIALS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Metal materials not otherwise specified shall conform to the requirements of this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Materials for fasteners are included in Section 05050, Metal Fastening.

B. Requirements for specific products made from the materials specified herein are included in other sections of the Specifications. See the section for the specific item in question.

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. ASTM A36 Standard Specification for Structural Steel


D. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless


F. ASTM A276 Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes


H. ASTM A446 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) quality

I. ASTM A500 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

J. ASTM A501 Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

K. ASTM A529 Standard Specification for Structural Steel with 42 000 psi (290 Mpa) Minimum Yield Point (1/2 in. (12.7 mm) Maximum Thickness)

L. ASTM A536 Standard Specification for Ductile Iron Castings
M. ASTM A570 Standard Specification for Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality
N. ASTM A572 Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
O. ASTM A992 Standard Specification for Structural Steel Shapes
P. ASTM A666 Standard Specification for Austenitic Stainless Steel, Sheet, Strip, Plate, and Flat Bar for Structural Applications
Q. ASTM A1085 Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS)
V. ASTM B209 Standard Specification for Aluminum-Alloy Sheet and Plate
X. ASTM B308 Standard Specification for Aluminum-Alloy Standard Structural Shapes, Rolled or Extruded
Y. ASTM B574 Standard Specification for Nickel-Molybdenum-Chromium Alloy Rod
a. ASTM F593 Standard Specification for Stainless Steel Fasteners

1.04 SUBMITTALS
A. Material certifications shall be submitted along with any shop drawings for metal products and fabrications required by other sections of the Specifications.

1.05 QUALITY ASSURANCE
A. Owner may engage the services of a testing agency to test any metal materials for conformance with the material requirements herein. If the material is found to be in conformance with Specifications the cost of testing will be borne by the Owner. If the material does not conform to the Specifications, the cost of testing shall be paid by the Contractor and all materials not in conformance as determined by the Engineer shall be replaced by the Contractor at no additional cost to the Owner. In lieu of replacing materials the Contractor may request further testing to determine conformance, but any such testing shall be paid for by the Contractor regardless of outcome of such testing.
PART 2 -- PRODUCTS

2.01 CARBON AND LOW ALLOY STEEL

A. Material types and ASTM designations shall be as listed below:

1. Steel W Shapes A992
2. Steel HP Shapes A572 Grade 50
3. Steel M, S, C, and MC shapes and Angles, Bars, and Plates A36
4. Rods F 1554 Grade 36
5. Pipe - Structural Use A53 Grade B
6. Hollow Structural Sections A500 Grade C or A1085
7. Cold-Formed Steel Framing A 653

2.02 STAINLESS STEEL

A. All stainless steel fabrications exposed to underwater service shall be Type 316. All other stainless steel fabrications shall be Type 304, unless noted otherwise.

B. Material types and ASTM designations are listed below:

1. Plates and Sheets ASTM A167 or A666 Grade A
2. Structural Shapes ASTM A276
3. Fasteners (Bolts, etc.) ASTM F593

2.03 ALUMINUM

A. All aluminum shall be alloy 6061-T6, unless otherwise noted or specified herein.

B. Material types and ASTM designations are listed below:

1. Structural Shapes ASTM B308
2. Castings ASTM B26, B85, or B108
3. Extruded Bars ASTM B221 - Alloy 6061
4. Extruded Rods, Shapes and Tubes ASTM B221 - Alloy 6063
5. Plates ASTM B209 - Alloy 6061
6. Sheets ASTM B221 - Alloy 3003

C. All aluminum structural members shall conform to the requirements of Section 05140, Structural Aluminum.
D. All aluminum shall be provided with mill finish unless otherwise noted.

E. Where bolted connections are indicated, aluminum shall be fastened with stainless steel bolts.

2.04 CAST IRON

A. Material types and ASTM designations are listed below:

1. Gray  
   ASTM A48 Class 30B
2. Malleable  
   ASTM A47
3. Ductile  
   ASTM A536 Grade 60-40-18

2.05 BRONZE

A. Material types and ASTM designations are listed below:

1. Rods, Bars and Sheets  
   ASTM B138 - Alloy B Soft

2.06 HASTELLOY

A. All Hastelloy shall be Alloy C-276.

2.07 DISSIMILAR METALS

A. Dielectric isolation shall be installed wherever dissimilar metals are connected according to the following table.
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<th>Zinc</th>
<th>Galvanized Steel</th>
<th>Aluminum</th>
<th>Cast Iron</th>
<th>Ductile Iron</th>
<th>Mild Steel/Carbon Steel</th>
<th>Copper</th>
<th>Brass</th>
<th>Stainless Steel</th>
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</tbody>
</table>

1. "●" signifies dielectric isolation is required between the two materials noted.
2. Consult Engineer for items not listed in table.

PART 3 -- EXECUTION

(NOT USED)

- END OF SECTION -
PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Where galvanizing is called for in the Contract Documents, the galvanizing shall be performed in accordance with the provisions of this Section unless otherwise noted.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Further requirements for galvanizing specific items may be included in other Sections of the Specifications. See section for the specific item in question.

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. California Building Code

2. ASTM A123 - Standard Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip

3. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

4. ASTM A653 - Standard Specification for Steel Sheet, Zinc Coated (Galvanized), or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

4. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

5. ASTM A780 - Standard Practice of Repair of Damaged Hot-Dip Galvanized Coatings

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300, Submittals.

   1. Certification that the item(s) are galvanized in accordance with the applicable ASTM standards specified herein. This certification may be included as part of any material certification that may be required by other Sections of the Specifications.

PART 2 -- PRODUCTS

2.01 GALVANIC COATING

A. Material composition of the galvanic coating shall be in accordance with the applicable ASTM standards specified herein.

PART 3 -- EXECUTION

3.01 FABRICATED PRODUCTS

A. Products fabricated from rolled, pressed, and forged steel shapes, plates, bars, and strips, 1/8 inch thick and heavier which are to be galvanized shall be galvanized in accordance with ASTM A123. Products shall be fabricated into the largest unit which is practicable to galvanize before the galvanizing is done. Fabrication shall include all operations necessary to complete the unit such as shearing, cutting, punching, forming, drilling, milling, bending, and welding. Components of bolted or riveted assemblies shall be galvanized separately before assembly. When it is necessary to straighten any sections after galvanizing, such work shall be performed without damage to the zinc coating. The galvanizer shall be a member of American Galvanizers Association.

B. Components with partial surface finishes shall be commercial blast cleaned prior to pickling.

C. Sampling and testing of each lot shall be performed prior to shipment from the galvanizer’s facility per ASTM A123.

3.02 HARDWARE

A. Iron and steel hardware which is to be galvanized shall be galvanized in accordance with ASTM A153 and ASTM F2329.

3.03 ASSEMBLED PRODUCTS

A. Assembled steel products which are to be galvanized shall be galvanized in accordance with ASTM A123. All edges of tightly contacting surfaces shall be completely sealed by welding before galvanizing.
B. Assemblies shall be provided with vent and drain holes as required by the fabricator. Vent and drain hole sizes and locations shall be included in the structural steel shop drawings required in Specification 05120 Structural Steel for approval. All vent and drain holes shall be plugged and finished to be flush with and blend in with the surrounding surface. Where water intrusion can occur, the plug shall be carefully melted into the surrounding zinc coating using an appropriate fluxing agent.

3.04 METAL DECK

A. Unless noted otherwise, metal deck shall be galvanized in accordance with ASTM A653 G60 minimum. In moist environments or as indicated on the Contract Drawings, galvanizing shall meet the requirements of ASTM A653 G90.

B. Galvanized metal deck shall meet the requirements of ASTM A924.

3.05 REPAIR OF GALVANIZING

A. Galvanized surfaces that are abraded or damaged at any time after the application of zinc coating shall be repaired by thoroughly wire brushing the damaged areas and removing all loose and cracked coating, after which the cleaned areas shall be painted with 2 coats of zinc rich paint meeting the requirements of Federal Specification DOD-P-21035A and shall be thoroughly mixed prior to application. Zinc rich paint shall not be tinted. The total thickness of the 2 coats shall not be less than 6 mils. In lieu of repairing by painting with zinc rich paint, other methods of repairing galvanized surfaces in accordance with ASTM A780 may be used provided the proposed method is acceptable to the Engineer.

-END OF SECTION-
SECTION 05050

METAL FASTENING

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Furnish all materials, labor, and equipment required to provide all metal welds and fasteners not otherwise specified, in accordance with the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 05010 - Metal Materials
B. Section 05035 - Galvanizing
C. Section 05120 - Structural Steel

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. California Building Code
2. AC 193 Acceptance Criteria for Mechanical Anchors in Concrete Elements
3. AC 308 Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements
4. ACI 318 Building Code Requirements for Structural Concrete
5. ACI 355.2 Qualifications of Post-Installed Mechanical Anchors in Concrete
6. ACI 355.4 Qualifications of Post-Installed Adhesive Anchors in Concrete
7. ICC-ES AC193 Acceptance Criteria for Expansion and Screw Anchors (Concrete)
8. AISC 348 The 2009 RCSC Specification for Structural Joints
9. AISC Code of Standard Practice
10. AWS D1.1 Structural Welding Code - Steel
11. AWS D1.2 Structural Welding Code - Aluminum
12. AWS D1.6 Structural Welding Code – Stainless Steel
13. Aluminum Association Specifications for Aluminum Structures
14. ASTM A572/A572M-94C Standard Specification for High Strength Low-Alloy Columbium-Vanadium Structural Steel Grade 50
15. ASTM A36 Standard Specification for Carbon Structural Steel
16. ASTM A325 Standard Specification for High-Strength Bolts for Structural Steel Joints
17. ASTM A489 Standard Specification for Eyebolts
18. ASTM A490 Standard Specification for Quenched and Tempered Alloy Steel Bolts for Structural Steel Joints
19. ASTM A563 Standard Specifications for Carbon and Alloy Steel Nuts
22. ASTM F436 Standard Specification for Hardened Steel Washers
23. ASTM F467 Standard Specification for Nonferrous Nuts for General Use

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300, Submittals.

1. Shop Drawings providing the fastener’s manufacturer and type and certification of the fastener’s material and capacity.

2. Anchor design calculations sealed by a Professional Engineer currently registered in the State of California. Only required if design not shown on Contract Drawings.
3. A current ICC-ES Evaluation Service Report shall be submitted for all anchors that will be considered for use on this project.

4. Manufacturer’s installation instructions.

5. Copy of valid certification for each person who is to perform field welding.

6. Certified weld inspection reports, when required.

7. Welding procedures.

8. Installer qualifications.


10. Inspection Reports.

10. Results of Anchor Proof Testing.

1.05 QUALITY ASSURANCE

A. Fasteners not manufactured in the United States shall be tested and certification provided with respect to specified quality and strength standards. Certifications of origin shall be submitted for all U.S. fasteners supplied on the project.

B. Installer Qualifications: All concrete anchors shall be installed by an Installer with at least three years of experience performing similar installations. Concrete adhesive anchor installer shall be certified as an Adhesive Anchor Installer in accordance with ACI-CRSI Adhesive Anchor Installation Certification Program.

C. Installer Training: For concrete adhesive, expansion and screw anchors, conduct a thorough training with the manufacturer or the manufacturer’s representative for the Installer on the project. Training shall consist of a review of the complete installation process to include but not be limited to the following:

1. Hole drilling procedure.

2. Hole preparation and cleaning technique.

3. Adhesive injection technique and dispenser training/maintenance.

4. Concrete adhesive anchor preparation and installation.

5. Proof loading/torquing.

6. Provide a list of names of all installers who are trained by the Manufacturer’s Field Representative on this jobsite prior to installation of products. Record must include the installer name, date of training, products included in the training and trainer name and contact information.

7. Provide a copy of the current ACI/CRSI “Adhesive Anchor Installer” certification.
cards for all installers who will be installing adhesive anchors in the horizontal to vertically overhead orientation.

D. All steel welding shall be performed by welders certified in accordance with AWS D1.1. All aluminum welding shall be performed by welders certified in accordance with AWS D1.2. All stainless steel welding shall be performed by welders certified in accordance with AWS D1.6. Certifications of field welders shall be submitted prior to performing any field welds.

E. Welds and high strength bolts used in connections of structural steel will be visually inspected in accordance with Article 3.04.

F. The Owner may engage an independent testing agency to perform testing of welded connections and to prepare test reports in accordance with AWS. Inadequate welds shall be corrected or redone and retested to the satisfaction of the Engineer and/or an acceptable independent testing laboratory, at no additional cost to the Owner.

G. Provide a welding procedure for each type and thickness of weld. For welds that are not prequalified, include a Performance Qualification Report. The welding procedure shall be given to each welder performing the weld. The welding procedure shall follow the format in Annex E of AWS D1.1 with relevant information presented.

H. “Inspections of the adhesive dowel system shall be made by the Engineer or other representatives of the Owner in accordance with the requirements of the ESR published by the manufacturer. Provide adequate time and access for inspections of products and anchor holes prior to injections, installation, and proof testing.”

PART 2 -- PRODUCTS

2.01 ANCHOR RODS (ANCHOR BOLTS)

A. Anchor rods shall conform to ASTM F1554 Grade 36 except where stainless steel or other approved anchor rods are shown on the Drawings. Anchor rods shall have hexagonal heads and shall be supplied with hexagonal nuts meeting the requirements of ASTM A563 Grade A.

B. Where anchor rods are used to anchor galvanized steel or are otherwise specified to be galvanized, anchor rods and nuts shall be hot-dip galvanized in accordance with ASTM F1554.

C. Where pipe sleeves around anchor rods are shown on the Drawings, pipe sleeves shall be cut from Schedule 40 PVC plastic piping meeting the requirements of ASTM D1785.

2.02 HIGH STRENGTH BOLTS

A. High strength bolts and associated nuts and washers shall be in accordance with ASTM A325 or ASTM A490. Bolts, nuts and washers shall meet the requirements of AISC 348 “The 2009 RCSC Specification for Structural Joints”.

B. Where high strength bolts are used to connect galvanized steel or are otherwise specified to be galvanized, bolts, nuts, and washers shall be hot-dip galvanized in accordance with ASTM A325.
2.03 STAINLESS STEEL BOLTS

A. Stainless steel bolts shall conform to ASTM F-593. All underwater fasteners, fasteners in confined areas containing fluid, and fasteners in corrosive environments shall be Type 316 stainless steel unless noted otherwise. Fasteners for aluminum and stainless steel members not subject to the above conditions shall be Type 304 stainless steel unless otherwise noted.

B. Stainless steel bolts shall have hexagonal heads with a raised letter or symbol on the bolts indicating the manufacturer, and shall be supplied with hexagonal nuts meeting the requirements of ASTM F594. Nuts shall be of the same alloy as the bolts.

2.04 CONCRETE ANCHORS

A. General

1. Where concrete anchors are called for on the Drawings, one of the types listed below shall be used; except, where one of the types listed below is specifically called for on the Drawings, only that type shall be used. The determination of anchors equivalent to those listed below shall be on the basis of test data performed by an approved independent testing laboratory. There are two types used:

a. Expansion anchors shall be mechanical anchors of the wedge, sleeve, drop-in or undercut type.

b. Adhesive anchors shall consist of threaded rods or bolts anchored with an adhesive system into hardened concrete. Adhesive anchors shall be two part injection type using the manufacturer’s static mixing nozzle and shall be supplied as an entire system.

c. Concrete screw anchors shall be one piece, heavy duty screw anchor with a finished hex head

2. Expansion anchors shall not be used to hang items from above or in any other situations where direct tension forces are induced in anchor.

3. Unless otherwise noted, all concrete anchors which are submerged or are used in hanging items or have direct tension induced upon them, or which are subject to vibration from equipment such as pumps and generators, shall be adhesive anchors.

4. Adhesive anchors shall conform to the requirements of ACI 355.4 or alternately to AC 308. Expansion, concrete screw or mechanical anchors shall conform to the requirements of ACI 355.2 or alternately to AC 193. Anchors in Seismic Design Categories C through F shall conform to the International Building Code and ACI 318 Appendix Chapter 17 requirements as applicable, including seismic test requirements.

5. Fire Resistance: All anchors installed within fire resistant construction shall either be enclosed in a fire resistant envelope, be protected by approved fire-resistive
materials, be used to resist wind and earthquake loads only, or anchor non-structural elements.

6. Engineer’s approval is required for use of concrete anchors in locations other than those shown on the Drawings.

B. Concrete Anchor Design:

An anchor design consists of specifying anchor size, quantity, spacing, edge distance and embedment to resist all applicable loads. Where an anchor design is indicated on the Drawings, it shall be considered an engineered design and anchors shall be installed to the prescribed size, spacing, embedment depth and edge distance. If all parts of an anchor design are provided on the Drawings except embedment depth, the anchors will be considered an engineered design and the Contractor shall provide the embedment depth as indicated in Paragraph B.3 unless otherwise directed by the Engineer. Where an anchor design is not indicated by the Engineer on the Drawings, the Contractor shall provide the anchor design per the requirements listed below.

1. Structural Anchors: All concrete anchors shall be considered structural anchors if they transmit load between structural elements; transmit load between non-structural components that make up a portion of the structure and structural elements; or transmit load between life-safety related attachments and structural elements. Examples of structural concrete anchors include but are not limited to column anchor bolts, anchors supporting non-structural walls, sprinkler piping support anchors, anchors supporting heavy, suspended piping or equipment, anchors supporting barrier rails, etc. For structural anchors, the Contractor shall submit an engineered design with signed and sealed calculations performed by an Engineer currently registered in the State of California. Structural anchors shall be of a type recommended by the anchor manufacturer for use in cracked concrete and shall be designed by the Contractor in accordance with ACI 318 Appendix D.

2. Non-Structural Anchors: All other concrete anchors may be considered non-structural concrete anchors. The Contractor shall perform an engineered design for non-structural anchors. The Engineer may request the Contractor provide anchor design details for review, but submission of a signed, sealed design is not required. Non-structural anchors shall be designed by the contractor for use in uncracked concrete.

3. Embedment Depth

   a. Minimum anchor embedment shall be as indicated on the Drawings or determined by the Contractor’s engineered design. Although all manufacturers listed are permitted, the embedment depth indicated on the Drawings is based on “HIT HY-200 Adhesive Anchoring System” by Hilti, Inc if the contractor submits one of the other concrete adhesive anchors listed, the Engineer shall evaluate the required embedment and the Contractor shall provide the required embedment depth stipulated by the Engineer specific to the approved dowel adhesive.

   b. Where the embedment depth is not shown on the Drawings, concrete anchors shall be embedded no less than the manufacturer’s standard embedment (expansion or mechanical anchors) or to provide a minimum
allowable bond strength equal to the allowable yield capacity of the rod according to the manufacturer (adhesive anchors).

c. The embedment depth shall be determined using the actual concrete compressive strength, a cracked concrete state, maximum long term temperature of 110 degrees F, and maximum short term temperature of 140 degrees F. In no case shall the embedment depth be less than the minimum or more than the maximum stated in the manufacturer’s literature.

C. Structural Anchors:

1. Mechanical Anchors:


   b. Screw Anchors: Screw anchors shall be “Kwik HUS-EZ” and “KWIK HUS-EZ-1” by Hilti, Inc., “Titen HD” by Simpson Strong-Tie Co., or “Screw-Bolt+” by DeWalt. Bits specifically provided by manufacturer of chosen system shall be used for installation of anchors.

   c. Sleeve Anchors: Sleeve anchors shall be “HSL-3 Heavy Duty Sleeve Anchor” by Hilti, Inc. or “Power-Bolt +” by DeWalt.


   e. Shallow Embedment Internally Threaded Insert (3/4” max embedment): “Mini-Undercut +Anchor” by DeWalt, “HSC-A” by Hilti, Inc. or approved equal.

2. Adhesive Anchors:


   b. Structural adhesive anchor systems shall be IBC compliant and capable of resisting short term wind and seismic loads (Seismic Design Categories A through F) as well as long term and short term sustained static loads in both cracked and uncracked concrete in all Seismic Design Categories. Structural adhesive anchor systems shall comply with the latest revision of ICC-ES Acceptance Criteria AC308, and shall have a valid ICC-ES report in accordance with the applicable building code. **No or equal products will be considered unless prequalified and approved by the Engineer and Owner.**

D. Non-Structural Anchors: In addition to the acceptable non-structural anchors listed below, all structural anchors listed above may also be used as non-structural anchors.
1. Mechanical Anchors:


   b. Screw Anchors: Screw anchors shall be “Kwik HUS” by Hilti, Inc., “Screw Bolt+” or 316 Stainless Steel Wedge-Bolt” by DeWalt, “Large Diameter Tapcon (LDT) Anchor” by ITW Redhead, or “Titen HD” by Simpson Strong-Tie Co. Bits specifically provided by manufacturer of chosen system shall be used for installation of anchors.


   d. Drop-In Anchors: Drop-in anchors shall be “Drop-In” by Simpson Strong-Tie Co., “HDI Drop-In Anchor” by Hilti, Inc. “Smart DI” by DeWalt or “Multi-Set II Drop-In Anchor” by ITW Redhead.


2. Adhesive Anchors:

   a. Adhesive anchors shall be “Epcon A7” or “Epcon C6+ Adhesive Anchoring System” by ITW Redhead, “HIT HY-200 Adhesive Anchoring System” by Hilti, Inc., “SET Epoxy Tie High Strength Anchoring Adhesive” or “AT High Strength Anchoring Adhesive” by Simpson Strong-Tie Co., or AC100+ Gold” Adhesive Anchoring System” by DeWalt

   b. Non-structural adhesive anchors systems shall be IBC compliant and capable of resisting short term wind and seismic (Seismic Design Categories A and B) as well as long term and short term sustained static loads in uncracked concrete.

   c. Non-structural adhesive anchor embedment depth of the rod shall provide a minimum allowable bond strength that is equal to the allowable yield capacity of the rod unless noted otherwise on the Drawings.

   d. No or equal products will be considered unless prequalified and approved by the Engineer and Owner.

E. Concrete Anchor Rod Materials:

1. Concrete anchors used to anchor structural steel shall be a threaded steel rod per manufacturer’s recommendations for proposed adhesive system, but shall not have a yield strength (fy) less than 58 ksi nor an ultimate strength (fu) less than 72.5 ksi, unless noted otherwise. Where steel to be anchored is galvanized,
concrete anchors shall also be galvanized unless otherwise indicated on the Drawings.

2. Concrete anchors used to anchor aluminum, FRP, or stainless steel shall be Type 304 stainless steel unless noted otherwise. All underwater concrete anchors shall be Type 316 stainless steel.

3. Nuts, washers, and other hardware shall be of a material to match the anchors.

2.05 MASONRY ANCHORS

A. Anchors for fastening to solid or grout-filled masonry shall be adhesive anchors as specified above for concrete anchors.

B. Anchors for fastening to hollow masonry or brick shall be adhesive anchors consisting of threaded rods or bolts anchored with an adhesive system dispensed into a screen tube inserted into the masonry. The adhesive system shall use a two-component adhesive mix and shall inject into the screen tube with a static mixing nozzle. Thoroughly clean drill holes of all debris and drill dust prior to installation of adhesive and anchor. Contractor shall follow manufacturer’s installation instructions. The adhesive system shall be “HIT HY-70 System” as manufactured by Hilti, Inc., or “AC100+ Acrylic Adhesive” by DeWalt, “SET-XP” as manufactured by Simpson Strong-Tie Co.

C. Masonry anchors used to anchor steel shall be a threaded steel rod per manufacturer’s recommendations for proposed adhesive system, but shall not have a yield strength (fy) less than 58 ksi nor an ultimate strength (fu) less than 72.5 ksi, unless noted otherwise. Where steel to be anchored is galvanized, masonry anchors shall also be galvanized.

D. Masonry anchors used to anchor aluminum, FRP, or stainless steel shall be Type 304 stainless steel unless noted otherwise. All underwater anchors shall be Type 316 stainless steel.

E. Although all manufacturers listed are permitted, the masonry anchor design is based on “SET-XP by Simpson Strong-Tie ER 265” Revised 1-31-2018. If the contractor submits one of the other concrete adhesive anchors listed, the Engineer shall evaluate the proposed product and the Contractor shall provide the conditions stipulated by the Engineer specific to the approved adhesive anchor.

2.06 WELDS

A. Electrodes for welding structural steel and all ferrous steel shall comply with AWS Code, using E70 series electrodes for shielded metal arc welding (SMAW), or F7 series electrodes for submerged arc welding (SAW).

B. Electrodes for welding aluminum shall comply with the Aluminum Association Specifications and AWS D1.2.

C. Electrodes for welding stainless steel and other metals shall comply with AWS D1.6.

2.07 WELDED STUD CONNECTORS

A. Welded stud connectors shall conform to the requirements of AWS D1.1 Type C.
2.08 EYEBOLTS

A. Eyebolts shall conform to ASTM A489 unless noted otherwise.

2.09 HASTELLOY FASTENERS

A. Hastelloy fasteners and nuts shall be constructed of Hastelloy C-276.

2.10 ANTISEIZE LUBRICANT

A. Antiseize lubricant shall be C5-A Anti-Seize by Loctite Corporation, Molykote P-37 Anti-Seize Paste by Dow Corning, 3M Anti-Seize by 3M, or equal.

PART 3 -- EXECUTION

3.01 MEASUREMENTS

A. The Contractor shall verify all dimensions and review the Drawings and shall report any discrepancies to the Engineer for clarification prior to starting fabrication.

3.02 ANCHOR INSTALLATION

A. Anchor Rods, Concrete Anchors, and Masonry Anchors

1. Anchor rods shall be installed in accordance with AISC "Code of Standard Practice" by setting in concrete while it is being placed and positioned by means of a rigidly held template. Overhead adhesive anchors, and base plates or elements they are anchoring, shall be shored as required and securely held in place during anchor setting to prevent movement during anchor installation. Movement of anchors during curing is prohibited.

2. The Contractor shall verify that all concrete and masonry anchors have been installed in accordance with the manufacturer's recommendations and that the capacity of the installed anchor meets or exceeds the specified safe holding capacity.

3. Concrete anchors shall not be used in place of anchor rods without Engineer's approval.

4. All stainless steel threads shall be coated with antiseize lubricant.

B. High Strength Bolts

1. All bolted connections for structural steel shall use high strength bolts. High strength bolts shall be installed in accordance with AISC 348 "The 2009 RCSC Specification for Structural Joints". All bolted joints shall be Type N, snug-tight, bearing connections in accordance with AISC Specifications unless noted otherwise on the Drawings.

C. Concrete Anchors
1. Concrete at time of anchor installation shall be a minimum age of 21 days, have a minimum compressive strength of 2500 psi, and shall be at least 50 degrees F.

2. Concrete anchors designed by the Contractor shall be classified as structural or non-structural based on the requirements indicated above.

3. Concrete Anchor Testing:
   a. At all locations where concrete anchors meet the requirements for structural anchors at least 25 percent of all concrete anchors installed shall be proof tested to the value indicated on the Drawings, with a minimum of one tested anchor per anchor group. If no test value is indicated on the Drawings but the installed anchor meets the requirements for structural anchors, the Contractor shall notify the Engineer to allow verification of whether anchor load proof testing is required.
   
   b. Contractor shall submit a plan and schedule indicating locations of anchors to be proof tested, load test values and proposed anchor testing procedure (including a diagram of the testing equipment proposed for use) to the Engineer for review prior to conducting any testing. Proof testing of anchors shall be in accordance with ASTM E488 for the static tension test. If additional tests are required, inclusion of these tests shall be as stipulated on Contract Drawings.
   
   c. Where Contract Documents indicate anchorage design to be the Contractor’s responsibility and the anchors are considered structural per the above criteria, the Contractor shall submit a plan and schedule indicating locations of anchors to be proof tested and load test values, sealed by a Professional Engineer currently registered in the State of California. The Contractor’s Engineer shall also submit documentation indicating the Contractor’s proof testing procedures have been reviewed and the proposed procedures are acceptable. Proof testing procedures shall be in accordance with ASTM E488.
   
   d. Concrete Anchors shall have no visible indications of displacement or damage during or after the proof test. Concrete cracking in the vicinity of the anchor after loading shall be considered a failure. Anchors exhibiting damage shall be removed and replaced. If more than 5 percent of tested anchors fail, then 100 percent of anchors shall be proof tested.
   
   e. Proof testing of concrete anchors shall be performed by an independent testing laboratory hired directly by the Contractor and approved by the Engineer. The Contractor shall be responsible for costs of all proof testing, including additional testing required due to previously failed tests.

4. All concrete anchors shall be installed in strict conformance with the manufacturer’s printed installation instructions. A representative of the manufacturer shall be on site when required by the Engineer.

5. All holes shall be drilled in accordance with the manufacturer’s instructions except that cored holes shall not be allowed unless specifically approved by the Engineer.
If cored holes are allowed by the manufacturer and approved by the Engineer, cored holes shall be roughened in accordance with manufacturer requirements. Thoroughly clean drill holes of all debris, drill dust, and water in accordance with the manufacturer's instructions prior to installation of adhesive and threaded rod unless otherwise recommended by the manufacturer. Degree of hole dampness shall be in strict accordance with manufacturer recommendations. Installation conditions shall be either dry or water-saturated. Water filled or submerged holes shall not be permitted unless specifically approved by the Engineer. Injection of adhesive into the hole shall be performed to minimize the formation of air pockets in accordance with the manufacturer's instructions. Wipe rod free from oil that may be present from shipping or handling.

6. All adhesive anchor installations in the horizontal to vertically overhead orientation shall be conducted by a certified Adhesive Anchor Installer as certified by ACI/CSRI per ACI 318-11 9.2.2. Current AAI Certificate must be submitted to the Engineer of Record prior to commencement of any adhesive anchor installations.

D. Other Bolts

1. All dissimilar metal shall be connected with appropriate fasteners and shall be insulated with a dielectric or approved equal.

2. All stainless steel bolts shall be coated with antiseize lubricant.

3.03 WELDING

A. All welding shall comply with AWS Code for procedures, appearance, quality of welds, qualifications of welders and methods used in correcting welded work.

B. Welded stud connectors shall be installed in accordance with AWS D1.1.

3.04 INSPECTION

A. High strength bolting will be visually inspected in accordance with AISC 348 "The 2009 RCSC Specification for Structural Joints". Rejected bolts shall be either replaced or retightened as required.

B. Field welds will be visually inspected in accordance with AWS Codes. Inadequate welds shall be corrected or redone as required in accordance with AWS Codes.

C. Post-installed concrete anchors shall be inspected as required by ACI 318.

3.05 CUTTING OF EMBEDDED REBAR

A. The Contractor shall not cut embedded rebar cast into structural concrete during installation of post-installed fasteners without prior approval of the Engineer.

- END OF SECTION -
SECTION 05120

STRUCTURAL STEEL

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Furnish all equipment, labor, materials, and services required to provide all structural steel work in accordance with the Contract Documents. The term "structural steel" shall include items as defined in the AISC "Code of Standard Practice".

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 05010 - Metal Materials
B. Section 05035 - Galvanizing
C. Section 05050 - Metal Fastening

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of the Specifications, all work specified herein shall conform to the applicable requirements of the following documents.

1. California Building Code
2. AISC - "Code of Standard Practice."
3. AISC - "Specification for Structural Steel Buildings".
5. AWS - "Structural Welding Code".

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300, Submittals.

1. Certified Mill Test Reports
2. Affidavit of Compliance with grade specified
3. Shop Drawings which include the following:
   a. Layout drawings indicating all structural shapes, sizes, and dimensions.
   b. Beam and column schedules.
c. Detailed drawings indicating jointing, anchoring and connection details and vent and drain holes where required.

4. Structural Steel Survey

1.05 QUALITY ASSURANCE

A. Shop inspection may be required by the Owner at his own expense. The Contractor shall give ample notice to the Engineer prior to the beginning of any fabrication work so that inspection may be provided. The Contractor shall furnish all facilities for the inspection of materials and workmanship in the shop, and the inspectors shall be allowed free access to the necessary parts of the work. Inspectors shall have the authority to reject any materials or work which do not meet the requirements of these Specifications. Inspection at the shop is intended as a means of facilitating the work and avoiding errors but is expressly understood that it will in no way relieve the Contractor from his responsibility for furnishing proper materials or workmanship under this Specification.

B. The erector shall be a qualified installer who participates in the AISC Certification program and is designated an AISC Certified Erector, Category ACSE.

C. The fabricator shall be a qualified fabricator who participates in the AISC Certification program and is designated an AISC Certified Plant, Category STD.

PART 2 -- PRODUCTS

2.01 MATERIALS

A. Structural Steel

1. Structural steel for W shapes shall conform to ASTM A992 unless otherwise indicated.

2. Structural steel for HP shapes shall conform to ASTM A572 Grade 50 unless otherwise indicated.

3. Structural steel for S, M, C, and MC shapes and angles and plates shall conform to ASTM A36 unless otherwise indicated.

4. Steel pipe shall be ASTM A53, Grade B.

5. HSS shall be ASTM A500, Grade C or ASTM A1085. All members shall be furnished full length without splices unless otherwise noted or accepted by the Engineer.

6. All unidentified steel will be rejected and shall be removed from the site and replaced by the Contractor, all at the expense of the Contractor.

7. Fasteners for structural steel shall be in accordance with Section 05050, Metal Fastening.
B. Welds

1. Electrodes for welding shall be in accordance with Section 05050, Metal Fastening.

PART 3 -- EXECUTION

3.01 MEASUREMENT

A. The Contractor shall verify all dimensions and shall make any field measurements necessary and shall be fully responsible for accuracy and layout of work. The Contractor shall review the Drawings and any discrepancies shall be reported to the Engineer for clarification prior to starting fabrication.

3.02 FABRICATION

A. Fabrication shall be in accordance with the AISC "Specification for Structural Steel Buildings and AISC "Code of Standard Practice". Fabrication shall begin only after Shop Drawing approval.

B. Except where otherwise noted on the Drawings or in this Specification, all shop connections shall be welded.

C. All holes in structural steel members required for anchors, anchor rods, bolts, sag rods, vent and drain holes or other members or for attachment of other work shall be provided by the fabricator and detailed on the Shop Drawings.

D. All materials shall be properly worked and match-marked for field assembly.

E. Where galvanizing of structural steel is required, it shall be done in accordance with Section 05035, Galvanizing.

3.03 DELIVERY, STORAGE AND HANDLING

A. Structural members shall be loaded in such a manner that they may be transported and unloaded without being over-stressed, deformed or otherwise damaged.

B. Structural steel members and packaged materials shall be protected from corrosion and deterioration. Material shall be stored in a dry area and shall not be placed in direct contact with the ground. Materials shall not be placed on the structure in a manner that might cause distortion or damage to the members or the supporting structures. The Contractor shall repair or replace damaged materials or structures as directed.

3.04 ERECTION

A. The erection of all structural steel shall conform to the applicable requirements of the AISC "Specification for Structural Steel Buildings" and AISC "Code of Standard Practice". All temporary bracing, guys and bolts as may be necessary to ensure the safety of the structure until the permanent connections have been made shall be provided by the Contractor.
B. Structural members shall be set accurately to the lines and elevations indicated. The various members shall be aligned and adjusted to form a part of a complete frame or structure before permanently fastened. A licensed land surveyor shall survey the structural steel during erection and shall provide a final survey indicating elevations and locations of all major members. Necessary adjustments to compensate for discrepancies in elevations and alignments shall be performed.

C. No cutting of structural steel members in the field will be allowed except by the written approval of the Engineer.

D. Bearing surfaces and other surfaces which will be in permanent contact shall be cleaned before assembly.

E. Field welding shall not be permitted unless specifically indicated in the Drawings or approved in writing by the Engineer. All field welding shall comply with Section 05050, Metal Fastening.

F. All bolted connections shall use high strength bolts in accordance with Section 05050, Metal Fastening. High strength bolts shall be installed in accordance with AISC 348 “The 2009 RCSC Specification for Structural Joints”. Bolts specified or noted on the Drawings to be a tension or slip critical “SC” type connection shall be fully pretensioned with proper preparation of the faying surfaces. All other bolts shall be snug tightened unless otherwise noted on the Drawings.

G. All field connections shall be accurately fitted up before being bolted. Drifting shall be only such as will bring the parts into position and shall not be sufficient to enlarge the holes or to distort the metal. All unfair holes shall be drilled or reamed.

H. Misfits at Bolted Connections

1. Where misfits in erection bolting are encountered, the Engineer shall be immediately notified. The Contractor shall submit a method to remedy the misfit for review by the Engineer. The Engineer will determine whether the remedy is acceptable or if the member must be refabricated.

2. Incorrectly sized or misaligned holes in members shall not be enlarged by burning or by the use of drift pins. The Contractor shall notify the Engineer immediately and shall submit a proposed method of remedy for review by the Engineer.

3. Where misalignment between anchor rods and rod holes in steel members are encountered, the Engineer shall be immediately notified. The Contractor shall submit a method to remedy the misalignment for review by the Engineer.
I. Grouting of Base Plates and Bearing Plates

1. The bottom surface of the plates shall be cleaned of all foreign materials, and concrete or masonry bearing surface shall be cleaned of all foreign materials and roughened to improve bonding.

2. Accurately set all base and bearing plates to designated levels with steel wedges or leveling plates.

3. Baseplates shall be grouted with non-shrink grout to assure full uniform bearing. Grouting shall be done prior to placing loads on the structure. Non-shrink grout shall conform to Section 03600, Grout.

4. Anchor rods shall be tightened after the supported members have been positioned and plumbed and the non-shrink grout has attained its specified strength.

J. Where finishing is required, assembly shall be completed including bolting and welding of units before start of finishing operations.

3.05 PAINTING

A. Painting shall be performed according to Section 09900, Painting and the following additional requirements.

1. Concrete Encased Steel: Steel members which will be encased in concrete shall be cleaned but not painted prior to encasement.

2. Contact Surfaces: Contact surfaces such as at field connections, shall be cleaned and primed but not painted.

3. Finished Surfaces: Machine finished surfaces shall be protected against corrosion by a rust-inhibiting coating which is easily removed prior to erection or which has characteristics that make removal unnecessary prior to erection.

4. Surfaces Adjacent to Field Welds: Surfaces within 2 inches of any field weld location shall be free of materials that would prevent proper welding or produce objectionable fumes while welding is being done.

- END OF SECTION -
SECTION 05520
HANDRAILS AND RAILINGS

PART 1 -- GENERAL

1.01 THE REQUIREMENT
   A. Furnish all materials, labor, and equipment required to provide all handrails and railings in accordance with the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE
   A. Section 05010 - Metal Materials
   B. Section 05050 - Metal Fastening

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS
   A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.
      2. Aluminum Association Specifications for Aluminum Structures
      3. Occupational Safety and Health Administration (OSHA) Regulations

1.04 SUBMITTALS
   A. Submit the following in accordance with Section 01300, Submittals.
      1. Complete fabrication and erection drawings of all metal work specified herein.
      2. Other submittals as required in accordance with Section 05010, Metal Materials and Section 05050, Metal Fastening.

PART 2 -- PRODUCTS

2.01 METAL MATERIALS
   A. Metal materials used for handrails and railings shall conform to Section 05010, Metal Materials, unless noted otherwise.
2.02 METAL FASTENING

A. All welds and fasteners used in handrails and railings shall conform to Section 05050, Metal Fastening, unless noted otherwise.

2.03 HANDRAILS AND RAILINGS

A. General - Handrail systems shall consist of all railings, posts, toeboards, baseplates, anchors, and accessories required for a complete and rigid installation.

1. All handrail systems shall be fabricated from extruded aluminum alloy 6061-T6 or 6105-T5, with Aluminum Association M12C22A41 finish, unless otherwise noted.

2. Metal railings shall be fabricated from 1-1/2 inch Schedule 40 pipe. Metal railing support posts shall be fabricated from 1-1/2 inch Schedule 80 pipe.

3. The centerline of the top guard rail shall be 42 inches above the walking surface for level rail. For stair rail, the centerline of the top guard rail shall be 42 inches above the leading edge of the tread nosing. Stair handrail shall be 34 inches above the leading edge of the tread nosing. See Standard Detail 0552000.

4. Posts

   a. Maximum horizontal spacing between posts for level rail shall be six feet.

   b. Maximum horizontal spacing between posts for stair rail shall be five feet.

5. All rail joints shall be finished flush and shall occur only at supports. Posts shall not interrupt the continuation of the top rail at any point along the railing, including corners and end terminations. The top surface of the top railing shall be smooth and shall not be interrupted by projecting fittings.

6. Toeboards

   a. Toeboards shall project 4-inches above the walking surface and shall not infringe on the minimum required walkway width.

   b. Aluminum toeboards shall be extruded from aluminum alloy 6063-T6 unless otherwise noted.

   c. Toeboards shall have a minimum thickness of 1/8" at any point. Geometry of toeboard shall closely resemble geometry shown on Drawings.

7. Expansion joint splices shall be provided at 30 foot maximum spacing and at all expansion joints in the structure supporting the handrail.

8. The handrail system shall be designed to resist the design loads specified by both OSHA and the California Building Code - 2016.

9. Provide handrail extensions at top and bottom of stairs and ramps in accordance with the California Building Code - 2016.
B. For metal handrail, the Contractor shall have the option of providing a handrail system of either an all welded type construction or a component type construction.

1. With both the all welded or component type construction, the baseplates and toeboards shall be furnished as shown on the Drawings.

2. Component Type System
   a. All fittings and brackets shall be designed for stainless steel concealed set screws with internal tyne type connectors.
   b. Exposed fittings shall be cast or extruded aluminum, or stainless steel to match ladder material, except where corrosion-resistant steel is employed as a standard fabricator's item for use.
   c. Component type handrail shall be as manufactured by Thompson Fabricating Company, Inc., or Hollaender Manufacturing Company, Inc.

3. Welded handrail may be field assembled using component type fittings as described herein.

C. Handrail shall be either Type I or Type II handrail as shown on the Drawings. If no type is indicated on Drawings, handrail shall be Type I.

1. Type I handrail shall be a two-rail system. The centerline of the intermediate rail shall be 21 inches above the walking surface.

2. Type II handrail shall be a three-rail system with vertical posts spanning between the two intermediate rails.
   a. The centerline of the lower intermediate rail shall be 7 inches above the walking surface.
   b. The centerline of the upper intermediate rail shall be 5-3/4" below the centerline of the top rail.
   c. Vertical posts spanning between the intermediate rails shall be 1/2" diameter schedule 40 pipe or fiberglass rod.
   d. Spacing of vertical posts shall be as required to prevent passage of a 4-inch sphere at any point.

D. Where gates are required in handrails as shown on the Drawings, they shall be self-closing and shall be provided by the same manufacturer as the handrail. Gates shall swing away from the opening being protected by the handrail.

E. Where safety chains are required in handrails as shown on the Drawings, chains shall be constructed of Type 304 stainless steel. Chains shall be straight link style, 3/16-inch diameter, with at least twelve links per foot, and with snap hooks on each end. Snap hooks shall be boat type and eye bolts for attachment of chains shall be 3/8-inch bolts with 3/4-inch eye diameter welded to the railing posts. Two (2) chains, four inches longer than the anchorage spacing shall be supplied for each guarded area.
2.04 FREE STANDING RAILING SYSTEM

A. Free standing railing system shall be installed on roof ledges where accessible equipment is provided on roof and roof does not have a perimeter parapet wall of a minimum height of 42 inches. Free standing railing system shall be Safety Rail 2000 Guardrail System by BlueWater Mfg., Inc. or approved equal.

B. Toe Board brackets shall be used when the parapet wall is less than 3-1/2" in height.

   1. Railing System shall be designed to withstand a minimum 200 pounds of test load in any direction.
   2. Railing System shall consist of a top rail and rail at mid height between top rail and walking surface.
   3. Railing system shall extend to a height of at least 42" from the finished roof deck.
   4. Railing system shall be free of sharp edges and snag points.

D. Railing and Base
   1. Rail shall be 1 5/8" O.D. Hot Rolled Pickled Electric Weld Tubing
   2. Each support post shall have a free standing base cast from Class 30 Gray Iron material.
   3. Each base shall have four (4) receiver posts for accepting the rails.
   4. The receiver posts shall have a positive locking system. A friction locking system will not be acceptable.
   5. The receiver posts shall have a slot to enable the rails to be mounted in any direction.

E. Hardware
   1. The securing pins shall be made from 1010 carbon steel. The pins shall be zinc plated and yellow chromate dipped. The pins shall consist of a collared pin and a lanyard that connects to a lynch pin.
   2. For Gate Assemblies Only. Bolts and washers shall be 3/8" x 3 ½" and 3/8" x 3" grade 5, zinc plated.
   3. Finish: Rails: Specify factory finish Safety Yellow Powder Coat Paint, Hot Dipped Galvanized or a color to match the building.
      Bases: Specify factory finish Safety Yellow Powder Coat Paint, Hot Dipped Galvanized or a color to match the building.
PART 3 -- EXECUTION

3.01 FABRICATION

A. All measurements and dimensions shall be based on field conditions and shall be verified by
the Contractor prior to fabrication. Such verification shall include coordination with all
adjoining work.

B. All fabricated work shall be shop fitted together as much as practicable, and delivered to the
field, complete and ready for erection.

C. All work shall be fabricated and installed in a manner that will provide for expansion and
contraction, prevent shearing of bolts, screws, and other fastenings, ensure rigidity, and
provide a close fit of sections.

D. Finished members shall conform to the lines, angles, and curves shown on the drawings and
shall be free from distortions of any kind.

E. All shearings shall be neat and accurate, with parts exposed to view neatly finished. Flame
cutting is allowed only when performed utilizing a machine.

F. Concrete anchors and bolts for attachment of handrail baseplates to supporting members
shall conform to Section 05050, Metal Fastening.

G. All fabricated items shall be shop painted in accordance with Section 09900, Painting.

3.02 INSTALLATION

A. Assembly and installation of handrails and railings shall be performed in strict accordance
with manufacturer’s recommendations.

B. All handrails and railings shall be erected square, plumb and true, accurately fitted,
adequately anchored in place, and set at proper elevations and positions.

- END OF SECTION -
SECTION 06610

GLASS FIBER AND RESIN FABRICATIONS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install all fiberglass items as specified herein and as shown on the Drawings. The Contractor shall be responsible for the coordination with related work specified elsewhere and to provide all hardware, accessories and appurtenances required for a complete installation, including all fabrication and mounting hardware.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 05050, Metal Fastening
B. Section 07900, Joint Fillers, Sealants, and Caulking
C. Section 09900, Painting

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. ASTM D2996 – Specification for Filament Sound Reinforced Thermosetting Resin Pipe
2. ASTM D3647 - Standard Practice for Classifying Reinforced Plastic Pultruded Shapes According to Composition

1.04 SUBMITTALS

A. The Contractor shall submit shop drawings showing fabrication details and a Performance Affidavit for all items specified herein in accordance with Section 01300, Submittals and Section 11000, Equipment General Provisions.

B. Certification of compliance with ASTM Standards.

C. Where specifically requested, design calculations sealed by a currently Registered Professional Engineer in the State of California.
1.05 QUALITY ASSURANCE

A. All fiberglass items of the same type provided shall be the products of a single manufacturer for compatibility.

B. It shall be the Contractor’s responsibility to ensure that the fiberglass items and appurtenances furnished shall be compatible and have the necessary operating clearances with the structural elements and equipment shown on the Drawings.

C. Manufacturer shall provide a 3 year warranty on all FRP products against defect in material and workmanship.

PART 2 -- MATERIALS

2.01 GENERAL

A. The manufacturer shall maintain a continuous quality control program and shall, upon request, furnish the Engineer with certified test reports consisting of physical tests of samples.

B. Ultraviolet light resistive resins shall be used for all exterior locations and where specified.

C. All FRP resins shall be flame resistant and shall meet the requirements of ASTM D 635 and ASTM E 84, Class 1 with a maximum flame spread rating of 25.

D. All edges shall be sealed in the mold where possible. Machined or cut edges shall be sealed with a compatible resin system.

2.02 GRATING AND TREADS

A. Fiberglass grating and treads shall be furnished and installed in areas shown on the Drawings including all FRP angle supports, fasteners and accessories. Gratings and treads shall consist of extruded bearing bars positioned and locked by crossbars. Grating and treads shall be installed in accordance with the manufacturer's recommendations.

B. Grating shall be fabricated into easily removable sections as large as possible up to 150 lbs. per section.

C. Fasteners shall not project above the walking surface.

D. Fiberglass grating and treads shall be manufactured of polyester resin except for sodium hypochlorite applications where vinyl ester resin shall be used. Grating and treads shall be produced by IKG Industries, Fibergrate, Inc., IMCO Reinforced Plastics, Inc., or equal.

E. Grating shall be designed for a uniform loading of 100 PSF over the gross projected area with deflection limited to 0.375" or grating span/240 whichever is less. Fiberglass or PVC support beams shall be provided as required to meet deflection criteria.
F. The grating and tread supplier shall supply all shelf support angles, embedded angles with anchors, concrete anchors and necessary 316 stainless steel grating clips coated with epoxy paint per Section 09900, Painting, for a complete system.

G. Treads shall be designed for a 300 lb. concentrated load at midspan. Treads shall be furnished with integral nosing.

2.03 GRATING FLOOR SYSTEM

A. Fiberglass grating floor system shall be furnished and installed in areas shown on the Drawings and shall include all FRP angle supports, FRP adjustable pedestal supports, FRP cross bracing, fasteners, and accessories as required for a complete system. Grating shall consist of bidirectional molded FRP gratings. Grating and supports shall be provided by a single manufacturer and installed in accordance with the manufacturer’s recommendations to provide a level walking surface.

B. Grating shall be fabricated into easily removable sections as large as possible up to 150 lbs. per section.

C. Fasteners shall not project above the walking surface.

D. Fiberglass grating and supports shall be manufactured of polyester resin. Grating and supports shall be produced by Fibergrate, Inc., IMCO Reinforced Plastics, Inc., American Grating, LLC, or equal.

E. Grating and supports shall be designed for a uniform loading of 100 psf. Grating deflection shall be limited to 0.25”.

F. Grating clips and metal fasteners shall be Type 316 stainless steel coated with epoxy paint per Section 09900, Painting.

2.04 FIBERGLASS WEIRS AND BAFFLES

A. Not used

2.05 EFFLUENT TROUGHS

A. Not used

2.06 PARSHALL FLUME

A. Not used

2.07 FRP STOP PLATES

A. Not used

2.08 FIBERGLASS (FRP) LOUVERS

A. Not used

2.09 MANHOLE LADDERS
A.  Not used

2.10  FIXED LADDERS
A.  Not used

2.11  CONNECTIONS
A.  All connections shall be non-corrosive, non-staining, and concealed where practicable, as detailed on the Drawings or specified herein.
B.  Fiberglass fasteners shall be "Fibrebolt", as manufactured by Strongwell, Inc., or equal.
C.  All metal fasteners shall be Type 316 stainless steel shall be used unless noted otherwise.
D.  Holes for bolts and screws shall be drilled.
E.  Joints exposed to weather shall be formed to exclude water.
F.  Design and installation of fiberglass items shall provide for expansion and contraction, prevent shearing of bolts, screws and other fastenings, and provide close fitting of sections.

2.12  STRUCTURAL SHAPES AND FLAT SHEETS
A.  Shapes shall conform to sizes indicated on Drawings and shall be ISOFR. Shapes shall be manufactured by Strongwell, Inc., or equal.
B.  Metal bolted connections shall be made with stainless steel bolts. Bolts shall conform to Section 05050, Metal Fastening.
C.  Adhesive bonded connections shall be made with a compatible epoxy adhesive following manufacturer's instructions. Adhesive bonded connections shall only be used where bolted connection are not feasible.

2.13  FRP HANDRAIL
A.  Not used

PART 3 -- EXECUTION

3.01  FABRICATION
A.  All cut edges and holes shall be sealed with a compatible resin.
B.  All FRP items shall conform to the dimensions indicated on the Drawings.
C.  All fiberglass items described in this Section shall be supplied by a manufacturer that normally fabricates such items so that appearance and quality control are first class.

3.02  HANDLING, TRANSPORTING, AND STORING
A. All FRP items shall be properly packed, labeled and stored in accordance with Divisions 1 and 11, and where directed by the Engineer.

3.03 INSTALLATION

A. Installation of all items shall be according to manufacturer's instructions, unless otherwise noted.

B. Exposed threads of FRP bolts shall be sealed with a compatible resin after installation of the bolts. Where bolts are attaching removable items, the exposed threads shall be sealed with a light coat of polyurethane sprayed onto the threads.

C. Weirs and baffles shall be installed in full accordance with the manufacturer's recommendations. Joints between weir plates and concrete and butting weir plates shall be watertight. The Contractor shall seal all weirs with caulk approved by the Engineer after weirs are set, checked for level, and are within specified tolerances.

- END OF SECTION -
SECTION 07900

JOINT FILLERS, SEALANTS AND CAULKING

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Furnish labor, materials, equipment and appliances required for the complete execution of Work shown on the Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03250 - Concrete Accessories
B. Section 03290 - Joints in Concrete

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of the other requirements of the specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced specifications, codes, and standards refer to the most current issue available at the time of Bid.

1. ASTM C-920 Elastomeric Joint Sealants
2. ASTM D-1056 Flexible Cellular Materials - Sponge or Expanded Rubber
3. SWRI Sealant and Caulking Guide Specification

1.04 SUBMITTALS

A. In accordance with the procedures and requirements set forth in Section 01300 – Submittals, submit the following:

1. Manufacturers literature and installation instructions.
2. Color samples of each type of sealant.

1.05 QUALITY ASSURANCE

A. Applicator shall be a company specializing in the installation of sealants with a minimum of five years experience.
1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in unopened labeled packages.

B. Store materials in location protected from freezing or damages.

C. Reject and remove from the site materials within broken or damaged packaging.

PART 2 -- PRODUCTS

2.01 MATERIALS

A. Sealants

1. Type 1: Multi-component, non-sag, low-modulus polyurethane rubber sealant meeting ASTM C-920, Type M, Grade NS, Class 25, use NT, M, A, and O. Capable of withstanding 50% in extension or compression such as Sikaflex-2C NS/SL, Sika Corporation, or Sonolastic NP-2, Sonneborn, or DynaTrol II by Pecora Corporation.

2. Type 2: Single component polyurethane sealant meeting ASTM C-920, Type S, Grade NS, Class 25, Use NT, M, A, and O. Capable of withstanding 25% in extension or compression such as Sikaflex 1A by Sika Corporation, DynaTrol 1-XL by Pecora Corporation, or Sonolastic NP-1 by BASF Construction Chemicals.

3. Type 3: Single component, low-modulus moisture curing silicone meeting ASTM C-920, Type S, Grade NS, Class 25, Use NT, M, G, and A. Capable of withstanding 50% extension and compression. Pecora 890 by Pecora Corporation, Sonolastic Omni Seal by BASF Construction Chemicals.

4. Type 4: Single component, mildew resistant, moisture-curing silicone meeting ASTM C-920, Type S, Grade NS, Class 25, Use NT, M, G, and A. Pecora 898 by Pecora Corporation, Sonolastic Omni Plus by BASF Construction Chemicals.

5. Type 5: Single component, acrylic latex meeting ASTM C-834. AC-20+ Silicone by Pecora Corporation, Sonneborn Sonolac by BASF Construction Chemicals.

6. Type 6: High grade butyl sealant meeting Federal Specification TT-S-00-1657. BC-158 by Pecora Corporation or equal.

7. Type 7: Multi-component chemical resistant polysulfide sealant conforming to ASTM C-920, Type M, Grade NS, Class 25 such as Deck-O-Seal by W.R. Meadows, Tammsflex by DuraJoint Concrete Accessories, or Synthacalk GC2+ by Pecora Corporation.

8. Type 8: Nonsag, Multi Component, Traffic grade polyurethane sealant meeting ASTM C920, Type 19, Grade NS, Class 25, use T, M, A, and O. DynaTread by Pecora Corporation, Sonolastic Ultra by BASF Construction Chemicals.

B. Primer: Non-staining primer recommended by sealant manufacturer for the substrates on this project.
C. Backer Rod: Closed cell foam, nonreactive with caulking materials, non-oily, and approved by the sealant manufacturer. Minimum density shall be 2.00 pounds per cubic foot. Use no asphalt or bitumen-impregnated fiber with sealants.

D. Joint Cleaner: Recommended by sealant or caulking compound manufacturer.

E. Bond breaker: Either polyethylene film or plastic tape as recommended by the sealant manufacturer.

F. Color: Where manufacturer’s standard colors do not closely match materials being sealed, provide a custom color.

PART 3 -- EXECUTION

3.01 QUALITY CONTROL

A. Coordinate work with details shown on approved shop drawings prepared by other trades.

B. Verify conditions in the field.

C. Schedule work to follow closely the installation of other trades.

D. Apply sealants and related items in temperatures and dry conditions recommended by the manufacturers.

E. Do not paint sealant, unless recommended by sealant and paint manufacturer.

3.02 PREPARATION

A. Protect finished surfaces adjoining by using masking tape or other suitable materials.

B. Clean and prime joints before starting any caulking or sealing work.

C. Thoroughly clean joints and spaces of mortar and other foreign materials. Cleaning agent shall be Xylol or similar non-contaminating solvent to remove any film from metal surfaces. Masonry or concrete surfaces shall be brushed or air jet cleaned.

D. Joint Requirements

1. All joints and spaces to be sealed in exterior work shall be less than 1/2 inch deep and not less than 1/4 inch wide. If joints in masonry are less than that specified herein, the mortar shall be cut out to the required width and depth. All joints and spaces to receive sealant shall be completely prepared and thoroughly dry before installation of sealant.

2. Unless otherwise specified, joints and spaces which are open to a depth of 1/2 inch or greater shall be solidly filled with back-up material to within 1/4 inch of the surface. Back-up material shall be packed tightly and made continuous throughout the length of the joints. Bond breaker shall be applied as required. If joints are less than 1/4 inch deep, the back-up material may be omitted, a bond breaker substituted and the joint completely filled with sealant. The back-up material shall not project beyond the 1/4 inch depth of the open space in any joint. The following width-to-depth ratio table shall be adhered to, unless otherwise recommended by manufacturer.
3.03 APPLICATION

A. Exercise care before, during, and after installation so as not to damage any material by tearing or puncturing. All finished work shall be approved before covering with any other material or construction.

B. Apply sealant by an approved type of gun except where the use of a gun is not practicable, suitable hand tools shall be used. Avoid applying the compound to any surface outside of the joints or spaces to be sealed. Mask areas where required to prevent overlapping of sealant.

C. All joints shall be waterproof and weathertight.

D. Point sealed joints to make a slightly concave joint, the edges of which are flush with the surrounding surfaces. Exposed joints in the interior side of the door and other frames shall be neatly pointed flush or to match adjacent jointing work.

E. Adjacent materials which have been soiled shall be cleaned immediately and the work left in neat and clean condition.

F. Comply with sealant manufacturer's written instructions except where more stringent requirements are shown or specified and except where manufacturer's technical representative directs otherwise.

3.04 ADJUSTMENT AND CLEANING

A. Remove misplaced sealant compounds promptly using methods and materials recommended by the manufacturer, as the work progresses.

B. Allow sealants to cure and remove protective edging, of doors, louvers, saddles windows etc. as directed by the Engineer.

3.05 SCHEDULE

<table>
<thead>
<tr>
<th>Application</th>
<th>Sealant</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical and horizontal expansion and construction joints in concrete structures unless noted otherwise herein or on Drawings.</td>
<td>Type 1</td>
<td>To closely match adjacent surfaces or mortar and as selected by the Owner.</td>
</tr>
<tr>
<td>Vertical and horizontal joints bordered on both sides by masonry, precast concrete, natural stone or other porous building material, unless noted otherwise herein or on Drawings.</td>
<td>Type 2</td>
<td>To closely match adjacent surfaces or mortar and as selected by the Owner.</td>
</tr>
<tr>
<td>Application</td>
<td>Sealant</td>
<td>Color</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------</td>
<td>--------------</td>
<td>-----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Vertical and horizontal joints bordered on both sides by painted metals,</td>
<td>Type 3</td>
<td>To closely match adjacent surfaces and as selected by the Owner.</td>
</tr>
<tr>
<td>anodized aluminum, mill finished aluminum, PVC, glass or other non-porous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>building material.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Masonry expansion and control joints less than 1¼&quot; wide.</td>
<td>Type 2</td>
<td>To closely match adjacent surfaces and as selected by the Owner.</td>
</tr>
<tr>
<td>Masonry expansion and control joints equal or greater than 1¼ inches</td>
<td>Type 1</td>
<td>To closely match adjacent surfaces and as selected by the Owner.</td>
</tr>
<tr>
<td>wide and not to exceed 2&quot;.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interior – wood trim and finish joints.</td>
<td>Type 5</td>
<td>Color to be selected by Owner</td>
</tr>
<tr>
<td>Sanitary areas, joints in ceramic tile, around plumbing fixtures,</td>
<td>Type 4</td>
<td>To closely match adjacent surfaces and as selected by the Owner.</td>
</tr>
<tr>
<td>countertops, and back splashes. See Note 1.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perimeter sealing of doors, windows, louvers, piping, ducts, and electrical</td>
<td>Type 2 OR</td>
<td>To closely match adjacent surfaces and as selected by the Owner.</td>
</tr>
<tr>
<td>conduit. See Note 2.</td>
<td>Type 3</td>
<td></td>
</tr>
<tr>
<td>Below thresholds.</td>
<td>Type 6</td>
<td>Manufacturer's standard</td>
</tr>
<tr>
<td>Submerged in liquids. See Note 4.</td>
<td>Type 1</td>
<td>Manufacturer's standard</td>
</tr>
<tr>
<td>Submerged in liquids with high concentration of chlorine (&gt; 2 ppm).</td>
<td>Type 7</td>
<td>Manufacturer’s standard</td>
</tr>
<tr>
<td>Horizontal Joints exposed to vehicular or pedestrian traffic.</td>
<td>Type 8</td>
<td>To closely match adjacent surfaces.</td>
</tr>
<tr>
<td>Other joints indicated on the drawings or customarily sealed but not</td>
<td>Type</td>
<td>To closely match adjacent surfaces and as selected by the Owner.</td>
</tr>
<tr>
<td>listed.</td>
<td>recommended by manufacturer</td>
<td></td>
</tr>
</tbody>
</table>

Note 1. Sealant for Laboratory Countertop shall be as recommended by countertop manufacturer.

Note 2. Provide UL approved sealants for penetrations thru fire-rated walls and as specified in Section 07270.

Note 3. Sealants which will come in contact with potable water shall meet the requirements of NSF 61.

Note 4. Where sealant will be immersed in liquid chemicals verify compatibility prior to installation of sealant.
SECTION 09900
PAINTING

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Furnish labor, materials, equipment and appliances required for complete execution of Work shown on Drawings and Specified herein.

B. Section Includes:

1. Paint Materials
2. Shop Painting
3. Field Painting
   a. Surface Preparation
   b. Piping and Equipment Identification
   c. Schedule of Colors
   d. Work in Confined Spaces
   e. OSHA Safety Colors

1.02 RELATED SECTIONS

A. Section 15030 - Piping and Equipment Identification Systems

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of these specifications the Work shall conform to the applicable requirements of the following documents:

1. SSPC – The Society for Protective Coatings Standards
   a. SSPC-Vis 1 Pictorial Surface Preparation Standards for Painting Steel Structures
   b. SSPC-SP2 Hand Tool Cleaning
   c. SSPC-SP3 Power Tool Cleaning
   d. SSPC-SP5 White Metal Blast Cleaning
   e. SSPC-SP6 Commercial Blast Cleaning
f. SSPC-SP10  Near-White Metal Blast

g. SSPC-SP13/NACE6  Surface Preparation of Concrete

2. NACE  - National Association of Corrosion Engineers


4. ASTM B117  - Method of Salt Spray (Fog) Testing

5. ASTM D4060  - Test Method for Abrasion Resistance of Organic Coating by the Taber Abraser

6. ASTM D3359  - Method for Measuring Adhesion by Tape Test

7. ANSI A159.1  - Steel Structures Painting Council, Surface Preparation Specifications

8. NSF/ANSI 61  - Drinking Water System Components

1.04 SUBMITTALS

A. In accordance with the procedures and requirements set forth in Section 01300 - Submittals, submit the following:

1. Manufacturer's literature and Material Safety Data Sheets for each product.

2. Painting schedule identifying surface preparation and paint systems proposed. Cross-reference with Tables 9-1 and 9-2. Statement that the selected prime coat is recommended by the manufacturer for use with the selected intermediate and finish coats, minimum recommended dry film thicknesses per coat for prime, intermediate, and finish coats, percent solids by volume, recommended thinners. Application instructions including recommended application, equipment, humidity, and temperature limitations. Provide the name of the paint manufacturer, and name, address, and telephone number of manufacturer's representative who will inspect the work. Submit schedule for approval as soon as possible following the Award of Contract, so approved schedule may be used to identify colors and specify shop paint systems for fabricated items.

1.05 SYSTEM DESCRIPTION

A. Work shall include surface preparation, paint application, inspection of painted surfaces and corrective action required, protection of adjacent surfaces, cleanup and appurtenant work required for the proper painting of all surfaces to be painted. Surfaces to be painted are designated within the Painting Schedule and may include new and existing piping, miscellaneous metals, equipment, buildings, exterior fiberglass, exposed electrical conduit and appurtenance.

B. Perform Work in strict accordance with manufacturer's published recommendations and instructions, unless the Engineer stipulates that deviations will be for the benefit of the project.
C. Paint surfaces which are customarily painted, whether indicated to be painted or not, with painting system applied to similar surfaces, areas and environments, and as approved by Engineer.

D. Piping and equipment shall receive color coding and identification. Equipment shall be the same color as the piping system.

1.06 QUALITY ASSURANCE

A. Painting operations shall be accomplished by skilled craftsman and licensed by the state to perform painting work.

B. Provide a letter indicating that the painting applicator has five years of experience, and 5 references which show previously successful application of the specified or comparable painting systems. Include the name, address, and the telephone number for the Owner of each installation for which the painting applicator provided services.

1.07 STORAGE AND DELIVERY

A. Bring materials to the job site in the original sealed and labeled containers.

B. Container label to include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Store paint materials at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

PART 2 -- MATERIALS

2.01 GENERAL INFORMATION

A. The term "paint" is defined as both paints and coatings including emulsions, enamels, stains, varnishes, sealers, and other coatings whether organic or inorganic and whether used as prime, intermediate, or finish coats.

B. Purchase paint from an approved manufacturer. Manufacturer shall assign a representative to inspect application of their product both in the shop and field. The manufacturer's representative shall submit a report to the Engineer at the completion the Work identifying products used and verifying that surfaces were properly prepared, products were properly applied, and the paint systems were proper for the exposure and service.

C. Provide primers and intermediate coats produced by same manufacturer as finish coat. Use only thinners approved by paint manufacturer, and only within manufacturer's recommended limits.

D. Ensure compatibility of total paint system for each substrate. Test shop primed equipment delivered to the site for compatibility with final paint system. Provide an acceptable barrier coat or totally remove shop applied paint system when incompatible with system specified, and repaint with specified paint system.
E. Use painting materials suitable for the intended use and recommended by paint manufacturer for the intended use.

F. Require that personnel perform work in strict accordance with the latest requirements of OSHA Safety and Health Standards for construction. Meet or exceed requirements of regulatory agencies having jurisdiction and the manufacturer's published instructions and recommendations. Maintain a copy of all Material Safety Data Sheets at the job site of each product being used prior to commencement of work. Provide and require that personnel use protective and safety equipment in or about the project site. Provide respiratory devices, eye and face protection, ventilation, ear protection, illumination and other safety devices required to provide a safe work environment.

2.02 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Specifications, provide products from one of the following manufacturers:

1. Tnemec Company Inc.
2. Ameron
3. CARBOLINE
4. Sherwin-Williams
5. International

PART 3 -- EXECUTION

3.01 SHOP PAINTING

A. Shop prime fabricated steel and equipment with at least one shop coat of prime paint compatible with finish paint system specified. Prepare surface to be shop painted in strict accordance with paint manufacturer's recommendations and as specified. Finish coats may be shop applied, if approved by the Engineer. Package, store and protect shop painted items until they are incorporated into Work. Repair painted surfaces damaged during handling, transporting, storage, or installation to provide a painting system equal to the original painting received at the shop.

B. Identify surface preparation and shop paints on Shop Drawings. Verify compatibility with field applied paints.

3.02 SURFACE PREPARATION

A. General

1. Surfaces to be painted shall be clean and dry, and free of dust, rust, scale, and foreign matter. No solvent cleaning, power or hand tool cleaning shall be permitted unless approved by the Engineer.
2. Protect or remove, during painting operations, hardware, accessories, machined surfaces, nameplates, lighting fixtures, and similar items not intended to be painted prior to cleaning and painting. Reposition items removed upon completion of painting operations.

3. Examine surfaces to be coated to determine that surfaces are suitable for specified surface preparation and painting. Report to Engineer surfaces found to be unsuitable in writing. Do not start surface preparation until unsuitable surfaces have been corrected. Starting surface preparation precludes subsequent claim that such surfaces were unsuitable for the specified surface preparation or painting.

4. Surface preparation shall be in accordance with specifications and manufacturer's recommendations. Provide additional surface preparation, and fill coats where manufacturer recommends additional surface preparation, in addition to requirements of specification.

5. Touch-up shop or field applied coatings damaged by surface preparation or any other activity, with the same shop or field applied coating; even to the extent of applying an entire coat when required to correct damage prior to application of the next coating. Touch-up coats are in addition to the specified applied systems, and not considered a field coat.

6. Protect motors and other equipment during blasting operation to ensure blasting material is not blown into motors or other equipment. Inspect motors and other equipment after blasting operations and certify that no damage occurred, or where damage occurred, the proper remedial action was taken.

7. Field paint shop painted equipment in compliance with Color Coding and as approved by Engineer.

B. Metal Surface Preparation

1. Conform to current The Society for Protective Coatings Standards (SSPC) Specifications for metal surface preparation. Use SSPC-Vis-1 pictorial standards or NACE visual standards TM-01-70 or TM-01-75 to determine cleanliness of abrasive blast cleaned steel.

2. Perform blast cleaning operations for metal when following conditions exist:
   a. Moisture is not present on the surface.
   b. Relative humidity is below 80%.
   c. Ambient and surface temperatures are 5°F or greater than the dew point temperature.
   d. Painting or drying of paint is not being performed in the area.
   e. Equipment is in good operating condition.
   f. Proper ventilation, illumination, and other safety procedures and equipment are being provided and followed.
3. Sandblast ferrous metals to be shop primed, or component mechanical equipment in accordance with SSPC-SP5, White Metal Blast.

4. Sandblast field prepared ferrous metals in accordance with SSPC-SP10, Near White Metal Blast, where metal is to be submerged, in a corrosive environment, or in severe service.

5. Sandblast field prepared ferrous metals in accordance with SSPC-SP6 Commercial Blast, where metal is to be used in mild or moderate service, or non-corrosive environment.

6. Clean nonferrous metals, copper, or galvanized metal surfaces in accordance to SSPC-SP1, Solvent Cleaning, or give one coat of metal passivator or metal conditioner compatible with the complete paint system.

7. Prime cleaned metals immediately after cleaning to prevent rusting.

8. Clean rusted metals down to bright metal by sandblasting and immediately field primed.

C. Concrete Surface Preparation

1. Cure concrete a minimum of 30 days before surface preparation, and painting begins.

2. Test concrete for moisture content, pH and salts using test method recommended by the paint manufacturer. Do not begin surface preparation, or painting until moisture content is acceptable to manufacturer.

3. Prepare concrete surfaces to receive coatings in accordance with SSPC-13 – Concrete Surface Preparation. Remove contaminants, open bugholes, surface voids, air pockets, and other subsurface irregularities using blasting or grinding. Do not expose underlying aggregate. Use dry, oil-free air for blasting operations. Surface texture after blasting shall achieve profile as required by manufacturer or where not defined by manufacturer similar to that of medium grit sandpaper. Remove residual abrasives, dust, and loose particles by vacuuming or other approved method.

4. Surface defects, such as hollow areas, bugholes, honeycombs, and voids shall be filled with polymeric filler compatible with painting system. Complete fill coats may be used in addition to specified painting system and as approved by the Engineer. Fins, form marks, and all protrusions or rough edges shall be removed.

5. Repair existing concrete surfaces which are deteriorated to the point that surface preparation exposes aggregate with fill coats or patching mortar as recommended by paint manufacturer and as directed by the Engineer.

6. Clean concrete of all dust, form oils, curing compounds, oil, tar, laitance, efflorescence, loose mortar, and other foreign materials before paints are applied.

D. Wood
1. Clean wood surfaces free of all foreign matter, with cracks and nail holes and other
defects properly filled and smoothed. Remove sap and resin by scraping and wipe
clean with rags dampened with mineral spirits.

2. Saturate end grain, cut wood, knots, and pitch pockets with an appropriate sealer
before priming.

3. Prime and backprime wood trim before setting in place.

4. After prime coat has dried, fill nailholes, cracks, open joints, and other small holes
with approved spackling putty. Lightly sand wood trim prior to applying second coat
of paint.

E. Castings

1. Prepare castings for painting by applying a brush or a knife-applied filler. Fillers are
not to be used to conceal cracks, gasholes, or excessive porosity.

2. Apply one coat of primer with a minimum thickness of 1.2 mils in addition to coats
specified. Allow sufficient drying time before further handling.

F. Masonry

1. Cure for a minimum of 30 days prior to paint application.

2. Clean masonry surfaces free from all dust, dirt, oil, grease, loose mortar, chalky
deposits, efflorescence, and other foreign materials.

3. Test masonry for moisture content. Use test method recommended by paint
manufacturer. Do not begin painting until moisture content is acceptable to
manufacturer.

G. Gypsum Drywall

1. Sand joint compound with sandpaper to provide a smooth flat surface. Avoid
sanding of adjacent drywall paper.

2. Remove dust, dirt, and other contaminants.

H. Previously-Painted Surfaces

1. Totally remove existing paint when: surface is to be submerged in a severe
environment, paint is less than 75% intact, brittle, eroded or has underfilm rusting.

2. Surfaces which are greater than 75% intact require removal of failed paints and then
spot primed. Spot priming is in addition to coats specified.

3. Remove surface contamination such as oil, grease, loose paint, mill scale, dirt,
foreign matter, rust, mold, mildew, mortar, efflorescence, and sealers.

4. Clean and dull glossy surfaces prior to painting in accordance with the
manufacturer's recommendations.
5. Check existing paints for compatibility with new paint system. If incompatible, totally remove existing paint system or apply a barrier coat recommended by the paint manufacturer. Remove existing paints of undetermined origin. Prepare a test patch of approximately 3 square feet over existing paint. Allow test patch to dry thoroughly and test for adhesion. If proper adhesion is not achieved remove existing paint and repaint.

3.03 APPLICATION OF PAINT

A. Apply paint by experienced painters with brushes or other applicators approved by the Engineer, and paint manufacturer.

B. Apply paint without runs, sags, thin spots, or unacceptable marks.

C. Apply at rate specified by the manufacturer to achieve at least the minimum dry mil thickness specified. Apply additional coats, if necessary, to obtain thickness.

D. Special attention shall be given to nuts, bolts, edges, angles, flanges, etc., where insufficient film thicknesses are likely. Stripe paint prior to applying prime coat. Stripe painting shall be in addition to coats specified.

E. Perform thinning in strict accordance with the manufacturer's instructions, and with the full knowledge and approval of the Engineer and paint manufacturer.

F. Allow paint to dry a minimum of twenty-four hours between application of any two coats of paint on a particular surface, unless shorter time periods are a requirement by the manufacturer. Longer drying times may be required for abnormal conditions as defined by the Engineer and paint manufacturer. Do not exceed manufacturer's recommended drying time between coats.

G. Suspend painting when any of the following conditions exist:

1. Rainy or excessively damp weather.

2. Relative humidity exceeds 85%.

3. General air temperature cannot be maintained at 50°F or above through the drying period, except on approval by the Engineer and paint manufacturer.

4. Relative humidity will exceed 85% or air temperature will drop below 40°F within 18 hours after application of paint.

5. Surface temperature of item is within 5 degrees of dewpoint.

6. Dew or moisture condensation are anticipated.

7. Surface temperature exceeds the manufacturer's recommendations.

3.04 INSPECTION

A. Each field coat of paint will be inspected and approved by the Engineer or his authorized representative before succeeding coat is applied. Tint successive coats so that no two
coats for a given surface are exactly the same color. Tick-mark surfaces to receive black paint in white between coats.

B. Use magnetic dry film thickness gauges and wet fiber thickness gauges for quality control. Furnish magnetic dry film thickness gauge for use by the Engineer.

C. Coatings shall pass a holiday detector test.

D. Determination of Film Thickness: Randomly selected areas, each of at least 107.5 contiguous square feet, totaling at least 5% of the entire control area shall be tested. Within this area, at least 5 squares, each of 7.75 square inches, shall be randomly selected. Three readings shall be taken in each square, from which the mean film thickness shall be calculated. No more than 20 percent of the mean film thickness measurements shall be below the specified thickness. No single measurement shall be below 80 percent of the specified film thickness. Total dry film thickness greater than twice the specified film thickness shall not be acceptable. Areas where the measured dry film thickness exceeds twice that specified shall be completely redone unless otherwise approved by the Engineer. When measured dry film thickness is less than that specified additional coats shall be applied as required.

E. Holiday Testing: Holiday test painted ferrous metal surfaces which will be submerged in water or other liquids, or surfaces which are enclosed in a vapor space in such structures. Mark areas which contain holidays. Repair or repaint in accordance with paint manufacturer's printed instructions and retest.

1. Dry Film Thickness Exceeding 20 Mils: For surfaces having a total dry film thickness exceeding 20 mils: Pulse-type holiday detector such as Tinker & Rasor Model AP-W, D.E. Stearns Co. Model 14/20, shall be used. The unit shall be adjusted to operate at the voltage required to cause a spark jump across an air gap equal to twice the specified coating thickness.

2. Dry Film Thickness of 20 Mils or Less: For surfaces having a total dry film thickness of 20 mils or less: Tinker & Rasor Model M1 non-destructive type holiday detector, K-D Bird Dog, shall be used. The unit shall operate at less than 75-volts. For thicknesses between 10 and 20 mils, a non-sudsing type wetting agent, such as Kodak Photo-Flow, shall be added to the water prior to wetting the detector sponge.

F. Paint manufacturer or his representative shall provide their services as required by the Engineer. Services shall include, but not be limited to, inspecting existing paint, determination of best means of surface preparation, inspection of completed work, and final inspection of painted work 11 months after the job is completed.
3.05 PROTECTION OF ADJACENT PAINT AND FINISHED SURFACES

A. Use covers, masking tape, other method when protection is necessary, or requested by Owner or Engineer. Remove unwanted paint carefully without damage to finished paint or surface. If damage does occur, repair the entire surface adjacent to and including the damaged area without visible lapmarks and without additional cost to the Owner.

B. Take all necessary precautions to contain dispersion of sandblasting debris and paint to the limits of the work. Take into account the effect of wind and other factors which may cause dispersion of the sandblasting debris and paint. Suspend painting operations when sanding debris or paint cannot be properly confined. Assume all responsibilities and cost associated with damage to adjacent structures, vehicles, or surfaces caused by the surface preparation and painting operations.

3.06 PIPING AND EQUIPMENT IDENTIFICATION

A. Piping and equipment identification shall be in accordance with Section 15030, Piping and Equipment Identification Systems.

3.07 SCHEDULE OF COLORS

A. Match colors indicated. Piping and equipment colors are indicated in Section 15030. Colors which are not indicated shall be selected from the manufacturer's full range of colors by the Engineer. No variation shall be made in colors without the Engineer's approval. Color names and numbers shall be identified according to the appropriate color chart issued by the manufacturer of the particular product in question.

3.08 WORK IN CONFINED SPACES

A. Provide and maintain safe working conditions for all employees. Supply fresh air continuously to confined spaces through the combined use of existing openings, forced-draft fans and temporary ducts to the outside, or direct air supply to individual workers. Exhaust paint fumes to the outside from the lowest level in the contained space. Provide explosion-proof electrical fans, if in contact with fumes. No smoking or open fires will be permitted in, or near, confined spaces where painting is being done. Follow OSHA, state and local regulations at all times.

3.09 OSHA SAFETY COLORS

A. Paint wall around wall-mounted breathing or fire apparatus with the appropriate safety red color; area not exceed 2-feet wide by 3-feet high, unless apparatus covers the area. Fire apparatus include fire hoses, extinguisher, and hydrants.

B. Paint hazardous areas and objects in accordance with OSHA regulations.
## TABLE 9-1
### PAINTING SCHEDULE

<table>
<thead>
<tr>
<th>SURFACE</th>
<th>APPLICATION</th>
<th>PAINTING SYSTEM &amp; NO. OF COATS</th>
<th>PRODUCT REFERENCE (TABLE 9.2)</th>
<th>TOTAL MIN. DRY FILM THICKNESS (MILS)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Concrete and Masonry</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interior masonry and concrete walls and ceilings</td>
<td>All new structures</td>
<td>1 coat sealer 2 coats acrylic epoxy</td>
<td>101 116</td>
<td>75-85 sq.ft./gal. 4-6/coat</td>
</tr>
<tr>
<td>Interior masonry and concrete walls in chemical rooms</td>
<td></td>
<td>1 coat sealer 2 coats epoxy polyamide</td>
<td>117 112</td>
<td>60-80 sq.ft./gal. 4-6/coat</td>
</tr>
<tr>
<td>Exterior masonry cavity walls on cavity face of inner wythe</td>
<td>All new structures</td>
<td>Dampproofing</td>
<td>See Section 07150</td>
<td></td>
</tr>
<tr>
<td>Exterior below grade if interior is dry</td>
<td>Accessible areas (e.g. pipe galleries, pump rooms, basements, etc.)</td>
<td>Waterproofing</td>
<td>See Section 07100</td>
<td></td>
</tr>
<tr>
<td><strong>Submerged water</strong></td>
<td>Water retaining side of new wall surfaces where opposite side of wall is interior and dry and where indicated &quot;epoxy waterproofing&quot; on drawing</td>
<td>2 coats NSF approved epoxy polyamide</td>
<td>Provide filler as required and recommended by manufacturer</td>
<td>105 4-6/coat</td>
</tr>
<tr>
<td><strong>Submerged wastewater</strong></td>
<td></td>
<td>2 coats high solids epoxy</td>
<td>Provide filler as required and recommended by manufacturer</td>
<td>119 6-10/coat</td>
</tr>
<tr>
<td><strong>Containment Liner</strong></td>
<td>Interior and exterior secondary containment floors, tank supports and walls</td>
<td>2 coats high solids epoxy coating</td>
<td>119 6-10/coat</td>
<td></td>
</tr>
<tr>
<td><strong>Metals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interior and exterior nonsubmerged (gloss)</td>
<td>All new blowers, pumps, motors and mechanical equipment, piping, etc.</td>
<td>1 coat epoxy polyamide primer 1 coat epoxy polyamide 1 coat aliphatic polyurethane</td>
<td>104 4-6 102 4-6 115 3-5</td>
<td></td>
</tr>
<tr>
<td>Interior insulated</td>
<td></td>
<td>1 coat acrylic latex</td>
<td>103 4</td>
<td></td>
</tr>
<tr>
<td><strong>Submerged water</strong></td>
<td>All metal piping, and mechanical equipment, etc.</td>
<td>2 coats NSF approved epoxy polyamide</td>
<td>105 4-6/coat</td>
<td></td>
</tr>
<tr>
<td><strong>Submerged Wastewater</strong></td>
<td></td>
<td>2 coats high solids epoxy</td>
<td>119 8-10/coat</td>
<td></td>
</tr>
<tr>
<td><strong>Steel doors, windows and door frames, steel stairs, monorails, structural steel, misc. metals (steel)</strong></td>
<td>1 coat epoxy polyamide 1 coat aliphatic polyurethane</td>
<td>102 5-8 115 3-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Aluminum surfaces in contact with concrete</strong></td>
<td>2 coats coal tar</td>
<td>107 26</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Shop Primed Structural Steel</strong></td>
<td>Pre-Engineered Buildings</td>
<td>1 barrier coat 1 coat epoxy 1 coat epoxy</td>
<td>113 114 120 2-3 3-4 3-4</td>
<td></td>
</tr>
</tbody>
</table>

1. Painting manufacturer shall verify compatibility of containment liner and chemical to be contained. Where incompatible substitute a compatible coating system.
### TABLE 9-1
PAINTING SCHEDULE (CONTINUED)

<table>
<thead>
<tr>
<th>SURFACE</th>
<th>APPLICATION</th>
<th>PAINTING SYSTEM &amp; NO. OF COATS</th>
<th>PRODUCT REFERENCE (TABLE 9.2)</th>
<th>TOTAL MIN. DRY FILM THICKNESS (MILS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interior: Gypsum Wallboard</td>
<td>All new structures</td>
<td>2 coats acrylic latex matte or satin</td>
<td>103</td>
<td>2-3/coat</td>
</tr>
<tr>
<td>Interior: Tar-dipped piping where color is required</td>
<td>2 coats epoxy resin sealer 2 coats epoxy polyamide</td>
<td>112 102</td>
<td></td>
<td>5-8/coat 5-8/coat</td>
</tr>
<tr>
<td>PVC Piping</td>
<td>1 coat epoxy polyamide 1 coat aliphatic polyurethane</td>
<td>102 115</td>
<td></td>
<td>5-8 3-4</td>
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<tr>
<td>REF.</td>
<td>SYSTEM</td>
<td>PURPOSE</td>
<td>Tmec Series</td>
<td>PPG/AMERON</td>
</tr>
<tr>
<td>------</td>
<td>-----------------------</td>
<td>-----------------------------------</td>
<td>-------------</td>
<td>------------</td>
</tr>
<tr>
<td>101</td>
<td>Acrylic filler</td>
<td>Primer-sealer</td>
<td>130-6601</td>
<td>BLOXFIL 4000</td>
</tr>
<tr>
<td>102</td>
<td>Epoxy polyamide</td>
<td>Finish coat semi-gloss or gloss</td>
<td>N69</td>
<td>AMERLOCK 2</td>
</tr>
<tr>
<td>103</td>
<td>Acrylic latex</td>
<td>Sealer</td>
<td>1028/1029</td>
<td>PITT TECH PLUS</td>
</tr>
<tr>
<td>104</td>
<td>Epoxy Polyamide – metal</td>
<td>Primer</td>
<td>66</td>
<td>AMERCOAT 385</td>
</tr>
<tr>
<td>105</td>
<td>Epoxy</td>
<td>Primer/Finish</td>
<td>20</td>
<td>AMERLOCK 2</td>
</tr>
<tr>
<td>106</td>
<td>Coal tar epoxy</td>
<td>Finish high-coat build</td>
<td>46H-413</td>
<td>AMERCOAT 78HB</td>
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<tr>
<td>107</td>
<td>Coal tar</td>
<td>Sealer</td>
<td>46-465</td>
<td>AMERCOAT 78HB</td>
</tr>
<tr>
<td>108</td>
<td>Alkyd-medium oil</td>
<td>Finish coat</td>
<td>2H</td>
<td>DEVGUARD 4308</td>
</tr>
<tr>
<td>109</td>
<td>Alkyd-long oil</td>
<td>Finish coat</td>
<td>1029</td>
<td>DEVGUARD 4308</td>
</tr>
<tr>
<td>110</td>
<td>Epoxy polyamide</td>
<td>Primer</td>
<td>66-1211</td>
<td>AMERCOAT 385</td>
</tr>
<tr>
<td>111</td>
<td>Epoxy polyamide</td>
<td>Sealer</td>
<td>66-1211</td>
<td>AMERCOAT 385</td>
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<tr>
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<td>Epoxy polyamide</td>
<td>Sealer</td>
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<td>AMERLOCK SEALER</td>
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<td>1074 or 1075</td>
<td>AMERCOAT 450 HS</td>
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<tr>
<td>115</td>
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<td>Finish coat</td>
<td>113 or 114</td>
<td>AQUAPON WB</td>
</tr>
<tr>
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<td>Acrylic epoxy</td>
<td>Finish coat</td>
<td>1254</td>
<td>AMERLOCK 114</td>
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<td>Epoxy block filler</td>
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<td>118</td>
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<td>High solids epoxy</td>
<td>Finish coat</td>
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</table>

- END OF SECTION -
SECTION 10524

EMERGENCY SHOWER/EYEWASH STATIONS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Furnish and install emergency shower/eyewash stations as shown on the Drawings and as specified herein. Coordinate work in this Section with painting and marking as specified in Section 09900, Painting. Certain equipment items will be field located by Owner, if not otherwise shown on the Drawings.

1.02 SUBMITTALS

A. Submit Shop Drawings, Performance Affidavit, Operation and Maintenance Instructions and other information as specified for all items of equipment in this Section in accordance with Section 11000, Equipment General Provisions and Section 01300, Submittals. Shop Drawings shall also include complete erection, installation, and adjustment instructions and recommendations.

1.03 MANUFACTURERS

A. The materials covered by these Specifications are intended to be standard equipment of proven reliability and as manufactured by reputable manufacturers having experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with the best practices and methods and shall operate satisfactorily when installed as shown on the Drawings and operated per manufacturers' recommendations.

PART 2 -- PRODUCTS

2.01 EMERGENCY SHOWER/EYEWASH STATIONS

A. Combination shower and eyewash stations shall be installed where shown on the Contract Drawings.

B. For exterior shower/eyewash units, the drench shower and the eyewash shall be operated independently by hand actuated flag type handles or push down plates that remain open until manually closed. All exterior shower/eyewash stations shall be freeze proof and shall be Model S19-310NN as manufactured by Bradley, Model 8300FP as manufactured by Haws, or equal. Dual automatic pressure compensation devices shall provide steady water flow under pressures varying from 30 to 75 psi.

C. For interior combination shower/eyewash units, the drench shower shall be operated by pull rod with triangular handle that remains open until manually closed, and the eyewash shall be operated by hand actuated flag type handle or foot treadle that remains open until manually closed. All interior combination shower/eyewash stations shall be Model S19-310UU as manufactured by Bradley, Model 8300 as manufactured by Haws, or equal. Dual automatic...
pressure compensation devices shall provide steady water flow under pressures varying from 30 to 75 psi.

PART 3 -- EXECUTION

3.01 INSTALLATION

A. Emergency shower/eyewash stations shall be installed where shown on the Drawings or as directed by the Engineer. Where required by OSHA regulations, the background of the mounting location shall be painted the appropriate color.

- END OF SECTION -
SECTION 11000
EQUIPMENT GENERAL PROVISIONS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, install, test, and place in acceptable operation all mechanical equipment and all necessary accessories as specified herein, as shown on the Drawings, and as required for a complete and operable system.

B. The mechanical equipment shall be provided complete with all accessories, special tools, spare parts, mountings, and other appurtenances as specified, and as may be required for a complete and operating installation.

C. It is the intent of these Specifications that the Contractor shall provide the Owner complete and operational equipment/systems. To this end, it is the responsibility of the Contractor to coordinate all interfaces with related mechanical, structural, electrical, instrumentation and control work and to provide necessary ancillary items such as controls, wiring, etc., to make each piece of equipment operational as intended by the Specifications.

D. The complete installation shall be free from excessive vibration, cavitation, noise, and oil or water leaks.

E. The requirements of this section shall apply to equipment furnished under Divisions 11, 13, 14, and 15.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. All equipment, materials, and installations shall conform to the requirements of the most recent editions with latest revisions, supplements, and amendments of the specifications, codes, and standards listed in Section 01090, Reference Standards.

1.03 SHOP DRAWINGS

A. Shop Drawings shall be submitted to the Engineer for all equipment in accordance with Section 01300, Submittals and shall include the following information in addition to the requirements of Section 01300, Submittals:

1. Performance characteristics and descriptive data.

2. Detailed equipment dimensional drawings and setting plans.

3. General lifting, erection, installation, and adjustment instructions, and recommendations.

4. Complete information regarding location, type, size, and length of all field welds in accordance with "Standard Welding Symbols" AWS A2.0 of the American Welding Society. Special conditions shall be fully explained by notes and details.
5. The total uncrated weight of the equipment plus the approximate weight of shipped materials. Support locations and loads that will be transmitted to bases and foundations. Exact size, placement, and embedment requirements of all anchor bolts.

6. Details on materials of construction of all components including applicable ASTM designations.

7. Information on bearing types and bearing life.

8. Gear box design and performance criteria and AGMA service factor.


10. Motor data sheet indicating motor horsepower; enclosure type; voltage; insulation class; temperature rise and results of dielectric tests; service-rating; rotative speed; motor speed-torque relationship; efficiency and power factor at ½, ¾, and full load; slip at full load; running, full load, and locked rotor current values; and safe running time-current curves.


12. Equipment shop coating systems, interior and exterior.

13. Panel layout drawings, schematic wiring diagrams, and component product data sheets for control panels.

14. A list of spare parts and special tools to be provided.

15. Any additional information required to show conformance with the equipment specifications.

16. Warranty documentation including statement of duration of warranty period and contact phone numbers and addresses for warranty issues.

1.04 OPERATION AND MAINTENANCE INSTRUCTION/MANUALS

A. Operation and Maintenance (O&M) manuals shall be submitted in accordance with Section 01300, Submittals.

B. O&M manuals shall include instructions, equipment ratings, technical bulletins, and any other printed matter such as wiring diagrams and schematics, prints or drawings, containing full information required for the proper operation, maintenance, and repair of the equipment. Included in this submission shall be a spare parts diagram, complete spare parts list, bill of materials, OEM part numbers and manufacturer’s catalog information of all equipment components.

C. Each set of instructions shall be bound together in appropriate three-ring binders with a detailed Table of Contents.
D. Written operation and maintenance instructions shall be required for all equipment items supplied for this project. The amount of detail shall be commensurate with the complexity of the equipment item.

E. Information not applicable to the specific piece of equipment installed on this project shall be struck from the submission.

F. Information provided shall include a source of replacement parts and names of service representatives, including address and telephone number.

G. Extensive pictorial cuts of equipment are required for operator reference in servicing.

H. When written instructions include Shop Drawings and other information previously reviewed by the Engineer, only those editions thereof which were approved by the Engineer, and which accurately depict the equipment installed, shall be incorporated in the instructions.

1.05 GENERAL INFORMATION AND DESCRIPTION

A. All parts of the equipment furnished shall be designed and constructed for the maximum stresses occurring during fabrication, transportation, installation, testing, and all conditions of operation. All materials shall be new, and both workmanship and materials shall be entirely suitable for the service to which the units are to be subjected and shall conform to all applicable sections of these Specifications.

B. All parts of duplicate equipment shall be interchangeable without modification. Manufacturer's design shall accommodate all the requirements of these Specifications.

C. Equipment and appurtenances shall be designed in conformity with ASTM, ASME, AIEE, NEMA, and other generally accepted applicable standards.

D. All bearings and moving parts shall be adequately protected by bushings or other approved means against wear, and provision shall be made for accessible lubrication by extending lubrication lines and fittings to approximately 30 inches above finished floor elevation.

E. Details shall be designed for appearance as well as utility. Protruding members, joints, corners, gear covers, etc., shall be finished in appearance. All exposed welds on machinery shall be ground smooth and the corners of structural shapes shall be rounded or chamfered.

F. Machinery parts shall conform within allowable tolerances to the dimensions shown on the working drawings.

G. All machinery and equipment shall be safeguarded in accordance with the safety codes of the USA and the State in which the project is located.

H. All rotating shafts, couplings, or other moving pieces of equipment shall be provided with suitable protective guards of sheet metal or wire mesh, neatly and rigidly supported. Guards shall be removable as required to provide access for repairs.

I. All equipment greater than 100 pounds shall have lifting lugs, eyebolts, etc., for ease of lifting, without damage or undue stress exerted on its components.
J. All manufactured items provided under this Section shall be new, of current manufacture, and shall be the products of reputable manufacturers specializing in the manufacture of such products.

1.06 EQUIPMENT WARRANTIES

A. Warranty requirements may be added to or modified in the individual equipment specifications.

B. The equipment furnished under this Contract shall be guaranteed to be free from defects in workmanship, design and/or materials for a period of one (1) year unless otherwise specified in the individual equipment specifications. The period of such warranties shall start on the date the particular equipment is placed in use by the Owner with corresponding start-up certification provided by the manufacturer's technical representative as specified herein, provided that the equipment demonstrates satisfactory performance during the thirty day operational period after the equipment startup. If the equipment does not perform satisfactorily during the thirty day operational period, the start of the warranty period will be delayed until the equipment demonstrates proper operation. The Equipment Supplier shall repair or replace without charge to the Owner any part of equipment which is defective or showing undue wear within the guarantee period, or replace the equipment with new equipment if the mechanical performance is unsatisfactory; furnishing all parts, materials, labor, etc., necessary to return the equipment to its specified performance level.

C. The Contractor shall provide an equipment warranty log book prepared specifically for this project and submit two (2) copies of the document to the Engineer prior to final payment. The equipment warranty log book shall include a summary listing of all equipment warranties provided, date received, and start date and end date of warranty period. A copy of each equipment warranty and equipment start-up certification shall also be provided in the document.

D. The Equipment Supplier shall guarantee to the Owner that all equipment offered under these specifications, or that any process resulting from the use of such equipment in the manner stated is not the subject of patent litigation, and that he has not knowingly offered equipment, the installation or use of which is likely to result in a patent controversy, in which the Owner as user is likely to be made the defendant.

Where patent infringements are likely to occur, each Equipment Supplier shall submit, as a part of his bid, license arrangements between himself, or the manufacturer of the equipment offered, and the patent owner or the controller of the patent, which will permit the use in the specified manner of such mechanical equipment as he may be bidding.

Each Equipment Supplier, by submitting his bid, agrees to hold and save the Owner and Engineer or its officers, agents, servants, and employees harmless from liability of any nature or kind, including cost and expenses for, or on account of, any patented or unpatented invention, process, article, or appliance manufactured or used in the performance of the work under this contract, including the use of the same by the Owner.

PART 2 -- PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS
A. The materials covered by these Specifications are intended to be equipment of proven reliability, and as manufactured by reputable manufacturers having experience in the production of such equipment. The Contractor shall, upon request of the Engineer, furnish the names of not less than 5 successful installations of the manufacturer's equipment of the same size and model of that offered under this contract. The equipment furnished shall be designed, constructed, and installed in accordance with the industry accepted practices and shall operate satisfactorily when installed as shown on the Drawings and operated per manufacturer's recommendations.

2.02 ANCHORS AND SUPPORTS

A. The Contractor shall furnish, install, and protect all necessary guides, bearing plates, anchor and attachment bolts, and all other appurtenances required for the installation of the devices included in the equipment specified. Working Drawings for installation shall be furnished by the equipment manufacturer, and suitable templates shall be used by the Contractor when required in the detailed equipment Specifications.

B. Anchor bolts and fasteners shall be furnished in accordance with Section 05050, Metal Fastening, and with the individual equipment Specifications. All anchor bolts shall be a minimum of 1/2-inch diameter. All anchor bolts, handrail bolts, washers, clips, clamps, and fasteners of any type shall be constructed of 316 stainless steel, unless otherwise specified the individual equipment Specifications.

C. The Contractor shall provide all concrete pads or pedestals required for equipment furnished. All concrete equipment pads shall be a minimum of 6” high, unless otherwise shown on the Drawings and shall be doweled.

D. Pipe sleeves or other means of adjusting anchor bolts shall be provided where indicated or required. Equipment shall be leveled by first using sitting nuts on the anchor bolts, and then filling the space between the equipment base and concrete pedestal with non-shrink grout, unless alternate methods are recommended by the manufacturer and are acceptable to the Engineer (such as shim leveling pumps, or chemical grout). Non-shrink grout shall be as specified in Section 03600, Grout.

2.03 STRUCTURAL STEEL

A. Structural steel used for fabricating equipment shall conform to the requirements of Section 05120, Structural Steel.

B. All materials shall conform to applicable provisions of the AISC Specifications for the design and fabrication of structural steel, and to pertinent ASTM Standard Specifications.

2.04 DISSIMILAR METALS

A. All dissimilar metals shall be properly isolated to the satisfaction of the Engineer.
2.05 GALVANIZING

A. Where required by the equipment specifications, galvanizing shall be performed in accordance with Section 05035, Galvanizing.

2.06 STANDARDIZATION OF GREASE FITTINGS

A. The grease fittings on all mechanical equipment shall be such that they can be serviced with a single type of grease gun. Fittings shall be “Zerk” type.

2.07 ELECTRICAL REQUIREMENTS

A. All electrical equipment and appurtenances, including but not limited to motors, panels, conduit and wiring, etc., specified in the equipment specifications shall comply with the applicable requirements of the Division 16 specifications and the latest National Electric Code.

B. Motors shall conform to the applicable requirements of Section 15170, Electric Motors. Medium voltage motors shall conform to the applicable requirements of Section 15171, Medium Voltage Electric Motors.

C. In the individual equipment specifications, specified motor horsepower is intended to be the minimum size motor to be provided. If a larger motor is required to meet the specified operating conditions and performance requirements, the Contractor shall furnish the larger sized motor and shall upgrade the electrical service (conduit, wires, starters, etc.) at no additional cost to the Owner.

D. Where variable frequency drives (VFDs) are specified, the Contractor shall be responsible for coordinating between equipment supplier and VFD supplier to ensure a complete and operational system.

E. Motor starters and controls shall be furnished and installed under Division 16 and Division 17 unless otherwise specified in the individual pump specifications.

2.08 ACCESSORIES, SPARE PARTS, AND SPECIAL TOOLS

A. Spare parts for equipment shall be furnished where indicated in the equipment Specifications or where recommended by the equipment manufacturer.

B. Spare parts shall be identical and interchangeable with original parts.

C. The spare parts shall be packed in containers suitable for long term storage, bearing labels clearly designating the contents and the pieces of equipment for which they are intended.

D. Painting requirements for spare parts shall be identical to those for original, installed parts. Where no painting or protective coating is specified, suitable provisions shall be made to protect against corrosion.
E. Spare parts shall be delivered at the same time as the equipment to which they pertain. Spare parts shall be stored separately in a locked area, maintained by the Contractor, and shall be turned over to the Owner in a group prior to substantial completion. All of these materials shall be properly packed, labeled, and stored where directed by the Owner and Engineer.

F. The Contractor shall furnish all special tools necessary to operate, disassemble, service, repair, and adjust the equipment in accordance with the manufacturers operation and maintenance manual.

G. The Contractor shall furnish a one year supply of all recommended lubricating oils and greases. The manufacturer shall submit a list of at least four manufacturer's standard lubricants which may be used interchangeably for each type of lubricant required. All of these materials shall be properly packed, labeled and stored where directed by the Engineer.

2.09 EQUIPMENT IDENTIFICATION

A. All mechanical equipment shall be provided with a substantial stainless steel nameplate, mechanically fastened with stainless steel hardware in a conspicuous place, and clearly inscribed with the manufacturer's name, year of manufacture, serial number, and principal rating data.

B. Each pump and other piece of mechanical equipment shall also be identified as to name and number by a suitable laminated plastic or stainless steel nameplate mechanically fastened with stainless steel hardware; for example, "Raw Water Pump #1". Coordinate name and number with same on remotely located controls, control panel, and other related equipment.

C. Nameplates shall not be painted over.

PART 3 -- EXECUTION

3.01 SHOP TESTING

A. All equipment shall be tested in the shop of the manufacturer in a manner which shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents and that it will operate in the manner specified or implied.

B. No equipment shall be shipped to the project until the Engineer has been furnished a certified copy of test results and has notified the Contractor, in writing, that the results of such tests are acceptable.

C. Five (5) certified copies of the manufacturer's actual test data and interpreted results thereof shall be forwarded to the Engineer for review.

D. If required by the individual equipment Specifications, arrangements shall be made for the Owner/Engineer to witness performance tests in the manufacturer's shop. The Engineer shall be notified ten working days before shop testing commences. Expenses are to be paid by Owner.
E. Shop testing of electric motors shall be in accordance with applicable requirements of Section 15170, Electric Motors; Section 15171, Medium Voltage Electric Motors, and Section 16000, Basic Electrical Requirements.

3.02 STORAGE OF EQUIPMENT AND MATERIALS

A. Contractor shall store his equipment and materials at the job site in strict accordance with the manufacturer's recommendations and as directed by the Owner or Engineer, and in conformity to applicable statutes, ordinances, regulations, and rulings of the public authority having jurisdiction. Equipment and materials shall not be delivered to the site prior to 90 days in advance of the scheduled installation. Partial payment requests will not be processed for materials delivered prior to 90 days before installation or for materials that are not properly stored.

B. Material or equipment stored on the job site is stored at the Contractor's risk. Any damage sustained of whatever nature shall be repaired to the Engineer's satisfaction at no expense to the Owner. Stored electrical equipment is to be protected from the elements and shall have space heaters energized.

C. Contractor shall not store unnecessary materials or equipment on the job site and shall take care to prevent any structure from being loaded with a weight which will endanger its security or the safety of persons.

D. Contractor shall observe all regulatory signs for loadings on structures, fire safety, and smoking areas.

E. Contractor shall not store materials or encroach upon private property without the written consent of the owners of such private property.

3.03 MANUFACTURER'S FIELD SERVICES

A. The Contractor shall arrange for a qualified Technical Representative from each manufacturer or supplier of equipment who is regularly involved in the inspection, installation, start-up, troubleshooting, testing, maintenance, and operation of the specified equipment. Qualification of the Technical Representative shall be appropriate to the type of equipment furnished and subject to the approval of the Engineer and the Owner. Where equipment furnished has significant process complexity, furnish the services of engineering personnel knowledgeable in the process involved and the function of the equipment. When necessary, the Contractor shall schedule multiple Technical Representatives to be present at the same time for the purpose of coordinating the operation of multiple pieces of related equipment.

B. For each site visit, the Technical Representative shall submit jointly to the Owner, the Engineer, and the Contractor a complete signed report of the results of his inspection, operation, adjustments, and testing. The report shall include detailed descriptions of the points inspected, tests and adjustments made, quantitative results obtained if such are specified.
C. The manufacturer's Technical Representative shall provide the following services.

1. Installation: The Technical Representative shall inspect the installed equipment to verify that installation is in accordance with the manufacturer's requirements. Where required by individual equipment specifications, the Technical Representative shall also supervise the installation of the equipment.

2. Testing: After installation of the equipment has been completed and the equipment is presumably ready for operation, but before it is operated by others, the Technical Representative shall inspect, operate, test, and adjust the equipment as required to prove that the equipment is in proper condition for satisfactory operation under the conditions specified. Unless otherwise noted in the signed site visit report, the report shall constitute a certification that the equipment conforms to the requirements of the Contract and is ready for startup and that nothing in the installation will render the manufacturer's warranty null and void. The report shall include date of final acceptance field test, as well as a listing of all persons present during tests.

3. Startup: The Technical Representative shall start up the equipment for actual service with the help of the Contractor. In the event that equipment or installation problems are experienced, the Contractor and the representative shall provide the necessary services until the equipment is operating satisfactorily and performing according to the specifications at no additional cost to the Owner. Unless otherwise noted in the signed site visit report, the report shall constitute a certification that the equipment conforms to the requirements of the Contract and is ready for permanent operation and that nothing in the installation will render the manufacturer's warranty null and void.

4. Training: The Technical Representative shall instruct the Owner's operating personnel in correct operation and maintenance procedures. The instruction shall demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment. Such instruction shall be scheduled at a time arranged with the Owner at least 2 weeks in advance of the training and shall be provided while the respective Technical Representative's equipment is fully operational. The Contractor shall have submitted, and had accepted, the O&M Manuals prior to commencement of training. Training shall be provided to one shift of the Owner's personnel between the hours of 8:00 A.M. and 5:00 P.M. as necessary. The Contractor shall provide professional video taping of all training sessions. Completed, labeled tapes shall be provided to the Owner for each type of training session.

5. Services after Startup: Where required by the individual equipment specifications, the Technical Representative shall return to the project site thirty (30) days after the start up date to review the equipment performance, correct any equipment problems, and conduct operation and maintenance classes as required by the Owner. This follow-up trip is required in addition to the specified services of Technical Representative prior to and during equipment startup. At this time, if there are no equipment problems, each manufacturer shall certify to the Owner in writing that his equipment is fully operational and capable of meeting operating requirements. If the equipment is operating incorrectly, the Technical Representative will make no certification to the Owner until the problems are corrected and the equipment demonstrates a successful thirty (30) days operating period.
D. Services of the Technical Representative will require a minimum of two (2) site visits, one for installation and testing and one for startup and training, and will be for the minimum number of days recommended by the manufacturer and approved by the Engineer but will not be less than the number of days specified in individual equipment sections.

E. The Contract amount shall include the cost of furnishing the Technical Representative for the minimum number of days specified, and any additional time required to achieve successful installation and operation. The times specified for services by the Technical Representative in the equipment Specifications are exclusive of travel time to and from the facility and shall not be construed as to relieve the manufacturer of any additional visits to provide sufficient service to place the equipment in satisfactory operation.

F. The Contractor shall notify the Engineer at least 14 days in advance of each equipment test or Owner training session.

G. The Technical Representative shall sign in and out at the office of the Engineer's Resident Project Representative on each day he is at the project.

3.04 INSTALLATION

A. The Contractor shall obtain written installation manuals from the equipment manufacturer prior to installation. Equipment shall be installed strictly in accordance with recommendations of the manufacturer. A copy of all installation instructions shall be furnished the Engineer's field representative one week prior to installation.

B. The Contractor shall have on hand sufficient personnel, proper construction equipment, and machinery of ample capacity to facilitate the work and to handle all emergencies normally encountered in work of this character. To minimize field erection problems, mechanical units shall be factory-assembled insofar as practical.

C. Equipment shall be erected in a neat and workmanlike manner on the foundations at the locations and elevations shown on the Drawings.

D. All equipment sections and loose items shall be match-marked prior to shipping.

E. For equipment such as pumping units, which require field alignment and connections, the Contractor shall provide the services of the manufacturer's qualified mechanic, millwright, or machinist, to align the pump and motor prior to making piping connections or anchoring the pump base. Alignment shall be as specified herein.

F. The Contractor shall furnish oil and grease for initial operation and testing. The manufacturer and grades of oil and grease shall be in accordance with the recommendations of the equipment manufacturer.

3.05 ALIGNMENT

A. Set equipment to dimensions shown on drawings. Dimensions shall be accurate to +/- 1/16 inch unless otherwise noted on the drawings. Wedges shall not be used for leveling, aligning, or supporting equipment.
B. General Equipment Leveling: Non-rotating equipment shall be set level to +/- 1/16 inch per 10 foot length (.005 inch per foot) unless otherwise noted on the drawings. Shims shall be used unless equipment is furnished with leveling feet. Set shims flush with equipment baseplate edges. When grouting is required, equipment shall be shimmed to allow a minimum of one inch grout thickness. Grout shall cover shims at least 3 inches. Final level check shall be held for inspection and approval by Engineer before proceeding.

C. Grouting

1. Fill anchor bolt holes or sleeves with grout, after bolt alignment is proven, and prior to placing grout under equipment bases.

2. Surface Preparation. Roughen surface by chipping, removing laitance, and unsound concrete. Clean area of all foreign material such as oil, grease, and scale. Saturate area with water at least 4 hours prior to grouting, removing excess water ponds.

3. Application. Place grout after the equipment base has been set and its alignment and level have been approved. Form around the base, mix grout, and place in accordance with the grout manufacturers published instructions. Eliminate all air or water pockets beneath the base using a drag chain or rope.

4. Finishing. Point the edges of the grout to form a smooth 45 degree slope.

5. After grout has cured (not before 3 days after placement) paint exposed surfaces of grout with shellac.

6. Level Verification. After grout has cured, and immediately prior to drive alignment, recheck equipment for level and plumb. Re-level and square as necessary. Hold final checks for inspection and approval by Engineer.

D. Inspect for and remove all machining burrs or thread pulls in female holes on mating surfaces of mounting frame and machine feet.

E. Inspect and clean equipment mounting base pads, feet, and frames to remove all grease, rust, paint and dirt.

F. Assembled equipment shafts shall be set level to .0015 inches per foot of shaft length (+/- .0005 inches) up to a maximum of 0.015 inches for any length shaft unless the manufacturers requirements are more stringent or unless otherwise noted in the equipment specifications. Use the machined surfaces on which the equipment sets for the base/mounting frame leveling plane. Use the machined shaft surface for equipment leveling plane.

G. Sprocket and Sheave Alignment. Check shaft mounted components for face runout and eccentricity (outside diameter) runout by magnetically mounting a dial indicator on a stationary base and indicating over 360 degrees on a continuous machined surface at the outside diameter of the component. Maximum allowable total indicated face runout and eccentricity for sprockets and sheaves will be per ANSI Standard B29.1-1975.

H. Belt tensioning. Set drive belt tension to manufacturer's specification for the belt type. Recheck alignment after drive tensioning.
I. Thermal/Mechanical Growth. Thermal/mechanical growth corrections for driver and driven machines will be used in vertical and horizontal alignment where applicable. The equipment manufacturer will determine thermal/mechanical growth applicability for any machine and provide the correction offsets to be used.

J. Rotating Shaft Alignment

1. Fixtures will be set up on the driver and driven machine, machines shaft surfaces. Machined coupling hubs may be used only if there is no clearance to mount fixtures directly on the shafts.

2. Primary alignment method for direct drive machines is when coupled. Uncoupled alignment will be used only when approved by the Engineer.

3. Account for possible coupling flex by always rotating coupled machines in the same direction during alignment.

4. Uncoupled machines must be connected so that both shafts turn together without relative motion during alignment.

5. Indicator bar sag will be measured and included for each reverse indicator alignment setup.

6. Reverse Dial Indicator. The final maximum allowable misalignment: vertical and horizontal from the desired targets of .000 inches (for a non-thermal growth machine) or from the given target readings (for a thermal growth machine) must meet BOTH of the following conditions simultaneously: 1/2 the final total indicator reading at each indicator will be no more than shown in the table below AND the final remaining correction at each machine foot be no more than .001 inches of required movement.

<table>
<thead>
<tr>
<th>Machine Speed (RPM)</th>
<th>Total Misalignment* (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 1800</td>
<td>.002</td>
</tr>
<tr>
<td>1800 and greater</td>
<td>.001</td>
</tr>
</tbody>
</table>

* 1/2 indicator reading

3.06 FIELD TESTING

A. All equipment shall be set, aligned and assembled in conformance with the manufacturer's drawings and instructions. Provide all necessary calibrated instruments to execute performance tests. Submit report certified by the pump manufacturer's representative.

B. Preliminary Field Tests, Yellow Tag

1. As soon as conditions permit, after the equipment has been secured in its permanent position, the Contractor shall:
   a. Verify that the equipment is free from defects.
   b. Check for alignment as specified herein.
c. Check for direction of rotation.

d. Check motor for no load current draw.

2. Contractor shall flush all bearings, gear housings, etc., in accordance with the manufacturer's recommendations, to remove any foreign matter accumulated during shipment, storage or erection. Lubricants shall be added as required by the manufacturer's instructions.

3. When the Contractor has demonstrated to the Engineer that the equipment is ready for operation, a yellow tag will be issued. The tag will be signed by the Engineer, or his assigned representative and attached to the equipment. The tag shall not be removed.

4. Preliminary field tests, yellow tag, must be completed before equipment is subjected to final field tests, blue tag.

C. Final Field Tests, Blue Tag

1. Upon completion of the above, and at a time approved by the Engineer, the equipment will be tested by operating it as a unit with all related piping, ducting, electrical and controls, and other ancillary facilities.

2. The equipment will be placed in continuous operation as prescribed or required and witnessed by the Engineer or his assigned representative and the Owner or his assigned representative.

3. The tests shall prove that the equipment and appurtenances are properly installed, meet their operating cycles and are free from defects such as overheating, overloading, and undue vibration and noise. Operating field tests shall consist of the following:

   a. Check equipment for excessive vibration and noise as specified herein.

   b. Check motor current draw under load conditions. The rated motor nameplate current shall not be exceeded.

   c. Recheck alignment with dial indicators where applicable, after unit has run under load for a minimum of 24 hours.

D. In addition to the above described field tests, any other tests specifically required by Section 11100, Pumps-General, the individual equipment Specifications, or by the manufacturer shall be performed.

E. Until final field tests are acceptable to the Engineer, the Contractor shall make all necessary changes, readjustments and replacements at no additional cost to the Owner.

F. Upon acceptance of the field tests, a blue tag will be issued. The tag will be signed by the Engineer and attached to the unit. The tag shall not be removed and no further construction work will be performed on the unit, except as required during start-up operations and directed by the Engineer.
G. Defects which cannot be corrected by installation adjustments will be sufficient grounds for rejection of any equipment.

H. All costs in connection with field testing of equipment such as lubricants, temporary instruments, labor, equipment, etc., shall be borne by the Contractor. Power, fuel, chemicals, water, etc. normally consumed by specific equipment shall be supplied by the Owner unless otherwise specified in the individual equipment specifications.

I. The Contractor shall be fully responsible for the proper operation of equipment during tests and instruction periods and shall neither have nor make any claim for damage which may occur to equipment prior to the time when the Owner formally takes over the operation thereof.

J. Field testing of electric motors shall be in accordance with Section 15170, Electric Motors; Section 15171, Medium Voltage Electric Motors, and Section 16000, Basic Electrical Requirements.

3.07 VIBRATION TESTING

A. Unless specified otherwise in the detailed equipment specifications, each pump, blower, compressor, motor or similar item of stationary rotating equipment having a rated power in excess of 40HP shall be tested after installation for acceptable vibration levels.

B. Vibration testing shall be performed by an experienced factory-trained and authorized third-party analysis expert (not a sales representative) retained by the Contractor and approved by the Engineer. Each unit or pump system shall be tested separately without duplicate equipment running. All field testing shall be done in the presence of the Engineer. The Engineer shall be furnished with four (4) certified copies of vibration test data for each test performed.

C. For systems with variable speed drives, tests shall be conducted at various speeds between maximum and minimum. For systems with two-speed drives, tests shall be conducted at both speeds. For systems with constant-speed drive, tests shall be conducted under various loading conditions as determined by the Engineer.

D. All field vibration tests shall be performed with the equipment operating on the product for which it is intended, or a substitute acceptable to the Engineer.

E. The term displacement, as used herein, shall mean total peak-to-peak movement of vibrating equipment, in mils; velocity or speed of the vibration cycle, measured in G's. Displacement and velocity shall be measured by suitable equipment equal to IRD Mechanalysis, Bentley, Nevada.

E. Frequency of vibration, in cycles per minute (cpm), shall be determined when vibration exceeds specified levels or as otherwise necessary. Vibration shall be measured on the bearing housing, unless other locations are deemed necessary by the vibration analysis expert and Engineer.
F. For all equipment tested, vibration shall be checked in the radial and axial directions. Unless otherwise specified elsewhere, axial vibration shall not exceed 0.1 in/sec; and radial vibration shall not exceed 0.2 in/sec. For pumps radial vibration shall not exceed that permitted by the Hydraulic Institute Standards except that, at vibration frequencies in excess of 8,000 cpm, the velocity shall not exceed 0.2 in/sec.

G. Copies of test results shall be submitted to the Engineer for review. Should the vibration field test results exceed shop test results, the manufacturer's recommendations, or the limits specified herein, the Contractor shall correct the deficiencies within thirty (30) days. After corrections have been completed, the vibration testing shall be re-run and the results re-submitted to the Engineer for review.

H. Noise or vibration in any rotating equipment which the Engineer judges to be excessive or damaging, shall be cause for rejection.

3.08 FAILURE OF EQUIPMENT TO PERFORM

A. Any defects in the equipment, or failure to meet the guarantees or performance requirements of the Specifications shall be promptly corrected by the Contractor by replacements or otherwise.

B. If the Contractor fails to make these corrections, or if the improved equipment shall fail again to meet the guarantees or specified requirements, the Owner, notwithstanding his having made partial payment for work and materials which have entered into the manufacture of said equipment, may reject said equipment and order the Contractor to remove it from the premises at the Contractor's expense.

C. The Contractor shall then obtain specified equipment to meet the contract requirements or upon mutual agreement with the Owner, adjust the contract price to reflect not supplying the specific equipment item.

D. In case the Owner rejects said equipment, then the Contractor hereby agrees to repay to the Owner all sums of money paid to him for said rejected equipment on progress certificates or otherwise on account of the lump sum prices herein specified.

E. Upon receipt of said sums of money, the Owner will execute and deliver to the Contractor a bill of sale of all his rights, title, and interest in and to said rejected equipment; provided, however, that said equipment shall not be removed from the premises until the Owner obtains from other sources other equipment to take the place of that rejected.

F. Said bill of sale shall not abrogate Owner's right to recover damages for delays, losses, or other conditions arising out of the basic contract.

3.09 PAINTING

A. All surface preparation, shop painting, field repairs, finish painting, and other pertinent detailed painting specifications shall conform to applicable sections of Section 09900, Painting.

B. All shop coatings shall be compatible with proposed field coatings.
C. All inaccessible surfaces of the equipment, which normally require painting, shall be finished painted by the manufacturer. The equipment and motor shall be painted with a high quality epoxy polyamide semi-gloss coating specifically resistant to chemical, solvent, moisture, and acid environmental conditions, unless otherwise specified.

D. Gears, bearing surfaces, and other unpainted surfaces shall be protected prior to shipment by a heavy covering of rust-preventive compound sprayed or hand applied which shall be maintained until the equipment is placed in operation. This coating shall be easily removable by a solvent.

3.10 WELDING

A. The Equipment Manufacturer's shop welding procedures, welders, and welding operators shall be qualified and certified in accordance with the requirement of AWS D1.1 "Structural Welding Code - Steel" or AWS D1.2 "Structural Welding Code - Aluminum" of the American Welding Society, as applicable.

B. The Contractor's welding procedures, welders, and welding operators shall be qualified and certified in accordance with the requirements of AWS D1.1 "Structural Welding Code - Steel" or AWS D1.2 "Structural Welding Code - Aluminum" of the American Welding Society, as applicable.

C. The Contractor shall perform all field welding in conformance with the information shown on the Equipment Manufacturer's drawings regarding location, type, size, and length of all welds in accordance with "Standard Welding Symbols" AWS A2.0 of the American Welding Society, and special conditions, as shown by notes and details.

- END OF SECTION -
SECTION 11136

SUBMERSIBLE CHEMICAL SUMP PUMPS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install chemical-resistant submersible sump pumps at the locations shown on the Drawings and as specified herein. All pumps shall be supplied by the same manufacturer.

B. Equipment shall be provided in accordance with the requirements of Section 11000, Equipment General Provisions.

1.02 OPERATING CONDITIONS AND PERFORMANCE REQUIREMENTS

A. Pumps shall be completely resistant to corrosion in the chemical services listed in the pump schedule.

B. Chemical Sump Pump Schedule

<table>
<thead>
<tr>
<th>Facility</th>
<th>Design Capacity (gpm)</th>
<th>Total Dynamic Head (ft.)</th>
<th>Motor Horsepower</th>
<th>Max. Pump Speed (rpm)</th>
<th>Temperature of Liquid Pumped</th>
<th>Discharge Connection</th>
<th>Discharge Diameter (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-9101</td>
<td>30</td>
<td>15</td>
<td>1</td>
<td>3,600</td>
<td>Ambient</td>
<td>NPT-F</td>
<td>11/2</td>
</tr>
</tbody>
</table>

PART 2 -- PRODUCTS

2.01 ACCEPTABLE MANUFACTURES

A. Pumps shall be Vanton Pumps Inc., Model SGK, BJM Corporation Model TIGF32-9NL, or equal.

2.02 MATERIALS AND CONSTRUCTION
A. The pump casing shall be constructed of fiberglass reinforced Noryl or CPVC. All exposed hardware (nuts, bolts, washers, and other fastening devices) shall be constructed of materials as specified below.

B. Impeller shall be constructed of fiberglass reinforced Noryl or CPVC. The impeller shall be secured to the motor shaft per manufacturer's recommendations. The impeller shall be statically balanced.

C. The shaft shall be sufficiently large in diameter to transmit safely the maximum torque developed by the drive unit and of such a design as to provide a rigid support for the impeller and to prevent excessive vibration.

D. Sump Pump Materials of Construction

<table>
<thead>
<tr>
<th>Calcium Chloride</th>
<th>Facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware</td>
<td>CPVC</td>
</tr>
<tr>
<td>O-Rings</td>
<td>Viton</td>
</tr>
<tr>
<td>Shafting</td>
<td>Hastelloy C, Titanium</td>
</tr>
<tr>
<td>Double lip seals</td>
<td>Viton</td>
</tr>
</tbody>
</table>

2.03 ELECTRICAL AND CONTROL REQUIREMENTS

A. The pump motor shall be designed for 120VAC single-phase operation. Motor horsepower shall be as specified in the pump schedule. Motors shall conform to the latest applicable NEMA, IEEE, and ANSI standards for submersible service. The motors shall be oil filled for cooling. A thermal contactor shall be provided to stop the motor if overheating occurs.

B. The cable entry water seal design shall insure a watertight and submersible seal.

C. Sump pumps shall be hard wired to the local control station as shown on Drawings.

D. Sump pump shall not be supplied with an integral float switch.

2.05 SPARE PARTS

A. Spare parts shall be provided in accordance with Section 11000, Equipment General Provisions.
PART 3 -- EXECUTION

3.01 INSTALLATION

A. Contractor shall provide a union in piping near pump discharge connection to allow for easy removal of pump.

- END OF SECTION -
SECTION 13121
PRE-FABRICATED METAL CANOPY

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Provide all labor, materials, equipment and incidentals as shown, specified, and required by the metal canopy manufacturer to furnish and install all metal canopy Work. The Work shall include but is not limited to:

1. The canopy extent shown on the Drawings.
2. Multi-span rigid frame systems and clear-span rigid frame systems.
3. Framed openings.
4. Metal roof system.
5. All accessories, trim flashing, closures, gutters, downspouts, and all other items not specified under this or other sections but required to provide a completely watertight and functioning canopy complying with these specifications.
6. Canopy structure shall match the style of the existing metal canopies on site, including roof type, pitch, materials of construction and color.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Requirements of related work are included in Division 1 of these Specifications.

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Without limiting the generality of other requirements of these Specifications, all work herein shall conform to or exceed the applicable requirements of the following documents to the extent that the provisions therein are not in conflict with the requirements of this Section.

1. California Building Code
4. American Iron and Steel Institute, "Cold Formed Steel Design Manual"
5. American Welding Society, Structural Welding Code
7. Steel Structures Painting Council, "Steel Structures Painting Manual, Vol. 2"
8. Underwriters Laboratories Incorporated (U.L.), "Bulletin of Research No. 52
9. All written requirements published by the canopy manufacturer
10. International Accreditation Service AC 472, Criteria for Inspection Programs for Manufacturers of Metal Building Systems

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300 - Submittals.

1. All design data and calculations shall be neatly prepared to facilitate review and shall be signed and stamped with the seal of a Registered Professional Engineer licensed to practice in the State of California and who is a recognized expert in this type of construction. The calculations shall be submitted to the Engineer prior to fabrication and concrete foundation placement.

2. Dimensioned shop drawings showing the canopy plans including column centerlines, canopy reactions to the foundation, elevations and cross-sections.

3. Manufacturer's product information, specifications, and installation instructions for canopy components and accessories.

4. Complete erection drawings showing anchor bolt settings, and roof framing, covering and trim details, and accessory installation details to clearly indicate the proper assembly of canopy components.

5. 12-inch long by actual width samples of roofing and siding panels, with required finishes.

6. Samples of fasteners for application of roofing and siding panels

7. Samples of sealants and closures

8. Copy of accreditation certificate showing metal canopy system manufacturer's qualifications per IAS AC 472 as described in Paragraph 1.05 below.

9. Copy of AISC Certified Erector certification showing the metal canopy system erector's qualifications as described in Paragraph 1.06 below

10. Guarantees described in Paragraph 1.07 below.
1.05 MANUFACTURER’S QUALIFICATIONS

A. The manufacturer of the metal canopy systems shall be a manufacturer which has successfully engaged in work of this nature for at least the past five years and is an active member of the Metal Building Manufacturers Association.

B. The metal canopy system manufacturer shall be accredited by IAS AC 472 as a certified metal building systems manufacturer.

C. The metal buildings shall be as manufactured by Varco Pruden Metal Building Systems, Memphis, Tennessee; CECO Building Systems, Columbus MS; Butler Manufacturing Company, Kansas City, MO; American Building Company, Eufaula, AL.

1.06 ERECTOR QUALIFICATIONS

A. Furnish the names of all erector proposed to use for this work including necessary evidence and/or experience records to ascertain their qualifications in the erection of metal buildings.

B. Erector qualifications shall include a certified letter from the metal canopy manufacturer, on the manufacturer's letterhead, signed by an officer of the company stating that the erector is on the manufacturer's approved list of contractors.

C. The metal canopy system erector shall be an AISC Certified Erector.

1.07 GUARANTEES

A. Furnish written guarantees from the manufacturer stating that the exterior paint is guaranteed for a period of 20 years.

B. Paint guarantee shall be against blistering, peeling, flaking, checking, chipping, excessive color change, chalking, and cracking.

C. The roof guarantee shall be against rupture, structural failure, and perforation.

D. Guarantee the roof against defects, leaks, etc. and the labor to repair such for a period of 20 years.

E. All guarantees shall be submitted to the Engineer for approval and will be effective from the date of acceptance by the Engineer.

PART 2 -- GENERAL

2.01 GENERAL

A. All work shall conform to the following list which shall be considered as minimum standards:

1. Hot-Rolled Structural Shapes  
   ASTM A36 or A529

2. Tubing or Pipe  
   ASTM A500, Grade B  
   ASTM A501 or A53
3. Plate or Bar  
   ASTM A529, A570, or A572
4. Cold Formed Members  
   ASTM A607, Grade 50
5. Galvanized Steel Sheet  
   ASTM A653 Class G90
6. Threaded Steel Rods  
   ASTM A36 or A572, Grade D
7. Bolts  
   ASTM A325
8. Anchor Bolts  
   ASTM A307
9. Panels  
   ASTM A792

2.02 MULTI-SPAN OR CLEAR SPAN RIGID FRAMES

A. Frames shall be fabricated from hot rolled structural steel, shop welded, built-up "I" shapes consisting of variable depth rafters and either tapered or parallel-flanged columns complete with baseplates and splice plates.

B. Rigid Frames shall be designed as pinned base.

C. Width of span and spacing of frames shall be as indicated on the Drawings.

D. Shop drill frames for bolted field assembly.

E. Vertical diagonal bracing shall be permitted only in sides. Horizontal bracing will be permitted providing it is above the canopy's required interior clear height.

F. Portal frames or wind posts will be permitted where bracing is considered to be an obstruction, except where functional interferences are created.

2.03 SECONDARY FRAMING

A. Secondary framing shall include but is not limited to purlins, girts, eave struts, trim angles and channels, flange braces, and sag bracing.

B. Framing members shall be a minimum 16 gage shop painted either cold formed, hot rolled, or built up steel sections.

C. Purlin and girt configuration, thickness, and spacing shall be the canopy manufacturer's standard provided that all design criteria in the referenced standards including deflection, are met or exceeded.

2.04 ROOF SYSTEM

A. The roof construction shall carry an Underwriter's Laboratories wind uplift Class 60 rating or better to meet the California Building Code.
B. The metal roof covering shall be 24-gage (minimum) steel panels with an aluminum-zinc alloy finish designed in accordance with AISI.

C. Roof panels shall be of "standing-seam interlocking" design, secured to the purlins with a concealed structural fastening system and meeting specified load carrying capacities and allowable deflections.

D. The concealed system shall provide minimal through penetration of the exposed roofing surface and allow the roof covering to move independently of any differential thermal movement by the structural framing system.

E. Except at the concealed fasteners, there shall be no thermal contact of the roof panels with the supporting purlins. Through penetration of the roofing by exposed fasteners shall occur only at terminal locations of the roof panels. Such fasteners shall be stainless steel or aluminum screws, bolts or rivets, with weather-seal washers. Carbon steel shank fasteners with vinyl heads shall also be acceptable.

F. The standing seams shall have a factory-applied, nonhardening sealant, and the seams shall be continuously locked or crimped together by mechanical means during erection.

G. Roof panels with lay-type side (longitudinal) joints and exposed structural fasteners shall not be considered acceptable.

H. Roof slope shall be as indicated on Drawings.

I. Openings 8" or smaller may be flashed and sealed to the roof panel by elastomeric boots provided complete structural support and weather tightness are maintained.

J. Openings larger than 8" shall be framed with a welded metal roof curb completely supported by the roof system, and with flanges configured to match the roof panel. The curb shall be sealed to provide complete weather tightness.

K. All curbs and boots shall be an integral component of the roofing system designed and supplied by the metal canopy manufacturer.

L. Snow Retention System: Provide clamps with stainless steel fasteners that mechanically attach to standing seams without penetrating the roof system. Snow retention system shall include cross members to retain snow with snow and ice clips. Snow retention system shall be specifically manufactured for profile of standing seam metal roofing. Snow retention system manufacturer shall design system for local conditions and provide multiple rows as required by the manufacturer’s design calculations to resist sliding snow. Snow retention system shall be approved for use by standing seam roofing system manufacturer and not void or limit warranty. Color to match standing seam roofing system and color warranty. Provide S-5 Colorguard by Metal Roof Innovations, Ltd., or SnoBar/ColorBar by SnoBlox-Snojax, or approved equal.

2.05 NOT USED

2.06 NOT USED

2.07 ACCESSORIES
A. **General** - Coordinate supply and installation of all accessory items. Coordinate framed opening requirements of accessory items with supplier. Provide special members, fasteners, and hardware required for proper securement and installation of accessory items.

### 2.08 SEALANTS AND CLOSURES

A. Sealants shall be asphaltic, nonhardening, nonshrinking, nonstaining, noncorrosive and nontoxic.

B. Closures shall match the panel profile and shall be installed as required to provide a weather tight canopy.

### 2.09 GUTTERS AND DOWNSPOUTS

A. Gutters and downspouts shall be fabricated from 26-gauge steel minimum with 70% Kynar coating. Color shall be selected by Engineer.

B. Downspouts shall be approximately 4-inches by 5-inches and shall be spaced according to the canopy manufacturer's standards.

### 2.10 MAINTENANCE STOCK

A. Provide a minimum of 5 percent access over the required amount of metal roof panels, roof insulation, nuts, bolts, screw, washers and other required fasteners for building.

B. Pack in cartons and store on the site where directed.

### PART 3 -- EXECUTION

#### 3.01 DESIGN

A. The canopy shall be as designed for dead, live, wind, and seismic loads according to the recommendations of the referenced standards.

B. Roof framing shall be designed for an additional live load of 5 psf to accommodate piping and lighting.

C. The canopy shall be designed for all loads and equipment shown on the Drawings.

D. The canopy anchor bolts shall be designed by the canopy manufacturer to resist all column reactions. Anchor bolts shall be furnished by the Contractor, and shall be installed per recommendations using a manufacturer's supplied template.

E. The Engineer shall verify the foundation capacity for the reactions provided by the Canopy Manufacturer.

#### 3.02 FABRICATION

A. Design prefabricated components and necessary field connections required for erection to permit easy assembly and disassembly. Fabricate components in such a manner that once
assembled, they may be disassembled, repackaged, and reassembled with a minimum amount of labor.

B. Clearly and legibly mark each piece of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.

C. Shop connections shall be bolted or welded.

D. Field connections shall be bolted.

3.03 PAINTING

A. Materials

1. The painting systems shall be compatible with Section 09900 - Painting.

B. Shop Painting

1. All fabricated steel work and materials shall receive at the factory at least one shop coat of prime paint compatible with the paint system required by Section 09900 - Painting. Surface preparations prior to shop painting shall be as specified. Finish coats may be applied in the shop if approved by the Engineer. All shop painted items shall be properly packaged and stored until they are incorporated in the work. Any painted surfaces that are damaged during handling, transporting, storage, or installation shall be cleaned, scraped, and patched before field painting begins so that the work shall be equal to the original painting received at the shop. Steel work or materials that are to be assembled on the site shall likewise receive a minimum of one shop coat of paint at the factory.

2. The Contractor shall specify the shop paints to be applied when ordering materials in order to assure compatibility of shop paints with field paints. The paints and surface preparation used for shop coating shall be identified on shop drawings to the Engineer for approval. Where a compatible shop primer is not available, the Contractor shall provide a barrier coat as recommended by field applied paint system manufacturer, or totally remove shop primer and provide paint system specified in Section 09900 - Painting. Barrier or tie coat shall be in addition to coats required by Section 09900 - Painting.

3.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver and store prefabricated components, sheets, and panels, and other manufactured items so that they will not be damaged or deformed.

B. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight ventilated covering.

C. Store metal sheets or panels so that water accumulations will drain freely.

D. Do not store sheets or panels in contact with other materials which might cause staining.

3.05 ERECTION
A. Erection of metal canopy, accessories, insulation and the interior finish, if applicable shall be performed by an AISC Certified Erector in accordance with Article 1.06 above.

B. The installation of the metal canopy shall be coordinated with any work which is to be installed with or attached to the metal canopy.

- END OF SECTION -
# SECTION 13207

## CROSS-LINKED POLYETHYLENE STORAGE TANKS

### PART 1 -- GENERAL

#### 1.01 THE REQUIREMENT

A. The Contractor shall furnish, deliver, install, test and place in satisfactory operation high-density cross-linked polyethylene storage tanks, complete with all necessary accessories, at the locations shown on the Drawings and as specified herein.

B. Equipment shall be provided in accordance with the requirements of Section 11000, Equipment General Provisions.

#### 1.02 CONDITIONS OF SERVICE/STORAGE TANK SCHEDULE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>One (1)</td>
</tr>
<tr>
<td>Tank Identification No.</td>
<td>T-0111</td>
</tr>
<tr>
<td>Max Solution Concentration</td>
<td>38%</td>
</tr>
<tr>
<td>Typical Solution Concentration</td>
<td>35%</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.4</td>
</tr>
<tr>
<td>Viscosity</td>
<td>8 cPs</td>
</tr>
<tr>
<td>Design Temperature</td>
<td>40-100 degrees F</td>
</tr>
<tr>
<td>pH</td>
<td>11</td>
</tr>
<tr>
<td>Type</td>
<td>Vertical, Cylindrical</td>
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<tr>
<td>Bottom Configuration</td>
<td>Flat Bottom</td>
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<tr>
<td>Top Configuration</td>
<td>Dome Top</td>
</tr>
<tr>
<td>Useable Capacity (to invert of overflow)</td>
<td>5,000 gallons</td>
</tr>
<tr>
<td>Maximum Diameter</td>
<td>9'-0&quot;</td>
</tr>
<tr>
<td>Maximum Straight Shell Height</td>
<td>13'</td>
</tr>
<tr>
<td>Maximum Overall Height</td>
<td>11'-6&quot;</td>
</tr>
<tr>
<td>Connection Openings*</td>
<td></td>
</tr>
<tr>
<td>1) Fill</td>
<td>2&quot;</td>
</tr>
<tr>
<td>2) Outlet</td>
<td>2&quot;</td>
</tr>
<tr>
<td>3) Not Used</td>
<td>N/A</td>
</tr>
<tr>
<td>4) Overflow</td>
<td>4&quot;</td>
</tr>
<tr>
<td>5) Vent</td>
<td>4&quot;</td>
</tr>
<tr>
<td>6) Top Manway Diameter</td>
<td>2'-0&quot;</td>
</tr>
<tr>
<td>7) Ultrasonic Level Instrument</td>
<td>Coordinate with Instrument Supplier</td>
</tr>
<tr>
<td>8) High Level Probe</td>
<td>Coordinate with Instrument Supplier</td>
</tr>
<tr>
<td>Heating Panels and Insulation</td>
<td>No</td>
</tr>
<tr>
<td>Materials of Construction of Metal Components Exposed to Chemical Fed to Process</td>
<td>Titanium</td>
</tr>
<tr>
<td>Materials of Construction of Metal Components in Containment Area</td>
<td>Titanium or Hastelloy C</td>
</tr>
<tr>
<td>Materials of Construction of Metal Components above Containment Area</td>
<td>316 Stainless Steel</td>
</tr>
</tbody>
</table>
1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. American National Standards Institute (ANSI)
   1. ANSI B16.5 – Pipe Flanges and Flanged Fittings.

B. American Society of Testing Materials (ASTM)
   2. ASTM D746 – Brittleness Temperature of Plastics and Elastomers by Impact.
   5. ASTM D1505 – Density of Plastics by the Density-Gradient Technique.

C. National Sanitation Foundation (NSF 61)

1.04 SUBMITTALS

A. The following items shall be submitted with the Shop Drawings in accordance with, or in addition to the submittal requirements specified in Section 01300, Submittals; and Section 11000, Equipment General Provisions:
   1. Performance Affidavit
   2. List of at least five similar installations of the tank type, size, chemical service, and location conditions being proposed, including date installed, contact name, address and phone number
   3. Warranty
   4. Dimensions of tank and dimensions, location, and orientation of openings, fittings, accessories, attachments, restraints and supports, anchor bolts, manways, and flexible connections.
   5. Weight of tanks
6. Detailed instructions for pipe connections and bolt torque values

7. Design calculations signed by registered Professional Engineer for tank restraint system to withstand seismic, wind, and buoyancy conditions as required, including details for anchorage, lateral restraint, foundation requirements, and anchor bolt sizes, depth of embedment, shear, and pullout strength

8. Not Used

9. Wall thickness calculations per ASTM D 1998-06 using 600 psi design hoop stress @ 100°F

10. A complete manufacturer’s specification of the resin used

11. Factory test report, including wall thickness verification, fitting placement verification, visual inspection, impact test, gel test, and hydrostatic test.

12. Statement that materials, resin, and fittings used are suitable for intended service

13. Statement that fabrication is in accordance with these Specifications

14. Instructions for handling, storage, loading and unloading, and installation of tanks.

15. Supporting information of ISO 9001 certification.


18. Spare parts and special tools list

18. Operation and maintenance manuals

1.05 QUALITY ASSURANCE

A. Tanks shall be constructed by a firm that has at least ten years prior experience in construction of similar polyethylene tanks in similar applications.

B. Tanks shall be manufactured by a firm with a nationally accepted quality standard (i.e., ISO 9001 or equal).

1.06 WARRANTY AND GUARANTEE

A. Warranty and Guarantee shall be as specified in Section 11000 with the exception that the warranty period shall be for five (5) years.

PART 2 -- PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS
A. The polyethylene storage tank(s) shall be as manufactured by PolyProcessing Company or approved equal.

2.02 MATERIALS AND CONSTRUCTION

A. Each tank shall be one-piece construction, rotationally molded, high-density cross-linked polyethylene. Tank shall be completely resistant to corrosion by the specified chemicals. The Contractor and tank manufacturer shall be fully responsible for the structural design and integrity and watertightness of the tank, including all anchorages and connections. Each tank shall be capable of storing the specified chemical at temperatures up to 100°F.

B. All materials in contact with the stored chemical shall be NSF 61 certified for use in the treatment of drinking water. Tank manufacturer shall provide a low-density polyethylene liner if required for oxidation resistance for the specified chemicals.

C. The plastic shall not contain any fillers. All plastic shall contain a minimum of 0.25 percent UV stabilizer and maximum of 0.60 percent. Pigments may be added as designated by the manufacturer, not to exceed 0.5 percent of dry blended or 2 percent if melt compound of the total weight of the tank.

D. The nominal properties of the material are as follows based on molded parts:

<table>
<thead>
<tr>
<th>Property</th>
<th>ASTM Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>D1505</td>
<td>.940 to .945 g/cc</td>
</tr>
<tr>
<td>ESCR Specification Thickness .125” F50 10% Igepal</td>
<td>D1693A</td>
<td>&gt;1,000 hours</td>
</tr>
<tr>
<td>Tensile Strength Ultimate 2 in/min</td>
<td>D638 Type IV</td>
<td>2,830 psi</td>
</tr>
<tr>
<td>Elongation at Break 2 in/min.</td>
<td>D638</td>
<td>700 percent</td>
</tr>
<tr>
<td>Vicat Softening Temperature</td>
<td>D1525</td>
<td>240 degrees F</td>
</tr>
<tr>
<td>Impact Brittleness temperature</td>
<td>D746</td>
<td>&lt;-40oF</td>
</tr>
<tr>
<td>Flexural Modulus</td>
<td>D790B</td>
<td>86,700 psi</td>
</tr>
</tbody>
</table>
E. Design Requirements

1. The minimum required wall thickness of the cylindrical shell at any fluid level shall be determined by the following equation, but shall not be less than 0.187 in thick.

\[
T = \frac{P \times O.D./2}{2 \times SD} = 0.433 \times S.G. \times H \times \frac{O.D.}{2 \times SD}
\]

- **T** = wall thickness, in.
- **SD** = Hydrostatic design stress, PSI
- **P** = pressure \(0.433 \times S.G. \times H\), PSI
- **H** = fluid head, ft.
- **S.G.** = specific gravity, g/cm^3
- **O.D.** = outside diameter, in.

Wall Thickness of Calcium Chloride Bulk Storage Tank No. T-297 @ 73°F = 0.433 * 1.4 * 13 * 108 / (2 * 600) = 0.71”

2. The hydrostatic design stress shall be determined by multiplying the hydrostatic design basis, determined by ASTM D2837 using rotationally molded samples, with a service factor selected for the application. The hydrostatic design stress is 600 PSI at 73 degrees Fahrenheit.

3. The hydrostatic design stress shall be derated for service above 100 degrees Fahrenheit and for mechanical loading of the tank.

4. The standard design specific gravity shall be 1.5.

5. The minimum required wall thickness for the cylinder shell must be sufficient to support its own weight in an upright position without any external support.

6. For dome top tanks, the top head must be integrally molded with the cylinder shell. The minimum thickness of the top head shall be equal to the top of the straight wall. For open top tanks, the open top shall include a reinforcing flange provided for attaching a flat, hinged top. The minimum thickness of the flat top shall be equal to the top of the straight wall.

F. All tank capacities (volumes) specified shall include only that volume in the straight shell below the overflow pipe invert elevation and above the top of the outlet pipe. At least four inches of freeboard shall be provided between the invert elevation of the overflow pipe and the top of the straight shell.

G. Tanks shall be anchored to the concrete base by the Contractor in accordance with the Drawings.

H. The tanks shall be cylindrical and vertical in orientation with tank penetrations as indicated on the Contract Drawings.

I. The outside diameter tolerances, including out-of-roundness, shall be +/- 3%.

2.03 CONNECTIONS AND ACCESSORIES
A. All connections/openings shall be flanged in accordance with ANSI B 16.5 150 pounds. Flanged connections, nozzles and openings shall be reinforced and shall be perpendicular to the straight shell of the tank. All pipe supports, gaskets, hardware, accessories, etc., shall be provided. All piping connected to the tanks shall be perpendicular or parallel to the straight shell of the tanks. All piping into the tanks shall be supported such that no weight is placed on the tank and its connections. Piping supports requiring holes through the side wall of the tanks shall not be allowed.

B. Each tank connection located on the lower third of the tank shall be provided with a flexible connector resistant to the specified chemical to allow for lateral and vertical expansion and contraction of the tank and to isolate the tank from pump and piping vibration. Flexible connectors shall be provided by the tank manufacturer or provided by the Contractor and approved by the tank manufacturer.

C. Sidewall fittings above the chemical fill level shall be Schedule 80 PVC or CPVC bulkhead fittings. Sidewall fittings below chemical fill level shall be bolted double flange PVC or CPVC with polyethylene encapsulated bolts. Opening for pump suction line shall be integrally molded flanged outlet or other approved integrally molded full drain outlet. Bolts and gaskets shall be constructed of materials as shown in the Storage Tank Schedule.

D. Vent lines shall be top-mounted. Each vent shall be extended to the atmosphere and shall have a PVC vent insect screen. Vent lines shall be supplied and furnished by the Contractor as required or as directed by the Engineer.

E. Each storage tank fill line shall be provided with a camlock type quick connect coupling with downstream ball valve as shown on the Drawings for connection with delivery vehicle. The dry quick connections shall be resistant to corrosion by the specified chemicals and shall be provided with fittings, quick lock coupling and dust cap and chain. The Contractor shall furnish and install a sign at each chemical fill station to identify the chemical filled. The signage shall be as specified in Section 10400. Tank fill shall be provided with internal drop pipe.

F. Each tank shall be provided with an overflow pipe as specified and indicated on the Drawings.

G. Each tank shall be provided with level instruments in accordance with Division 17, Control and Information Systems. The mounting and connecting requirements, including mounting flange diameter, required clearance between mounting flange and tank wall, and height above liquid level, shall be coordinated with the Instrument Supplier.

H. The Contractor shall provide a magnetic sight level indicator as specified in Section 17750 Magnetic Level Indicator and Transmitter.

I. Each tank shall be provided with a top-mounted chemically-resistant manway with a bolt-on type cover. Gaskets and bolts shall be resistant to specified chemicals. Manway cover shall provide emergency pressure relief venting.

J. Access Ladder – Not Required.

K. The tank shall be provided with a minimum of three lifting lugs integrally molded into the top head. Lifting lugs shall be capable of withstanding weight of an empty tank with a safety factor of 3 to 1.
L. Each tank shall be provided with a restraint system with necessary cable assemblies, anchor clips and anchor bolts. Materials in the containment area shall be completely resistant to corrosion by the specified chemicals. Restraint system shall be capable of withstanding buoyancy of empty tank in a containment area flooded to the top of the containment wall, wind load, and seismic activity. Wind and seismic restraint systems shall be designed to meet current UBC code. Refer to Drawings for containment wall height. The anchor bolts, nuts, washers, shims and related hardware shall be sized by the tank manufacturer and provided by the Contractor. The tank manufacturer shall size the anchor bolt anchoring depth and edge distance for the tank pad. The tank manufacturer shall submit calculations, sealed by a Professional Engineer, to verify that restraint system can withstand buoyancy, wind load, and seismic activity. Anchor clips requiring holes through the side wall of the tanks shall not be allowed.

M. The tank shall be provided with a permanently attached label providing the following information:

- Type of material stored
- Concentration of material stored
- Specific gravity
- Maximum temperature
- Tank capacity
- Manufacturer
- Date of manufacture

2.04 PIPING SUPPORT

A. All horizontal sections of piping inside the containment area and trench shall be supported by thermoplastic pads at maximum 5-foot intervals as shown in the Drawings to prevent the piping from resting directly on concrete.

B. For piping exterior to the tank, all pipe supports, hardware, accessories, etc., shall be provided for connections as shown in the Tank Schedule. Vertical piping into the tanks shall be supported every five feet and shall be parallel to the tank wall. External vertical piping shall be not less than 6 inches from the tank wall.

C. All piping into the tanks shall be supported such that no weight is placed on the tank or its connections.

PART 3 -- EXECUTION

3.01 MANUFACTURER’S FIELD SERVICES

A. The services of a qualified manufacturer's technical representative shall be provided in accordance with Section 11000, Equipment General Provisions and shall include the following site visits for each series of tanks:

<table>
<thead>
<tr>
<th>Service</th>
<th>Number of Trips</th>
<th>Number of Days/Trip</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation and Testing</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
### 3.02 INSTALLATION

A. The Contractor shall furnish and install the polyethylene storage tanks and related items in accordance with the manufacturers’ recommendations and in accordance with Section 11000, Equipment General Provisions.

B. A manufacturer’s field representative shall be on site when each tank is installed to observe installation and verify that each tank has been installed per manufacturer’s recommendations. The manufacturer shall provide a report certifying that each tank has been installed properly.

C. All piping, valves, fittings, conduit, wiring, etc., required to interconnect system components shall be furnished and installed by the Contractor. Piping materials shall be as specified in Section 15390 – Schedule.

D. All metallic fasteners, brackets, mounting hardware, and accessories located in chemical storage and feed areas shall be constructed of corrosion-resistant metals as specified in the Tank Schedule.

E. The Contractor shall install 2 layers of roofing paper between each concrete pad and storage tank. The tanks shall be installed on level pads.

### 3.03 SHOP TESTING

A. Material Testing

1. Perform gel and low temperature impact tests in accordance with ASTM D 1998 on condition samples cut from each polyethylene chemical storage tank.

2. Degree of Crosslinking. Use Method C of ASTM D 1998- Section11.4 to determine the ortho-xylene insoluble fraction of cross-linked polyethylene gel test. Samples shall test at no less than 60 percent.

B. Tank Testing

1. Dimensions: Take exterior dimensions with the tank empty, in the vertical position. Outside diameter tolerance, including out-of-roundness, shall be per ASTM D 1998. Fitting placement tolerance shall be +/- 1/2-in vertical and +/- 1 degree radial.


3. Hydrostatic test: Following fabrication, the bottom tanks, including inlet and outlet fittings, shall be hydraulically tested with water by filling to the top sidewall for a minimum of 1 hour and inspected for leaks. Following successful testing, the tank shall be emptied and cleaned prior to shipment.

### 3.04 FIELD TESTING
A. Field testing shall be performed in accordance with Section 11000, Equipment General Provisions.

B. Upon completion of installation of tank and prior to connecting piping, the Contractor shall provide blind flanges or other suitable plugs for all openings in the tanks, fill tanks with clean water provided by the Owner from a source approved by the Engineer and conduct a leakage test as specified herein. Tanks shall be filled up to the top of the straight shell of the tank and left to sit over a 5-day test period. There shall be no leakage over the test period. Leakage around openings in the tanks shall be stopped by tightening nuts and bolts or replacing gaskets as required. Leakage tests shall be repeated for any replaced or repaired tank. Upon satisfactory completion of leakage test, Contractor shall drain, thoroughly clean, and dry the tanks and dispose of water in a suitable manner.

- END OF SECTION -
SECTION 15000

BASIC MECHANICAL REQUIREMENTS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install to the required line and grade, all piping together with all fittings and appurtenances, required for a complete installation. All piping located outside the face of structures or building foundations and all piping embedded in concrete within a structure or foundation shall be considered exterior piping.

B. The Contractor shall furnish and install fittings, couplings, connections, sleeves, adapters, harness rods and closure pieces as required to connect pipelines of dissimilar materials and/or sizes herein included under this Section and other concurrent Contracts for a complete installation.

C. The Contractor shall furnish all labor, materials, equipment, tools, and services required for the furnishing, installation and testing of all piping as shown on the Drawings, specified in this Section and required for the Work. Piping shall be furnished and installed of the material, sizes, classes, and at the locations shown on the Drawings and/or designated in this Section. Piping shall include all fittings, adapter pieces, couplings, closure pieces, harnessing rods, hardware, bolts, gaskets, wall sleeves, wall pipes, hangers, supports, and other associated appurtenances for required connections to equipment, valves, or structures for a complete installation.

D. Piping assemblies under 4-inch size shall be generally supported on walls and ceilings, unless otherwise shown on the Drawings or ordered by the Engineer, being kept clear of openings and positioned above “headroom” space. Where practical, such piping shall be run in neat clusters, plumb and level along walls, and parallel to overhead beams.

E. The Contractor shall provide taps on piping where required or shown on the Drawings. Where pipe or fitting wall thicknesses are insufficient to provide the required number of threads, a boss or pipe saddle shall be installed.

F. The work shall include, but not be limited to, the following:

1. Connections to existing pipelines.

2. Test excavations necessary to locate or verify existing pipe and appurtenances.

3. Installation of all new pipe and materials required for a complete installation.

4. Cleaning, testing and disinfecting as required.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Division 1, General Requirements
B. Division 2, Sitework  
C. Division 5, Metals  
D. Division 9, Finishes  
E. Division 11, Equipment  
F. Division 16, Electrical  

1.03 MATERIAL CERTIFICATION AND SHOP DRAWINGS  
A. The Contractor shall furnish to the Owner (through the Engineer) a Material Certification stating that the pipe materials and specials furnished under this Section conform to all applicable provisions of the corresponding Specifications. Specifically, the Certification shall state compliance with the applicable standards (ASTM, AWWA, etc.) for fabrication and testing.  
B. Shop Drawings for major piping (2-inches in diameter and greater) shall be prepared and submitted in accordance with Section 01300 – Submittals. In addition to the requirements of Section 01300 – Submittals, the Contractor shall submit laying schedules and detailed Drawings in plan and profile for all piping as specified and shown on the Drawings.  
C. Shop Drawings shall include, but not be limited to, complete piping layout, pipe material, sizes, class, locations, necessary dimensions, elevations, supports, hanger details, pipe joints, and the details of fittings including methods of joint restraint. No fabrication or installation shall begin until Shop Drawings are approved by the Engineer.  

PART 2 -- PRODUCTS  

2.01 GENERAL  
A. All specials and every length of pipe shall be marked with the manufacturer's name or trademark, size, class, and the date of manufacture. Special care in handling shall be exercised during delivery, distribution, and storage of pipe to avoid damage and unnecessary stresses. Damaged pipe will be rejected and shall be replaced at the Contractor's expense. Pipe and specials stored prior to use shall be stored in such a manner as to keep the interior free from dirt and foreign matter.  
B. Testing of pipe before installation shall be as described in the corresponding ASTM or AWWA Specifications and in the applicable standard specifications listed in the following sections. Testing after the pipe is installed shall be as specified in Section 3.09.  
C. Joints in piping shall be of the type as specified in the appropriate Piping System Schedule in Section 15390, Schedules.  
D. ALL BURIED EXTERIOR PIPING SHALL HAVE RESTRAINED JOINTS FOR THRUST PROTECTION UNLESS OTHERWISE SPECIFIED OR SHOWN ON THE DRAWINGS. ALL EXPOSED EXTERIOR PIPING SHALL HAVE FLANGED JOINTS, UNLESS OTHERWISE SPECIFIED OR SHOWN ON THE DRAWINGS.
E. The Drawings indicate work affecting existing piping and appurtenances. The Contractor shall excavate test pits as required of all connections and crossings which may affect the Contractor's work prior to ordering pipe and fittings to determine sufficient information for ordering materials. The Contractor shall take whatever measurements that are required to complete the work as shown or specified.

2.02 WALL PIPES

A. Where wall sleeves or wall pipes occur in walls that are continuously wet on one or both sides, they shall have water stop flanges at the center of the casting or as shown on the Drawings. Ends of wall pipes shall be flange, mechanical joint, plain end, or bell as shown on the Drawings, or as required for connection to the piping. Wall pipes shall be of the same material as the piping that they are connected to. If welded waterstop flanges are employed, welds shall be 360 degree continuous on both sides of flange. Unless otherwise shown on the Drawings, waterstop flanges shall conform to the minimum dimensions shown below:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Waterstop Flange Diameter</th>
<th>Waterstop Flange Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>4&quot; - 12&quot;</td>
<td>OD + 3.10&quot;</td>
<td>0.50&quot;</td>
</tr>
<tr>
<td>14&quot; - 24&quot;</td>
<td>OD + 4.15&quot;</td>
<td>0.75&quot;</td>
</tr>
<tr>
<td>30&quot; - 36&quot;</td>
<td>OD + 4.50&quot;</td>
<td>1.00&quot;</td>
</tr>
<tr>
<td>42&quot; - 48&quot;</td>
<td>OD + 5.00&quot;</td>
<td>1.25&quot;</td>
</tr>
<tr>
<td>54&quot;</td>
<td>OD + 5.90&quot;</td>
<td>1.50&quot;</td>
</tr>
</tbody>
</table>

2.03 SLEEVES

A. Unless shown otherwise, all piping passing through walls and floors shall be installed in sleeves or wall castings accurately located before concrete is poured, or placed in position during construction of masonry walls. Sleeves passing through floors shall extend from the bottom of the floor to a point 3 inches above the finished floor, unless shown otherwise. Water stop flanges are required on all sleeves located in floors or walls which are continually wet or under hydrostatic pressure on one or both sides of the floor or wall.

B. Sleeves shall be cast iron, black steel pipe, or fabricated steel in accordance with details shown on the Drawings. If not shown on the Drawings, the Contractor shall submit to the Engineer the details of sleeves he proposes to install; and no fabrication or installation thereof shall take place until the Engineer's approval is obtained. Steel sleeves shall be fabricated of structural steel plate in accordance with the standards and procedures of AISC and AWS. Steel sleeve surfaces shall receive a commercial sandblast cleaning and then be shop painted in accordance with Section 09900 – Painting.

C. When shown on the Drawings or otherwise required, the annular space between the installed piping and sleeve shall be completely sealed against a maximum hydrostatic pressure of 20 psig. Seals shall be mechanically interlocked, solid rubber links, trade name "Link-Seal", as manufactured by Garlock Pipeline Technologies (GPT) or equal. Rubber link, seal-type, size, and installation thereof, shall be in strict accordance with the manufacturer's recommendations. For non-fire rated walls and floors, pressure plate shall be glass reinforced nylon plastic with EPDM rubber seal and 304 stainless steel bolts and nuts. For fire rated walls and floors, two independent seals shall be provided consisting of
low carbon steel, zinc galvanized pressure plates, silicon rubber seals and low carbon steel, zinc galvanized bolts and nuts.

D. Cast iron mechanical joint adapter sleeves shall be Clow # 1429, as manufactured by the Clow Corp., or equal. Mechanical joint adapter sleeves shall be provided with suitable gasket, follower ring, and bolts to effect a proper seal. In general, sleeves installed in walls, floors, or roofs against one side of which will develop a hydrostatic pressure, or through which leakage of liquid will occur, shall be so sealed. If welded waterstop flanges are employed, welds shall be 360 degree continuous on both sides of flange.

2.04 SOLID SLEEVE COUPLINGS (FOR BURIED SERVICE THROUGH 54-INCH)

A. Solid sleeve couplings shall be used to connect buried service piping where shown on the Drawings. Solid sleeves shall be ductile iron, long body and shall conform to the requirements of ANSI A21.10 (AWWA C110). Unless otherwise shown or specified, solid sleeve couplings shall be Style A11760 as manufactured by American Cast Iron Pipe Co., or equal. Solid sleeve couplings shall be restrained with wedge-type restraining glands to meet the pressures specified in 15390.

B. Alternatively, EBAA Iron 3800 Mega-Coupling is acceptable.

2.05 NOT USED

2.06 FLANGED COUPLING ADAPTERS

A. Flanged coupling adapters shall be furnished as required and as shown on the Drawings.

B. Flanged coupling adapters shall be of ductile iron or carbon steel construction and shall be rated for the same pressure as the connected piping.

C. All flanged coupling adapters shall be harnessed by tying the adapter to the nearest pipe joint flange using threaded rods and rod tabs unless otherwise approved by the Engineer.

D. Flanged coupling adapters shall be manufactured by Smith-Blair Model 912 or 913, Romac Industries Model FCG or FC 400, Dresser Industries Model 128-W, or equal.

E. Flanged coupling adapters shall be provided with manufacturer’s fusion bonded epoxy painting system.

2.07 DISMANTLING JOINTS

A. Dismantling joints shall be furnished at locations shown on the Drawings.

B. Dismantling joints for sizes less than 12-inch shall be of ductile iron or carbon steel construction and shall be rated for the same pressure as the connected piping. Dismantling joints for sizes greater than 12-inches shall be of carbon steel construction and shall be rated for the same pressure as the connected piping.

C. Flanges for dismantling joints shall match the bolt pattern and pressure rating of the flanges for the connected piping.
D. All dismantling joints shall be restrained utilizing restraining rods provided by the manufacturer. Restraining rods shall be constructed from ASTM A193 Grade B7 steel. Restraining rods and restraint system shall be installed in strict accordance with manufacturer’s recommendations.

E. Dismantling joints shall be provided with manufacturer’s fusion bonded epoxy painting system.

F. Dismantling joints shall be manufactured by Smith Blair Model 975, Romac Industries Model DJ400, or equal.

2.08 GROOVED COUPLINGS

A. Grooved end pipe couplings shall be furnished as specified or shown on the Drawings.

B. Materials shall be of malleable iron and couplings shall be rated for the same pressures as the connecting piping.

C. Gaskets shall be rubber. Bolts and nuts shall be heat treated carbon steel track bolts and shall be plated.

D. After installation, buried couplings shall receive two heavy coats of an approved coal tar which is compatible with the finish of the coupling. Exposed couplings shall be painted in accordance with Section 09900 - Painting.

E. Couplings shall be manufactured by Victaulic Company of America Style 31 or equal.

2.09 TAPPING SLEEVES AND TAPPING SADDLES

A. Tapping sleeves shall be similar to Mueller Outlet Seal, American Uniseal or Kennedy Square Seal. All sleeves shall have a minimum working pressure of 150 psi. All sleeves larger than twelve (12) inches shall be ductile iron. All taps shall be machine drilled; no burned taps will be allowed.

B. Tapping saddles may be used on mains sixteen (16) inches and larger where the required tap size does not exceed one-half the size of the main (i.e. 8-inch tapping saddle for use on a 16-inch main). Tapping saddles shall be manufactured of ductile iron providing a factor of safety of at least 2.5 at a working pressure of 250 psi. Saddles shall be equipped with a standard AWWA C-110-77 flange connection on the branch. Sealing gaskets shall be "O" ring type, high quality molded rubber having an approximate seventy durometer hardness, placed into a groove on the curved surface of the tapping saddles. Straps shall be of alloy steel. The tapping saddle shall be the American tapping saddle, U.S. Pipe tapping saddle, or equal. All taps shall be machine cut, no burned taps will be allowed.

2.10 UNIONS

A. For ductile iron, carbon steel, and grey cast iron pipes assembled with threaded joints and malleable iron fittings, unions shall conform to ANSI B16.39.

B. For copper piping, unions shall have ground joints and conform to ANSI B16.18.
C. For PVC and CPVC piping, unions shall be socket weld type with Viton O-ring.

2.11 THERMOPLASTIC TUBING AND FITTINGS

A. Thermoplastic tubing shall be manufactured from polyallomer tubing. Tubing shall be protected from ultraviolet radiation degradation with a black coating or integral color conforming to ASTM D-1248, Type 1, Class C, Category 3. Fittings and connectors used with thermoplastic tubing shall be the flareless tube type constructed of brass conforming to SAE CA377, SAE CA360 or equal. Brass sleeves shall be used.

B. Assembly of the thermoplastic tubing shall consist of pushing the tubing into the fitting and hand tightening the nut with final tightening with a wrench. Care shall be taken not to overtighten the nut. Plastic tube racks and bend holders shall be provided for holding the tubing in position. Needle valves used with thermoplastic tubing shall be the globe type constructed with a brass body, stem and seat and Buna-N "O"-ring seals. Installation shall be in accordance with the manufacturer's recommendations. Thermoplastic tubing, shall be the Impolene (polyallomer) system and needle valves, fittings and connectors shall be the Poly-Flo with 261 UB Universal Nut and Sleeve system as manufactured by Imperial Eastman, or equal.

2.12 HEAT TRACED PIPING

A. Not Required.

2.13 FLEXIBLE RESTRAINED EXPANSION JOINTS

A. Restrained expansion joints shall be manufactured of 60-42-10 ductile iron conforming to material and other applicable requirements of ANSI/AWWA C153/A21.53.

B. Each pressure containing component shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the materials requirements of, and tested in accordance with, ANSI/AWWA C213 and shall meet or exceed the requirements of ANSI/AWWA C550.

C. Seals shall conform to the applicable requirements of ANSI/AWWA C111/A21.11.

D. All bolts used in the assemblies shall be stainless steel and shall be coated with a premium quality epoxy.

E. Flanged ends shall comply with ANSI/AWWA C110/A21.10, with the addition of O-ring groove and O-ring.

F. Mechanical joint ends shall comply with ANSI/AWWA C153/A21.53.

G. Restrained expansion joints shall have a minimum pressure rating of 350 psi with a minimum safety factor of 3:1 assembly shall be tested at 350 psi before shipment.

H. Restrained expansion joints shall provide for self restraint without tie rods and shall provide for expansion and contraction capabilities cast as an integral part of the end connection.

I. Flexible restrained expansion joints shall allow for 8-inches (+6"-2") minimum expansion.
J. Flexible restrained expansion joints shall consist of an expansion joint designed and cast as an integral part of a ball and socket type flexible joint having a minimum of 15° deflection per ball.

K. Restrained expansion joints shall be the Single Ball or Double Ball FLEX-TEND Expansion Joint as manufactured by EBAA Iron Inc., or equal.

PART 3 -- EXECUTION

3.01 INSTALLATION

A. All piping shall be installed by skilled workmen and in accordance with the best standard practice for piping installation as shown on the Drawings, specified or recommended by the pipe manufacturer. Proper tools and appliances for the safe and convenient handling and installing of the pipe and fittings shall be used. Great care shall be taken to prevent any pipe coating from being damaged on the inside or outside of the pipe and fittings. All pieces shall be carefully examined for defects, and no piece shall be installed which is known to be cracked, damaged, or otherwise defective. If any defective pieces should be discovered after having been installed, it shall be removed and replaced with a sound one in a satisfactory manner by the Contractor and at his own expense. Pipe and fittings shall be thoroughly cleaned before they are installed and shall be kept clean until they are accepted in the complete work. All piping connections to equipment shall be provided with unions or coupling flanges located so that piping may be readily dismantled from the equipment. At certain applications, Dresser, Victaulic, or equal, couplings may also be used. All piping shall be installed in such a manner that it will be free to expand and contract without injury to itself or to structures and equipment to which it is connected. All piping shall be erected to accurate lines and grades with no abrupt changes in line or grade and shall be supported and braced against movement, temporary, or permanent. All exposed piping shall be installed with vertical and horizontal angles properly related to adjoining surfaces or pipes to give the appearance of good workmanship. Unless otherwise shown or approved, provided a minimum headroom clearance under all piping of 7 feet 6 inches.

B. Unless otherwise shown or specified, all waste and vent piping shall pitch uniformly at a 1/4-inch per foot grade and accessible cleanouts shall be furnished and installed as shown and as required by local building codes. Installed length of waste and vent piping shall be determined from field measurements in lieu of the Drawings.

C. All excavation shall be made in such a manner and to such widths as will provide ample room for properly installing the pipe and permit thorough compaction of backfill around the pipe. The minimum trench widths shall be in strict accordance with the "Trench Width Excavation Limits" as shown on the Drawings. All excavation and trenching shall be done in strict accordance with these specifications and all applicable parts of the OSHA Regulations, 29CFR 1926, Subpart P.

D. ALL EXCAVATION REQUIRED BY THIS CONTRACT SHALL BE UNCLASSIFIED. NO ADDITIONAL PAYMENT WILL BE MADE FOR ROCK EXCAVATION REQUIRED FOR THE INSTALLATION OF PIPE OR STRUCTURES SHOWN ON THE DRAWINGS.

E. Enlargements of the trench shall be made as needed to give ample space for operations at pipe joints. The width of the trench shall be limited to the maximum dimensions shown on the Drawings, except where a wider trench is needed for the installation of and work within sheeting and bracing. Except where otherwise specified, excavation slopes shall be flat.
enough to avoid slides which will cause disturbance of the subgrade, damage to adjacent areas, or endanger the lives or safety of persons in the vicinity.

F. Hand excavation shall be employed wherever, in the opinion of the Engineer, it is necessary for the protection of existing utilities, poles, trees, pavements, or obstructions.

G. No greater length of trench in any location shall be left open, in advance of pipe laying, than shall be authorized or directed by the Engineer and, in general, such length shall be limited to approximately one hundred (100) feet. The Contractor shall excavate the trenches to the full depth, width and grade indicated on the Drawings including the relevant requirements for bedding. The trench bottoms shall then be examined by the Engineer as to the condition and bearing value before any pipe is laid or bedding is placed.

H. No pressure testing shall be performed until the pipe has been properly backfilled in place. All pipe passing through walls and/or floors shall be provided with wall pipes or sleeves in accordance with the specifications and the details shown on the Drawings. All wall pipes shall be of ductile iron and shall have a water stop located in the center of the wall. Each wall pipe shall be of the same class, thickness, and interior coating as the piping to which it is joined. All buried wall pipes shall have a coal tar outside coating on exposed surfaces.

I. JOINT DEFLECTION SHALL NOT EXCEED 75 PERCENT OF THE MANUFACTURERS RECOMMENDED DEFLECTION. Excavation and backfilling shall conform to the requirements of Section 02200 - Earthwork, and as specified herein. Maximum trench widths shall conform to the Trench Width Excavation Limits shown on the Drawings. All exposed, submerged, and buried piping shall be adequately supported and braced by means of hangers, concrete piers, pipe supports, or otherwise as may be required by the location.

J. Following proper preparation of the trench subgrade, pipe and fittings shall be carefully lowered into the trench so as to prevent dirt and other foreign substances from gaining entrance into the pipe and fittings. Proper facilities shall be provided for lowering sections of pipe into trenches. UNDER NO CIRCUMSTANCES SHALL ANY OF THE MATERIALS BE DROPPED OR DUMPED INTO THE TRENCH.

K. Water shall be kept out of the trench until jointing and backfilling are completed. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that no water, earth, or other substance will enter the pipes, fitting, or valves. Pipe ends left for future connections shall be valved, plugged, or capped, and anchored as required.

L. All piping shall be installed in such a manner that it will be free to expand and/or contract without injury to itself or to structures and equipment to which it is connected. All piping shall be erected to accurate lines and grades with no abrupt changes in line or grade and shall be supported and braced against movement, temporary, or permanent. All exposed piping shall be installed with vertical and horizontal angles properly related to adjoining surfaces or pipes to give the appearance of good workmanship. Pipes crossing within a vertical distance of less than or equal to one (1) foot shall be encased and supported with concrete at the point of crossing to prevent damage to the adjacent pipes as shown on the Drawings.

M. The full length of each section of pipe shall rest solidly upon the bed of the trench, with recesses excavated to accommodate bells, couplings, joints, and fittings. Before joints are made, each pipe shall be well bedded on a solid foundation; and no pipe shall be brought into position until the preceding length has been thoroughly bedded and secured in place. Pipe that has the grade or joint disturbed after laying shall be taken up and relaid by the
Contractor at his own expense. Pipe shall not be laid in water or when trench conditions are unsuitable for work.

N. Proper and suitable tools and appliances for the safe convenient handling and laying of pipe shall be used and shall in general agree with manufacturer's recommendations.

O. AT THE CLOSE OF EACH WORK DAY THE END OF THE PIPELINE SHALL BE TIGHTLY SEALED WITH A CAP OR PLUG SO THAT NO WATER, DIRT, OR OTHER FOREIGN SUBSTANCE MAY ENTER THE PIPELINE, AND THIS PLUG SHALL BE KEPT IN PLACE UNTIL PIPE LAYING IS RESUMED.

P. During the laying of pipe, each pipe manufacturer shall provide his own supervisor to instruct the Contractor's pipe laying personnel in the correct procedure to be followed.

Q. Ordinarily only full lengths of pipe (as furnished by the pipe manufacturer) shall be used exceptions: closure pieces at manholes and areas where joint deflection is required.

R. For gravity sewer installations, the Contractor shall use a laser device to maintain the trench and pipe alignment. The laser device shall be re-checked for correct elevation and pipe alignment prior to pipe installation if the device is left in the pipe overnight. Corrected invert elevations at each manhole and any adjustments will be coordinated and approved by the Engineer.

S. ALL PIPING SHALL HAVE TYPE "A" BEDDING AS SHOWN ON THE DRAWINGS, UNLESS OTHERWISE SPECIFIED HEREIN OR INDICATED ON THE DRAWINGS.

T. Detector tape shall be installed 12 inches below final grade and directly above all buried potable water piping. The tape shall be blue and silver and shall be clearly and permanently labeled "Water". Detector tape shall be Lineguard III as manufactured by Lineguard, Inc., or equal.

U. AT THE CLOSE OF WORK EACH DAY PIPELINE TRENCHES SHALL BE COMPLETELY BACKFILLED. IN PAVED AREAS THE SURFACE SHALL BE RESTORED AS SPECIFIED IN SECTION 02510, PAVING AND SURFACING, TO ALLOW FOR TRAFFIC OVER THE TRENCH DURING NON-WORKING HOURS. UNDER NO CONDITIONS SHALL ANY PIPELINE TRENCH BE LEFT OPEN DURING NON-WORKING HOURS.

3.02 REINFORCED CONCRETE PIPE, CONCRETE CULVERT, AND DRAIN PIPE

A. The laying of reinforced concrete pipe shall conform to the applicable sections of the Concrete Pipe Handbook as published by the American Concrete Pipe Association.

3.03 PRESTRESSED CONCRETE PIPE

A. The laying of prestressed concrete pipe shall be in accordance with the manufacturer's recommendations and shall conform to the applicable sections of AWWA Manual M-9. Prior to assembling the spigot end into the bell end, both ends shall be thoroughly cleaned and the rubber gasket and the bell end of the previously laid pipe shall be coated with vegetable soap furnished by the manufacturer.
B. For each crew that is inexperienced in laying this type of pipe, one reliable man shall be furnished by the manufacturer's representative with and instructed in the use of a set of steel inserts and feeler gauge to be used in determining if the rubber gasket is in proper position prior to the joint being pushed or pulled home. An experienced crew may omit the use of a feeler gauge. In either method of operation, the Contractor shall be responsible for a good, proper and sound joint. Any joint found in later tests to be faulty shall be repaired to the satisfaction of the Engineer.

C. After the pipe is "home" a cloth diaper (minimum 7-inches wide) supplied by the pipe manufacturer shall be placed and wired around the outside of the pipe at the joint. This diaper shall serve as a form for pouring a 1:2 cement-sand grout in the external recess.

D. Great care shall be taken to prevent the concrete core or jacket or the steel bell and spigot rings from being damaged, and any core, jacket or ring damaged in any way shall be repaired or replaced by the Contractor to the satisfaction of the Engineer.

3.04 DUCTILE IRON PIPE

A. Ductile iron pipe (DIP) shall be installed in accordance with the requirements of the Ductile Iron Pipe Handbook published by the Ductile Iron Pipe Research Association, and AWWA C600.

B. Where it is necessary to cut ductile iron pipe in the field, such cuts shall be made carefully in a neat workmanlike manner using approved methods to produce a clean square cut. The outside of the cut end shall be conditioned for use by filing or grinding a small taper, at an angle of approximately 30 degrees.

C. UNLESS OTHERWISE APPROVED BY THE ENGINEER, FIELD WELDING OF DUCTILE IRON WILL NOT BE PERMITTED.

3.05 PVC/CPVC AND HDPE PIPE

A. Polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC) and High Density Polyethylene (HDPE) pipe shall be laid and joints assembled according to the respective manufacturer's recommendation. PVC pipe installation shall comply with applicable sections of the Uni-Bell PVC Pipe Association Recommended Standard Specifications.

B. Plastic piping shall not be installed when the temperature is less then 60°F except as otherwise recommended by the manufacturer and approved by the Engineer.

3.06 CARBON AND STAINLESS STEEL PIPE

A. Installation of steel pipe shall be by skilled workmen and shall conform to the applicable sections of AWWA Manual M-11. Joints for steel piping shall be either screwed, welded, or flanged as shown on the Drawings or as specified.

B. Welding in the field shall be performed only when requested on the shop drawings and permitted by the Engineer for carbon steel pipe. No welding of stainless steel pipe shall be allowed in the field. All field welds shall be radiographically inspected.
C. Installation of the steel casing pipe shall be by skilled workmen and in accordance with the best standard practice for steel pipe installation. Joints for steel casing pipe shall be butt welded.

1. The boring equipment to be used for installing the jacked casing shall be of such size and capacity to allow the boring to proceed in a safe and expeditious manner. The installation of the casing and boring of the hole shall be done simultaneously to avoid cave-ins or settlement and for safety of traffic above.

2. The Contractor shall check the vertical and horizontal alignment of the casing by survey instrument at least once during each four feet of advance, or as directed by the Engineer. Pits shall be well sheeted and braced as necessary for safe and adequate access for workmen, inspectors and materials and shall be of a size suitable to equipment and material handling requirements.

3. Under no conditions shall jetting or wet boring of encasement under pavement be allowed.

4. After installation of the carrier pipe, each end of the casing pipe shall be made watertight with a brick masonry bulkhead. In addition, a Class B concrete cradle shall be provided from each end of the bulkhead to the first pipe joint outside of the bulkhead.

3.07 COPPER PIPE

A. Installation of copper pipe shall be by skilled workman in accordance with the manufacturer's recommendations. Use teflon tape at all fittings unless otherwise required for intended service. Install unions at the connections to each piece of equipment to allow removal of equipment without dismantling connecting piping.

B. Wall sleeves shall be provided for all piping passing through exterior walls and shall be of the same material as the piping to which it is joined. All wall sleeves shall be provided with an acceptable waterstop.

C. The Contractor shall provide hot and cold water mains with branches and risers complete from point indicated on the Drawings running to all fixtures and other outlets indicated. Mains and branches shall be run generally as shown on the Drawings. The Contractor shall provide all interior water piping, branches, and risers as shown on the Drawing and shall make connections to all plumbing fixtures, hose bibs, wall hydrants, and other points requiring water under this and other Divisions of the Specifications.

D. All water mains and branches shall be pitched at least one (1) inch in twenty-five (25) feet toward fixtures. The piping installation shall be arranged so that the entire system can be drained through fixture supply connections.

E. Unions shall be installed at the connections to each piece of equipment to allow for removal of equipment without dismantling connecting piping.

F. Joints 1-1/4 inches and larger shall be made with silver solder. For joints less than 1-1/4 inches and all valves (regardless of size) use 95/5 solder. Soldered joints shall be prepared with a non-corrosive paste flux in accordance with manufacturer's instructions. All joints
shall be thoroughly cleaned with emery cloth and reamed out before assembly. Acid core solder will not be permitted.

3.08 POLYPROPYLENE AND POLYVINYLIDENE FLUORIDE PIPE

A. The pipe and fittings shall be of the same material for both inner and outer walls of the pipe.

B. Polypropylene pipe shall be black UV stabilized co-polymer conforming to the requirements of ASTM D-4101. Where used in exterior locations, material shall provide a weathering resistance absent of further coating, covering, or wrapping unless specified herein or shown on the Drawings.

C. Polyvinylidene flouride shall comply with ASTM D-3222. The material shall provide a translucence, thus enabling a visual inspection of liquid in the annular space between the inner and outer walls.

D. Where elastomers are selected by the manufacturer, such selection shall be with regard to the application of the chemical solution to be transported.

E. Pipe and associated fittings shall be rated for not less than 75 psi at 73°F.

F. Double-walled pipe and fittings shall be molded and used throughout. Molded ribs shall maintain permanent alignment of the inner and outer walls of the pipe and fittings.

G. Ends of fittings shall be flush, creating a single plane.

H. Wall thickness of the inner and outer walls of double-walled pipe shall be identical, providing identical pressure ratings.

I. Where shown on the Drawings, a leak detection system of the manufacturer's design shall be supplied, complete with vent pipes, manual drain outlet, and electric float switch. Switch shall be rated for 0.080 amps at 120 VAC.

J. Polypropylene and polyvinylidene flouride pipe shall be laid and joints assembled by skilled workers according to the respective manufacturer's recommendations. Joints shall be butt fusion welded.

K. Plastic piping shall not be installed when the ambient temperature is less than 60°F except as otherwise recommended by the manufacturer and approved by the Engineer.

L. Wall sleeves shall be provided where piping passes through exterior walls. All sleeves shall be provided with an acceptable waterstop.

M. Double walled pipe shall be Asahi/American or equal. Pipe shall be furnished complete with flanges or other appurtenant fittings by the same manufacturer and made especially for use with the double walled pipe.

3.09 JOINTS IN PIPING

A. Restrained joints shall be provided on all pipe joints as specified herein and shown on the Drawings. Restrained joints shall be made up similar to that for push-on joints.
B. Push-on joints include a single rubber gasket which fits into the bell end of the pipe. The gasket shall be wiped clean, flexed and then placed in the socket. Any bulges in the gasket which might interfere with the entry of the plain end of the pipe shall be removed. A thin film of lubricant shall be applied to the gasket surface which will come into contact with the spigot end of the pipe. The lubricant shall be furnished by the pipe manufacturer. The plain end of the pipe, which is tapered for ease of assembly, shall be wiped clean and a thick film of lubricant applied to the outside. The pipe shall be aligned and carefully entered into the socket until it just makes contact with the gasket. The joint assembly shall be completed by entering the pipe past the gasket until it makes contact with the bottom of the socket. The pipe shall be pulled "home" with an approved jack assembly as recommended by the pipe manufacturer. If assembly is not accomplished by reasonable force, the plain end shall be removed, and the condition corrected.

C. Flanged joints shall be brought to exact alignment and all gaskets and bolts or studs inserted in their proper places. Bolts or studs shall be uniformly tightened around the joints. Where stud bolts are used, the bolts shall be uniformly centered in the connections and equal pressure applied to each nut on the stud. Pipes in all lines subject to temperature changes shall be cut short and cold sprung into place to compensate for expansion when hot.

D. Mechanical joints shall be made up with gaskets, glands and bolts. When a joint is to be made up, the bell or socket and plain end shall be cleaned and washed with a solution of mild soap in water; the gland and gasket shall be slid onto the plain end and the end then entered into the socket until it is fully "home" on the centering ring. The gasket shall then be painted with soapy water and slid into position, followed by the gland. All bolts shall be inserted and made up hand tight and then tightened alternately to bring the gland into position evenly. Excessive tightening of the bolts shall be avoided. All nuts shall be pulled up using a torque wrench which will not permit unequal stresses in the bolts. Torque shall not exceed the recommendations of the manufacturer of the pipe and bolts for the various sizes. Care shall be taken to assure that the pipe remains fully "home" while the joint is being made. Joints shall conform to the applicable AWWA Specifications.

E. Threaded and/or screwed joints shall have long tapered full depth threads to be made with the appropriate paste or jointing compound, depending on the type of fluid to be processed through the pipe. All pipe up to, and including 1-1/2-inches, shall be reamed to remove burr and stood on end and well pounded to remove scale and dirt. Wrenches on valves and fittings shall be applied directly over the joint being tightened. Not more than three pipe threads shall be exposed at each connection. Pipe, in all lines subject to temperature changes shall be cut short and cold sprung into place to compensate for expansion when hot. Joints in all piping used for chlorine gas lines shall be made up with a glycerine and litharge cement. Joints in plastic piping (PVC/CPVC) shall be laid and joints made with compounds recommended by the manufacturer. Installation shall conform to the requirements of ASTM D2774 and ASTM D2855. Unions required adjacent to valves and equipment.

F. Soldered joints shall have the burrs removed and both the outside of pipe and the inside of fittings shall be thoroughly cleaned by proper tools recommended for that purpose. Flux shall be applied to both pipe and inside of fittings and the pipe placed into fittings and rotated to insure equal distribution of flux. Joints shall be heated and solder applied until it shows uniformly around the end of joints between fitting and pipe. All joints shall be allowed to self-cool to prevent the chilling of solder. Combination flux and solder paste manufactured by a reputable manufacturer is acceptable. Unions required adjacent to valves and equipment.
G. Welded joints shall be made by competent operators in a first class workmanlike manner, in complete accordance with ANSI B31.1 and AWWA C206. Welding electrodes shall conform to ASTM A233, and welding rod shall conform to ASTM A251. Only skilled welders capable of meeting the qualification tests for the type of welding which they are performing shall be employed. Tests, if so required, shall be made at the expense of the Contractor, if so ordered by the Engineer. Unions shall be required adjacent to valves and equipment.

H. Copper joints shall be thoroughly cleaned and the end of pipes uniformly flared by a suitable tool to the bevels of the fittings used. Wrenches shall be applied to the bodies of fittings where the joint is being made and in no case to a joint previously made. Dimensions of tubing and copper piping shall be in complete accordance with the fittings used. No flare joints shall be made on piping not suited for flare joints. Installations for propane gas shall be in accordance with NFPA 54 and/or 58.

I. Solvent or adhesive welded joints in plastic piping shall be accomplished in strict accordance with the pipe manufacturer's recommendations, including necessary field cuttings, sanding of pipe ends, joint support during setting period, etc. Care shall be taken that no droppings or deposits of adhesive or material remain inside the assembled piping. Solvent or adhesive material shall be compatible with the pipe itself, being a product approved by the pipe manufacturer. Unions are required adjacent to valves and equipment. Sleeve-type expansion joints shall be supplied in exposed piping to permit 1-inch minimum of expansion per 100 feet of pipe length.

J. Dielectric isolation such as flange isolation kits, dielectric unions, or similar, shall be installed wherever dissimilar metals are connected according to the following table.

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1. "●" signifies dielectric isolation is required between the two materials noted.
2. Consult Engineer for items not listed in table.
3. Provide flange isolation kits for all flanged connections of dissimilar metals and hardware including connections to equipment.

4. Contractor shall include all isolation descriptions with piping submittals.

K. Eccentric reducers shall be installed where air or water pockets would otherwise occur in mains because of a reduction in pipe size.

L. Joints in polypropylene and polyvinylidene fluoride pipe shall be butt fusion weld. All butt welding shall follow the requirements of ASTM D-2657 and the manufacturer's recommendations.

3.10 FLUSHING AND TESTING

A. All piping shall be properly flushed and tested unless specifically exempted elsewhere in the Specifications or otherwise approved by the Engineer. Air and gas pipelines shall be flushed and tested with compressed air. All other liquid conveying pipelines shall be flushed and tested with water. The Contractor shall furnish and install all means and apparatus necessary for getting the air or water into the pipeline for flushing and testing including pumps, compressors, gauges, and meters, any necessary plugs and caps, and any required blow-off piping and fittings, etc., complete with any necessary reaction blocking to prevent pipe movement during the flushing and testing. All pipelines shall be flushed and tested in such lengths or sections as agreed upon among the Owner, Engineer, and Contractor. Test pressures shall be as specified in Section 15390 – Schedules, and shall be measured at the lowest point of the pipe segment being tested. The Contractor shall give the Owner and Engineer reasonable notice of the time when he intends to test portions of the pipelines. The Engineer reserves the right, within reason, to request flushing and testing of any section or portion of a pipeline.

B. The Contractor shall provide water for all flushing and testing of liquid conveying pipelines. Raw water or non-potable water may be used for flushing and testing liquid pipelines not connected to the potable water system. Only potable water shall be used for flushing and testing the potable water system.

C. Air and gas piping shall be completely and thoroughly cleaned of all foreign matter, scale, and dirt prior to start-up of the air or gas system.

D. At the conclusion of the installation work, the Contractor shall thoroughly clean all new liquid conveying pipe by flushing with water or other means to remove all dirt, stones, pieces of wood, etc., which may have entered the pipe during the construction period. If after this cleaning any obstructions remain, they shall be corrected by the Contractor, at his own expense, to the satisfaction of the Engineer. Liquid conveying pipelines shall be flushed at the rate of at least 2.5 feet per second for a duration suitable to the Engineer or shall be flushed by other methods approved by the Engineer.

E. Compressed/service air and gas piping shall be flushed by removing end caps from the distribution lines and operating one (1) compressor, in accordance with the manufacturer's instructions.

F. After flushing, all air piping shall be pressure and leak tested prior to coating and wrapping of welded joints. Immediately upon successful completion of the pressure and leak test, welded joints shall be thoroughly cleaned of all foreign matter, scale, rust, and discoloration and coated in accordance with the Specifications.
G. All process air piping shall be leak tested by applying a soap solution to each joint. Leak tests shall be conducted with one (1) blower in service at normal operating pressure.

H. During testing the piping shall show no leakage. Any leaks or defective piping disclosed by the leakage test shall be repaired or replaced by the Contractor, at his own expense, and the test repeated until all such piping shows tight.

I. All buried process air piping shall be pressurized to 25 psig and tested for leaks by applying a soap solution to each joint. The air supply shall be stopped and the pipe pressure monitored. System pressure shall not fall by more than 0.5% of the 25 psig test pressure over a one-hour test period. Should the system fail to hold the required pressure for one hour, the cause shall be determined and corrected and the test repeated until a successful test of the entire system is obtained.

J. Field leakage tests shall be performed for all submerged process air piping. The procedure shall consist of operating the system under clear nonpotable water for visual identification of all leaks. All field leakage tests shall be witnessed by the Engineer. All submerged piping shall be installed free of any leaks.

K. After flushing, all liquid conveying pipelines shall be hydrostatically tested at the test pressure specified in the appropriate Piping System Schedule in Section 15390 – Schedules. The procedure used for the hydrostatic test shall be in accordance with the requirements of AWWA C600. Each pipeline shall be filled with water for a period of no less than 24 hours and then subjected to the specified test pressure for 2 hours. During this test, exposed piping shall show no leakage. Allowable leakage in buried piping shall be in accordance with AWWA C600.

L. Any leaks or defective pipe disclosed by the hydrostatic test shall be repaired or replaced by the Contractor, at his own expense, and the test repeated until all such piping shows tight.

M. After flushing, all gas piping shall be leak tested in accordance with all local codes and regulations and in conformance with the recommendations or requirements of any National Institute or Association for the specific service application.

3.11 DISINFECTION

A. All pipe and fitting connected to and forming a part of a potable water supply shall be disinfected in accordance with the procedures described in AWWA C 651. Disinfection shall also be in accordance with the requirements of the State of California Department of Water Resources, Division of Drinking Water (CA DDW) and the Owner.

B. Disinfection shall be accomplished after the pipe has been flushed, if applicable, and passed the hydrostatic test. Such piping shall be filled with 50 parts per million (PPM) of chlorine and held in contact for not less than 24 hours. Final tests after 24 hours contact time shall show a minimum residual chlorine content of 10 ppm in all parts of the system. Disinfection shall be repeated as often as necessary, and as directed by the Engineer and/or CA DDW and/or the Owner until the minimum residual chlorine content of 10 ppm has been reached. The Contractor shall obtain certificates of satisfactory bacteriological tests and furnish them to the Owner before the request is made for acceptance of the work. The Contractor shall furnish and install, at his own expense, all means and apparatus necessary for performing the disinfection. The chlorine solution shall be thoroughly flushed out prior to placing the
new sections of pipe in service. The Contractor is cautioned that the spent chlorine solution must be disposed of in such a way as not to be detrimental to animal, plant, or fish life. Chlorine residual tests will be made after flushing to assure that residual is not in excess of 1 ppm at any point in system.

3.12 PAINTING AND COLOR CODING SYSTEM

A. All exposed piping specified shall be color coded in accordance with the Owner's standard color designation system for pipe recognition and in accordance with Section 15030 – Piping and Equipment Identification Systems. In the absence of a standard color designation system, the Engineer will establish a standard color designation for each piping service category from color charts submitted by the Contractor in compliance with Section 09900 – Painting.

B. All piping specified in this Section shall be painted in accordance with Section 09900 – Painting, except as follows:

1. Copper pipe

2. Stainless steel pipe. Flanges and supports or hangers shall be painted.

- END OF SECTION -
SECTION 15008
PVC/CPVC PIPE AND THERMOPLASTIC HOSE

PART 1 -- GENERAL

1.01 THE REQUIREMENT
   
   A. Reference Section 15000, Basic Mechanical Requirements.

PART 2 -- PRODUCTS

2.01 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

   A. PVC pipe and fittings shall be manufactured in accordance with ASTM D 1785, D 1784 and F 441, "normal impact" pipe, Schedule 40 or 80 as specified.

   B. Fittings used with this pipe shall be socket type or flanged type as specified herein, in Section 15390 - Schedules, or indicated on the Drawings. Plastic piping shall be installed in full accordance with the manufacturer's recommendations for the specific installation. No field bending or distortion of the pipe will be permitted.

   C. PVC pipe shall be Type 1 Grade 1 conforming to ASTM D 1784 and D 1785. Fittings shall conform to the following standard specifications:

       | Socket Type (Schedule 40); ASTM D 2466 |
       | Socket Type (Schedule 80); ASTM D 2467 |

   D. Provide flanged fittings of the same material as the specified pipe and material conforming to ANSI B16.5 at all valves and equipment except at true (double) union valves. Flange gaskets shall be natural rubber or other material fully compatible with the fluid being conveyed. Where flanged piping is used with chemical systems, the gasket material shall conform to the requirements of the following table. Flange bolts shall be type 316 stainless steel minimum, with higher grade materials used where necessary for fluid (chemical) compatibility.

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Acceptable Gasket Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium Chloride</td>
<td>EPDM</td>
</tr>
</tbody>
</table>

   E. Solvent cement for socket type joints shall conform to ASTM D 2564 for PVC pipe and fittings. Solvent cement for chemical service shall be Weld-On 724 as manufactured by IPS Corporation, or equal.

   F. C900-Class 200 shall be in sizes between 4 inches and 12 inches and shall meet the requirements of AWWA C900 "Poly Vinyl Chloride (PVC) Pressure Pipe" and shall conform to all the requirements of ASTM D1784 and ASTM D2241. The pipe shall be a minimum of DR 14 and shall be capable of withstanding the overburden pressures determined by the
Pipe material shall be made from clean, virgin, NSF approved Class 12454-A PVC compound conforming to resin specification ASTM D1784. Standard laying lengths shall be 20-feet (±1 inch). Random lengths of not more than 15% of the total footage of each size may be shipped in lieu of the standard lengths. Reruns of reclaimed material shall not be accepted.

The pipe shall have bell and spigot ends with push-on, O-ring rubber gasket, compression type joints conforming to the requirements of ASTM 2672. Elastomeric gaskets shall conform to the requirements of ASTM F477.

Minimum pipe stiffness (F/dY) at 5% deflection shall be 914 psi for all sizes when tested in accordance with D2241.

The pipe shall be designed to pass a quick burst test pressure of 985 psi applied in 60 to 70 seconds when tested in accordance with ASTM D1599, as referenced in ASTM D2241.

Fittings for C900-Class 200, DR 14 shall be ductile iron, bolted mechanical joint.

C900-Class 150 shall be in sizes between 4 inches and 12 inches and shall meet the requirements of AWWA C900 "Poly Vinyl Chlorine (PVC) Pressure Pipe" and shall conform to all the requirements of ASTM D1784 and ASTM D2241. The pipe shall be a minimum of DR 18 and shall be capable of withstanding the overburden pressures determined by the depth of burial in the field.

Pipe material shall be made from clean, virgin, NSF approved Class 12454-A PVC compound conforming to resin specification ASTM D1784. Standard laying lengths shall be 20-feet (±1 inch). Random lengths of not more than 15% of the total footage of each size may be shipped in lieu of the standard lengths. Reruns of reclaimed material shall not be accepted.

The pipe shall have bell and spigot ends with push-on, O-ring rubber gasket, compression type joints conforming to the requirements of ASTM 2677. Elastomeric gaskets shall conform to the requirements of ASTM F477.

Minimum pipe stiffness (F/dY) at 5% deflection shall be 435 psi for all sizes when tested in accordance with D2241.

The pipe shall be designed to pass a quick burst test pressure of 755 psi applied in 60 to 70 seconds when tested in accordance with ASTM D1599, as referenced in ASTM D2241.

Fittings for C900-Class 150, DR 18 shall be ductile iron, bolted mechanical joint.

PVC pressure rated pipe (PR 160) shall be in sizes between 1 1/2 inches and 12 inches and shall conform to all the requirements of ASTM D1784 and ASTM D2241 and shall be a minimum of SDR 26 and shall be capable of withstanding the overburden pressures determined by the depth of burial in the field.
1. Pipe material shall be made from clean, virgin, NSF approved Class 12454-A PVC compound conforming to resin specification ASTM D1784. Standard laying lengths shall be 20-feet (1± inch). Random lengths of not more than 15% of the total footage of each size may be shipped in lieu of the standard lengths. Reruns of reclaimed materials shall not be accepted.

2. The pipe shall have bell and spigot ends with push-on, O-ring rubber gasket, compression type joints conforming to the requirements of ASTM 2672. Elastomeric gaskets shall conform to the requirements of ASTM F477.

3. Minimum pipe stiffness (F/dY) at 5% deflection shall be 135 psi for all sizes when tested in accordance with ASTM D2241.

4. The pipe shall be designed to pass a quick burst test pressure of 500 psi applied in 60 to 70 seconds when tested in accordance with ASTM D1599, as referenced in ASTM D2241.

5. The pipe shall be designed to pass for 1000 hours a sustained test pressure of 340 psi when tested in accordance with ASTM D1598, as referenced in ASTM D2241.

I. Fittings for PR 160, SDR 26 shall be PVC and designed for the pipe being supplied.

J. Acrylonitrile-butadiene-styrene (ABS) shall conform to the requirements of ASTM D 2661. Pipe and fittings shall have socket type couplings with solvent cement joints. Solvent cement shall conform to ASTM D 2235.

K. Type PSM polyvinyl chloride (PVC) pipe and fittings shall conform to the requirements of ASTM D 3034 with a maximum SDR of 35. Pipe and fittings shall have bell and spigot ends with O-ring rubber gasketed, compression type joints. Joints shall conform to the requirements of ASTM Specification D 3212. Reruns of reclaimed materials shall not be accepted. Unless indicated otherwise, PVC wall pipes shall be provided for all piping passing through exterior walls. Wall pipes shall have a water stop solvent-welded to the pipe. Each wall pipe shall be of the same class and type as the piping to which it is joined.

L. Perforated and closed drainage pipe and fittings shall be rigid PVC pipe, Schedule 40 unless otherwise shown or specified with solvent welded type joints, or approved equal. Pipe shall be slotted or have two rows of 1/4-inch diameter holes spaced 4-inches apart along the circumference of the pipe. Longitudinal spacing of holes shall be 5-inches maximum.

2.02 CHLORINATED POLYVINYL CHLORIDE (CPVC) PIPE AND FITTINGS

A. CPVC shall be manufactured in accordance with ASTM D 1785, D 1784 and F 441, "normal impact" pipe, Schedule 40 or 80 as specified.

B. Fittings used with this pipe shall be socket type or flanged type as specified herein or indicated on the Drawings. Plastic piping shall be installed in full accordance with the manufacturer's recommendations for the specific installation. No field bending or distortion of the pipe will be permitted.

C. CPVC pipe shall be Type 4, Grade 1, Schedule 80, conforming to ASTM D 1784 and ASTM F 441. CPVC fittings shall be socket type conforming to ASTM F 439.
D. Solvent cement for socket type joints shall conform to ASTM F 493 for CPVC pipe and fittings. Solvent cement for chemical service shall be Weld-On 724 as manufactured by IPS Corporation, or equal.

- END OF SECTION -
SECTION 15020

PIPE SUPPORTS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Furnish all equipment, labor, materials, and design calculations required to provide pipe supports in accordance with the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01350 – Seismic Anchorage and Bracing
B. Division 3, Concrete – Appropriate and Related Sections
C. Section 05010 – Metal Materials
D. Section 05035 – Galvanizing
E. Section 05050 – Metal Fastening
F. Section 05061 – Stainless Steel
G. Section 05120 – Structural Steel
H. Section 05500 – Metal Fabrications
I. Section 15000 – Basic Mechanical Requirements

1.03 SUBMITTALS

A. Applicable and associated cut sheets and drawings for materials and support components shall be submitted with the Shop Drawings in accordance with or in addition to the submittal requirements specified in Section 01300 – Submittals, Section 15000 – Basic Mechanical Requirements, and other referenced Sections above.

1. Catalog cut information on all system components such as pipe supports, hangers, guides, anchors, and channel type supports.

2. Drawings of the piping support systems, locating each support, brace, hanger, guide, component and anchor. Identify support, hanger, guide and anchor type by catalog number and Shop Drawing detail number.

3. With each piping support system Shop Drawing, the Contractor shall attach calculations prepared and sealed by a Professional Engineer licensed in the State of California showing that the piping support system complies with the specified requirements, including all building code and seismic code requirements pertaining to support of piping and other non-structural components. See Section 01350 –
Seismic Anchorage and Bracing.

4. Table showing the manufacturer’s recommended hanger support spacing for PVC, CPVC and FRP pipe for the services listed in Section 15390 – Schedules.

PART 2 – PRODUCTS

2.01 GENERAL

A. The Contractor shall be responsible for the design of all piping support systems, unless noted otherwise herein. The absence of pipe supports and details on the Drawings shall not relieve the Contractor of the responsibility of providing a pipe support design sealed by a Professional Engineer. Standard Details for pipe supports have been included on the Drawings to define minimum requirements as to the types of Contractor designed pipe supports that will be acceptable.

B. Where a specific location or type of support is shown on the Drawings, the location and type shall be incorporated in the Contractor’s pipe support design.

C. Where special pipe support fabrications are required, products and execution shall be as specified in Section 05500 – Metal Fabrications and other related and referenced Sections of the Specifications.

D. Existing piping support systems to support new piping shall only be used if the Contractor can show and demonstrate by submitting supporting calculations that they are adequate for the additional load imposed by the new piping, or if they are strengthened to support the additional load.

E. Design Criteria for Piping Support Systems:

1. Design pipe supports for dead loads imposed by the weight of the pipes filled with water, except for air and gas pipelines, plus the weight of insulation. If applicable by location, ice loads per code shall be applied as indicated in the governing building code.

2. Design for the thermal expansion and contraction of the piping and its associated pipe support and pipe expansion systems and couplers.

3. Design the pipe supports for all seismic loading requirements and conditions as specified in the governing building code and referenced seismic design codes. Refer to Section 01350 – Seismic Anchorage and Bracing and the structural code drawing for seismic design criteria to be used for this particular project.

4. A minimum safety factor of 2 or as approved by the Engineer, based upon the yield strength of the support material, shall be used for pipe supports, braces, hangers, and guides as well as for beam and column members used in channel-type support systems.

5. The horizontal pipe hanger and/or floor support spacing shall be as recommended by the pipe and/or hanger manufacturer, but shall not exceed 10 feet on center.
unless indicated otherwise herein or on the Drawings.

6. Seismic and sway bracing shall be provided at maximum 10-foot centers.

7. The design, sizing and spacing of anchor bolts, including concrete anchors, shall be based on withstanding shear and pullout loads imposed by loading at each particular support. The minimum anchor bolt size shall be ½ inches in diameter. Refer to Section 05830 – Bearing Devices and Anchoring.

8. Pipe support design shall not utilize process equipment for thrust restraint or support of piping loads.

2.02 HANGERS AND SUPPORTS

A. All piping shall be adequately supported and braced by means of steel hangers and/or supports, concrete piers, supplemental lateral bracing components, pre-fabricated brackets, or otherwise as may be required by the location and forces applied per governing code, including gravity and lateral forces from earthquake and/or wind (if exterior). Generally, concrete supports shall be used where pipe centerline is less than 3 feet above floor, and hangers above 6 feet unless specified or shown otherwise. Supports shall be not more than 10 feet on center for steel and cast iron, 5 feet on center for plastic unless otherwise shown on the Drawings or required by the specific manufacturer. All necessary inserts or appurtenances shall be furnished and installed in the concrete or structures for adequately securing hangers and supports to the structure. Refer to Standard Detail Drawings.

1. Metal pipe support materials, where stainless steel pipe is supported, shall be Type 304 stainless steel meeting the requirements of Section 05061 – Stainless Steel.

2. Metal pipe support materials, where carbon steel, ductile or other ferrous pipe is supported, shall be galvanized carbon steel meeting Section 05120 – Structural Steel and Section 05035 – Galvanizing unless indicated otherwise on the Drawings or in the specifications or by the Engineer.

3. Metal pipe supports indicated as standard type pipe hangers are designed and detailed for gravity loading only. Resulting lateral loads from wind, earthquake, or other lateral loads per code, or special loading conditions during construction, shall be applied to the pipe in accordance with the governing building code. Supplemental lateral stiffening members (when necessary) shall be provided along pipe or at gravity supports using appropriate supplemental members and connections when required by calculations. The Contractor shall include design calculations and details with all pipe hangar and support submissions for review by the Engineer. The main structure and structural components that will support the pipe hangers and other appurtenant components of the facility have been designed to resist all resulting secondary lateral loading from pipe hangers and other non-structural members for gravity and resulting lateral loads.

B. Hangers and supports shall conform to the following requirements:

1. All fabricated metal hangers and supports shall be capable of adjustment after installation. Different types of hangers and supports along a pipe length, including bends, shall be kept to a minimum.

2. Hanger rods shall be straight and vertical. Chain, wire, strap, or perforated bar
hangers shall not be used. Hangers shall not be suspended from other piping.

3. Vertical piping shall be properly supported at each floor and between floors by stays or braces to prevent rattling and vibration.

4. Supports and hangers for plastic and FRP piping shall include wide saddles or bands as recommended by the manufacturer and approved by the Engineer to distribute load and thus avoid localized deformation of the pipe.

5. Hanger and supports shall prevent contact between dissimilar metals by use of copper plated, rubber, vinyl coated or stainless-steel hangers.

6. Ferrous pipes to be painted shall be painted in accordance with Section 09900 - Painting. Ferrous pipes that require painting or galvanizing shall be supported by galvanized hangers and supports. Stainless steel piping shall be supported by stainless steel saddles and straps (if required).

7. Copper piping shall be supported by plastic coated or copper plated steel hangers and supports.

8. Plastic piping shall be supported by plastic coated steel hangers and supports.

9. Hangers and supports shall provide for thermal expansion throughout the full operating temperature range.

10. Expansion and adhesive type anchors used for pipe hangers and supports shall be Type 304 stainless steel.

C. Metallic hangers and supports may be standard make by Anvil International, Inc., "Witch" by Carpenter & Paterson, Ltd., B-Line Systems, Inc., or equal; and data on the types and sizes to be used shall be furnished to the Engineer for approval. Metallic support system brackets, rods, support clips, clevis hangers, hardware, etc. shall be cast iron or welded steel construction. All gravity type hangers and supports shall be restrained laterally to resist seismic loading and other loading as required by the governing code.

D. Non-metallic support system shall be a heavy-duty channel framing system. Channel frames shall be manufactured by the pultrusion process using corrosion grade polyester or vinylester resins. All fiberglass construction shall include suitable ultraviolet inhibitors for UV exposure and shall have a flame spread rating of 25 or less per ASTM E84. Piping accessories, pipe clamps, clevis hangers, support posts, support racks, fasteners, etc., shall be constructed of vinylester or polyurethane resin. Non-metallic support systems shall be standard make Aickinstrut by Aickinstrut, Inc., Unistrut Fiberglass by Unistrut, Inc., Enduro Fiberglass Systems, or equal. The Contractor shall submit data on the types and sizes of approval. Unless otherwise shown or specified the Contractor shall provide support spacings in the conformance with the pipe and support system manufacturer's requirements.

2.03 PROCESS AIR PIPE SUPPORTS

A. Unless specifically designed and detailed on the Drawings, process air piping shall be supported by slide bearings as manufactured by Fluorocarbon Company, Anaheim, California, Anvil International, Inc., Portsmouth, New Hampshire, or equal. Refer to Section 05830 – Bearing Devices and Anchoring for supplemental information and
requirements.

B. The slide bearing material shall be 3/32-inch-thick, 25 percent glass-fiber reinforced structural grade teflon. The bearing material shall withstand at least 1000 psi (compression) at 250°F with a coefficient of friction between 0.05 and 0.08. The performance of bearing and bonding materials shall be unaffected by continual immersion in wastewater containing domestic and industrial waste at a temperature of 210°F.

C. Non-submerged slide bearing type supports shall be provided with a bearing material covering a 120° arc centered at the bottom of the pipe. The Teflon shall be at least 4 inches wide at the underside of the pipe and 8 inches wide at the top of the support. The Teflon material shall be hot press bonded to 10 ga. stainless steel plates for welding to the bottom of the pipe and securing to the top of the support.

D. Submerged slide bearing type supports shall be provided with Teflon bonded to the underside of the hold down strap and the top of the pipe such that the sliding surface is formed between two sheets of Teflon. Each surface shall cover a 120° arc centered at the top of the pipe. On the underside of the strap the Teflon bearing shall be hot press bonded directly to the stainless-steel strap or to a 10 ga. stainless steel plate for welding to the strap. At the top of the pipe, the Teflon shall be bonded to a 10 ga. stainless steel plate for welding to the pipe.

E. Pipe straps shall not tightly bind the pipe but shall provide 1/16-inch clearance over the top 180° of the pipe surface.

F. Wall bracket supports shall be used where shown for pipe to be installed adjacent to a wall. Where it is not feasible to install hanger supports, adjustable pipe saddle supports may be used with the permission of the Engineer. Concrete pier supports shall be spaced at a maximum distance of 10 feet and shall be at least 12" wider than O.D. of pipe and 10 inches thick unless otherwise shown on the Drawings. Refer to the Standard Detail Drawings.

G. Small diameter piping (6-inches in diameter or less) shall not be strapped or otherwise secured directly to walls. Suitable wall offset brackets of an approved type shall be used. Anchors shall not be attached using percussion fasteners.

H. Sliding surfaces shall be protected from accumulation of dirt, grit, or other foreign matter.

I. Slide bearings shall be capable of adequately supporting the design loads and shall be attached to pipe and supports as specified and recommended by the manufacturer.
J. The slide bearings shall be installed in the locations shown or indicated on the Drawings, at required elevations, true to orientation and level, assuring that the correct half of each bearing is in its proper position. The Contractor shall store the bearings to protect them from mechanical damage prior to installation and shall protect the same during and after installation from contamination and damage due to placing of concrete and other materials. The Contractor shall clean the operating surfaces of bearings thoroughly before final assembly.

K. The Contractor shall note that all pipe support locations are not shown on the Drawings and shall follow the Specifications herein in locating supports. Where deviations and modifications are required, they shall be made only with the permission of the Engineer. A detailed layout of pipe supports and hangers shall be submitted for approval.

PART 3 -- EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Support piping connections to equipment by pipe support and not by the equipment.

B. Support large or heavy valves, fittings, flow meters and appurtenances independently of the connected piping.

C. Support no pipe from the pipe above it.

D. Support piping at changes in direction or in elevation, adjacent to flexible joints, expansion joints, and couplings, and where shown.

E. The Contractor shall not install piping supports and hangers in equipment access areas or bridge crane runs.

F. Brace hanging pipes against horizontal movement by both longitudinal and lateral sway bracing.

G. Install pipe anchors (fixed supports and/or guides) where shown and/or as may otherwise be required to withstand expansion thrust loads and to direct and control thermal expansion. The Contractor may install additional pipe anchors and flexible couplings to facilitate piping installation, provided that complete details describing location, pipe supports and hydraulic thrust protection are submitted.

- END OF SECTION -
SECTION 15030

PIPING AND EQUIPMENT IDENTIFICATION SYSTEMS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install all components of the system for identification of piping and equipment as specified hereinafter. The system shall include the application of color coding to all new and altered plant piping. The Contractor shall paint the equipment and piping of all Contracts in the colors herein specified, and in accordance with the requirements of Section 09900, Painting.

B. In addition to the legends specified herein the Engineer may order the Contractor to furnish and install additional identification legends and arrows at no additional cost to the Owner. Such additional signs may be requested near completion of the work and shall be limited to no more than five (5) signs for each type specified herein. The legends and color combinations for additional signs shall conform to the requirements specified herein.

C. The Contractor shall submit a schedule of the colors and designations proposed in accordance with Section 01300, Submittals, and this Section. A minimum of four (4) color charts with cross-references to the colors listed herein shall be included with the Submittal.

D. Reference Section 15000, Basic Mechanical Requirements.

PART 2 -- PRODUCTS

2.01 PIPING BAND

A. All new and altered piping shall receive identification bands. Such bands shall be 6-inches wide, neatly made by masking, and spaced at intervals of 30-inches on centers regardless of the diameter of the pipe being painted. The Contractor may use approved precut and prefinished metal bands on piping, in lieu of the masked and painted bands, where approved by the Engineer.

2.02 PIPING IDENTIFICATION LEGEND

A. The Contractor shall apply identification legends to all types and sections of piping as shown on the Drawings or as designated by the Engineer. Such legends shall be in the form of plain block lettering giving the name of the pipe content in full or abbreviated form, and showing the direction of flow by arrows. All lettering and arrows shall be of the plastic snap-on type, Seton nameplate "setmarks", or equal, or they shall be formed by stenciling in an approved manner using white or black as directed and shall have an overall height in inches in accordance with the following table:
<table>
<thead>
<tr>
<th>Diameter of Pipe or Pipe Covering</th>
<th>Height of Lettering</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4 to 1-1/4 inches</td>
<td>1/2-inches</td>
</tr>
<tr>
<td>1-1/2 to 2 inches</td>
<td>3/4-inches</td>
</tr>
<tr>
<td>2-1/2 to 6 inches</td>
<td>1-1/4-inches</td>
</tr>
<tr>
<td>8 to 10-inches</td>
<td>2-1/2-inches</td>
</tr>
<tr>
<td>Over 10-inches</td>
<td>3-1/2-inches</td>
</tr>
</tbody>
</table>

B. Identification lettering shall be located midway between color coding bands where possible. Identification lettering and arrows shall be placed as directed by the Engineer, but shall generally be located each fifteen (15) feet in pipe length, and shall be properly inclined to the pipe axis to facilitate easy reading. In the event lettering and arrow identifications are required for piping less than 3/4-inch in diameter, the Contractor shall furnish and attach approved color coded tags where instructed.

C. The colors referenced in the legend are as manufactured by KOP-COAT. They are used for convenience only.

D. **Piping and Equipment Identification**

<table>
<thead>
<tr>
<th>Service</th>
<th>Legend</th>
<th>Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium Chloride</td>
<td>Calcium Chloride</td>
<td>Not painted</td>
</tr>
<tr>
<td>Hydrants</td>
<td>-</td>
<td>Red</td>
</tr>
</tbody>
</table>

- END OF SECTION -
SECTION 15066
SECONDARY CONTAINMENT PIPING

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install engineered dual containment piping, fittings, anchors, terminations, access tees, carrier pipe supports and associated pipe joining method, all in accordance with the requirements of the Contract Documents.

B. System shall provide the ability to visually inspect for leaks. Low-point instrumentation taps shall be provided as specified.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 15000 – Basic Mechanical Requirements

B. Section 15008 – PVC/CPVC Pipe

C. See drawings for pipe schedule

1.03 References

A. The system design shall meet the requirements of ASME/ANSI B31.3 for design criteria where temperature and pressure fall within the limits of that code.

B. The system design shall meet the stated minimum requirements of Federal Regulations 40 CFR-280.

1.04 SUBMITTALS

A. Shop Drawings: The Contractor shall submit from the manufacturer shop drawings of the containment piping system in accordance with the requirements of section entitled “Submittals” and section entitled “Materials and Equipment”.

B. Product Data: The Contractor shall furnish from the manufacturer product data for each type of double containment specified including details of construction relative to materials, dimensions of individual components, profiles, and finishes.

C. Certifications: The Contractor shall furnish a certified affidavit of compliance with all applicable regulatory requirements for the containment systems and other products furnished under this section of the specifications.

1.05 ACCEPTABLE MANUFACTURERS

A. Containment Piping
1. The double containment piping system shall be a prefabricated system. Each contained piping system shall consist of a primary piping system within a secondary containment housing. Each system shall be provided with suitable drains and vents and be designed to provide complete drainage of both the primary and secondary containment piping. The system shall be fabricated, installed and tested in accordance with manufacturer’s recommendations and as specified herein and shall have a minimum of ten (10) years experience. Contractor shall not design and/or fabricate the piping system.

2. Manufacturers or equal
   a. IPEX CPVC Guardian Engineered Piping System
   b. No Or equal

1.05 MANUFACTURER’S SERVICE REPRESENTATIVE

A. Inspection, Startup and Field Adjustment: The service representative of the Manufacturer shall be present at the site for two (2) work days, to furnish the services required by section entitled “Equipment General Provisions”.

B. Training of District’s Personnel: The training representative of the Manufacturer shall be present at the site one work day to furnish the services required by section entitled “Equipment General Provisions”.

C. For the purposes of this paragraph, a work day is defined as an eight hour period at the site, excluding travel time.

D. The times specified shall not be construed as to relieve the manufacturer of any additional visits to provide sufficient service to place the system in satisfactory operation. Any additional time required to achieve successful installation and operation shall be at the expense of the Contractor.

E. The Engineer may require that the inspection, startup, and field adjustment services above be furnished in three (3) separate trips.

F. The manufacturer’s representative shall sign in and out at the office of the Engineer Residence Project Representative on each day the manufacturer’s representative is at the project site.

PART 2 – PRODUCTS

2.01 CARRIER PIPE

A. Carrier pipe and Containment Pipe materials shall be as shown on the Contract Drawings and in accordance with the piping schedule shown on the drawings. Pipe shall be Co-extruded double-wall pipe and shall be at a minimum Schedule 80 for the primary pipe and for the secondary pipe with continuous interconnecting ribs between the two pipes.
B. All pipe, fittings and fabricated piping components shall be produced of CPVC in accordance with Section 15008.

C. Secondary containment piping systems shall be provided as shown on the Drawings for Calcium Chloride.

D. All single and double-wall piping shall be extruded and seamless and furnished in straight lengths.

E. The secondary containment pipe shall contain all hazardous material discharged from a service pipe for a period of time equal to or longer than the maximum anticipated time sufficient to allow recovery of the discharged material. All secondary containment piping shall be such that it will contain 110 percent of the volume of the service pipe. Containment shall be drainable and air testable.

F. Secondary containment pipe shall be sized as follows:

<table>
<thead>
<tr>
<th>Carrier</th>
<th>Containment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5&quot;, (1/2&quot;)</td>
<td>2&quot;</td>
</tr>
<tr>
<td>0.75&quot; (3/4&quot;), 1&quot;</td>
<td>3&quot;</td>
</tr>
<tr>
<td>1-1/2&quot; - 2&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>3&quot;</td>
<td>6&quot;</td>
</tr>
<tr>
<td>4&quot;</td>
<td>8&quot;</td>
</tr>
<tr>
<td>6&quot;</td>
<td>10&quot;</td>
</tr>
<tr>
<td>8&quot;</td>
<td>12&quot;</td>
</tr>
</tbody>
</table>

2.03 SUBASSEMBLIES

A. Gland seals and anchors shall be designed and factory-prefabricated to prevent the ingress of moisture into the system. All subassemblies shall be designed to allow for complete draining and drying of the double pipe.

2.05 PIPE SUPPORTS

A. Internal carrier pipe shall be supported in the center of the secondary containment pipe with integrally manufactured supports within the piping.

2.06 ANCHORS

A. Anchors shall be provided of same resin as product pipe and containment pipe. Anchors shall be of same wall thickness as product and containment pipe, and must be of unitary construction. Anchors shall be fully pressure rated and be Centra-Lok molded supports.

2.07 FITTINGS:

A. All fittings will be pre-assembled. 1/2” through 4” carrier fittings will be supported by locking mechanism, locking the carrier fitting within the containment fitting. 6” and larger carrier fittings will be supported by standard Polypropylene fitting discs and pre-tested by manufacturer. Unless otherwise indicated, containment fittings in carrier and containment fittings shall be constructed using injection molded fittings. Anchors shall be...
of sufficient thickness to withstand the maximum possible end loads that can be
generated by the carrier pipe during the life of the system. Bends must be anchored at
both ends. Tees and laterals must be anchored on both the run and branch connections.

B. All double-wall fabricated fittings shall be made of injection-molded fittings and
designed, manufactured and furnished from the factory ready for simultaneous “Butt
Fusion” welding to the pipe. Other fitting components may be machined. The primary
and secondary fittings are to be the same Schedule thickness as their respective pipes.

C. The manufacturer shall supply all fittings whether molded or fabricated from the
factory. The installer shall not fabricate fittings in the field.

2.08 VENTS/DRAINS
High-point vents and low-point drains shall provide adequate flows to completely drain
annular space. Vents/drains shall be located per contract drawings. Vents/drains shall
be of same resin as product pipe.

2.09 LEAK DETECTION
Access locations at the low points in the piping shall be provided to verify if the piping is
leaking. Auto leak detection is not required, however, access locations should allow for
instruments to be lowered to determine liquid level if any. Leak detection the piping can
be installed to allow one access point along the routing if the piping is less than 200 feet.

2.10 ACCESS TEES
Shall be provided per contract drawings and per leak detection manufacturer’s
requirements. Access tees shall be of same resin as pipe.

2.11 SOLVENT WELDED JOINTS
Solvent-welded joints shall be used to connect the piping system. Joints for both interior
carrier pipe and exterior secondary containment pipe shall be capable of being solvent
welded at the same time.

PART 3 -- EXECUTION

3.01 GENERAL
A. The secondary containment piping system shall be installed according to the
manufacturer’s printed instructions and recommendations.

3.02 TESTING
A. The testing schedule shall be submitted in writing for approval a minimum of 48 hours
before testing is to start.

B. All test equipment, temporary valves, bulkheads, or other air control equipment and
materials shall be determined and furnished by the Contractor subject to the Engineer’s
review. No materials shall be used which would be injurious to the containment pipe or
its future function.
C. Unless otherwise provided herein, air for testing shall be furnished by the Contractor.

D. All testing operations shall be performed in the presence of the Engineer.

E. Prior to pressure testing, the containment system shall be flushed or blown out as appropriate. The Contractor shall test the containment system either in sections or as a unit. The test shall be made closing valves when available, or by placing temporary bullheads in the pipe and filling the line with air. The Contractor shall be responsible for ascertaining that all test bulkheads are suitably restrained to resist the thrust of the test procedure without damage to, or movement of, the adjacent pipe.

F. The containment system shall be filled at a rate which will not cause any damage to the line or adjacent structures.

G. The secondary containment piping shall be air tested at 5 psi, and the service piping shall be hydrostatically tested to the pressures noted in the pipe schedule and measured at the lowest point of the containment system section being tested. The test pressure shall be held for not less than 4 hours.

G. The containment system shall not show a loss of pressure of more than 5 percent. In case the containment system fails to pass the described leakage test, the Contractor shall determine the cause of the leakage, shall take corrective measures necessary to repair the leaks and shall again test the containment system.

I. Secondary containment pipe joints completed at the factory shall be air tested and shall have no leakage.

- END OF SECTION -
SECTION 15100

VALVE OPERATORS AND ELECTRIC VALVE ACTUATORS

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. Equipment shall be provided in accordance with the requirements of Section 11000 – Equipment General Provisions and Section 15000 – Basic Mechanical Requirements.

B. Reference Section 15390 – Schedules for additional information on valves and operators/actuators.

C. The electric valve actuators shall meet the signal requirements described in Section 17060 – Signal Coordination Requirements, Section 17920 – Control System Input/Output Schedule, and Section 17950 – Functional Control Descriptions.

D. Valve operators and electric valve actuators shall be designed to unseat, open or close, and seat the valve under the most adverse operating condition to which the valves will be subjected.

E. Operator mounting arrangements shall be as indicated on the Drawings or as directed by the manufacturer and/or Engineer. There shall be no mounting restrictions on the electric valve actuator.

F. The valve operators and electric actuators shall be the full and undivided responsibility of the valve manufacturer in order to ensure complete coordination of the components and to provide unit responsibility.

1.02 SUBMITTALS

A. The following items shall be submitted with the Shop Drawings in accordance with, or in addition to the submittal requirements specified in Section 01300, Submittals; and Section 11000, Equipment General Provisions:

1. A Performance Affidavit shall be submitted for electric actuators in accordance with Section 11000, Equipment General Provisions.

2. Certification that the force required to operate all valves is as specified herein.
PART 2 -- PRODUCTS

2.01 GENERAL

A. Electric actuators shall be provided where specified in the Valve Schedule in Section 15390 – Schedules.

B. Manual operators shall be provided on all valves which do not receive electric actuators. Manual operator type shall be as specified herein and as shown on the Drawings.

C. Quarter turn valves 8” and greater in size shall have geared operators. Gate valves 14” and greater in size shall have geared operators.

D. Operators/actuators shall be furnished with conservatively sized extension bonnets, extension stems, or torque tubes, and all required appurtenances required for a complete installation. Operators furnished with extension bonnets shall include stainless steel extension stems, or stainless steel torque tubes.

2.02 MANUAL OPERATORS

A. Unless otherwise specified or shown on the Drawings, manual operator type shall be as follows:

1. Buried valves shall be equipped with nut operators, extended stems, and valve boxes. Where the depth of the operating nut is more than 4 feet below finish grade, a valve operator extension shall be provided to bring the operating nut to within 18-24 inches of the surface.

2. Exposed valves up to 6-inch shall be lever operated (except gate valves).

3. Exposed valves 8-inches and larger shall be handwheel operated.

4. Exposed gate valves shall be handwheel operated.

5. Valves with centerline of operator located more than 6-feet above the floor or platform from which it is to be operated shall have a chainwheel operator unless otherwise indicated on the Drawings.

B. Manual operators shall be rigidly attached to the valve body unless otherwise specified or shown on the Drawings.

C. All operators shall turn counter-clockwise to open and shall have the open direction clearly and permanently marked.

D. Valve operators shall be designed so that the force required to operate the handwheel, lever, or chain (including breakaway torque requirements) does not exceed 80 pounds applied at the extremity of handwheel or chainwheel operator. Design pressures for sizing of valve operators shall be the piping test pressure for the piping in which the valve is to be installed as shown in the Piping Schedule in Section 15390 – Schedules.

E. Handwheels for valves operators shall not be less than 12 inches in diameter. The maximum diameter of any handwheel shall not exceed 24”.

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F. Nut operators shall have standard 2-inch square AWWA operating nuts designed in accordance with AWWA C504-94.

G. Geared manual operators shall be of the worm gear, traveling nut or scotch yolk type except manual operators for butterfly valves 18-inch in diameter or larger which shall be worm gear, unless otherwise indicated in the individual valve specification. Gear operators shall be of the worm gear or bevel gear type. Gear box designs incorporating end of travel stops in the housing shall be equipped with AWWA input stops. Each gearbox shall require a minimum of 10 turns for 90 degree rotation or full valve stem travel and shall be equipped with a mechanical valve position indicator.

H. Manual operators on below grade (and vault installed) valves shall be permanently lubricated and watertight under an external water pressure of 10 psi.

2.03 ELECTRIC VALVE ACTUATORS

A. Electric Actuators shall be open/close service or modulating service as specified in the Valve Schedule in Section 15390 – Schedules.

   1. Open/Close (non-modulating) valve actuators shall be IQ series as manufactured by Rotork, SA series as manufactured by AUMA, or Approved Equal.

   2. Modulating valve actuators shall be Type IQM as manufactured by Rotork, Type SAR as manufactured by AUMA, or Approved Equal.

B. Performance Requirements

   1. The actuators shall be designed for indoor and outdoor service and shall be capable of mounting in any position.

   2. Torque capacity of the actuators shall be sufficient to operate the valves with the maximum pressure differential, as indicated in the Valve Schedule in Section 15390, with a safety factor of 1.5. Actuators in modulating service will be selected such that the required dynamic valve torque is no more than 60% of the electric actuator’s maximum rated breakaway of torque.

   3. Operating time for full limits of travel shall be not more than 2 seconds per inch diameter of the valve, +/- 50 percent through 20 inches; +/- 30 percent for valves 24 inches and larger. Operating time shall not be less than 60 seconds for all modulating valves.

   4. Actuators shall be capable of operating in ambient temperatures ranging from 0 degrees F – 160 degrees F.

   5. For open/close (non-modulating) actuators, the gearing, motor and contactor shall be capable of 60 starts per hour without overheating.

   6. For modulating actuators, the gearing, motor and contactor shall be capable of 1200 starts per hour without overheating.
C. The actuators shall include, in one integral housing, individual compartments for the motor, gearing, wiring terminals, and control circuits. The terminal compartment shall be separated from the inner electrical components of the actuator by means of a watertight seal. The inner seal shall protect the motor and all other internal electrical elements of the actuator from entrance of moisture and dust when the terminal cover is removed. Double cartridge shaft seals shall be provided on the handwheel and output shafts for weatherproof protection. All external fasteners shall be stainless steel. Compartments shall be provided with moisture and dust-proof rigid cast covers meeting NEMA 6, certified to submergence in 6 ft of water for 30 minutes. Actuators located in classified areas shall be suitable for use in Class 1, Division 1, Group D environments.

D. The actuators shall be provided with externally operable and lockable 480VAC circuit breakers integral to the control housing.

E. All gearing shall be hardened alloy steel or bronze and shall be rated at twice the output torque of the operator and shall be designed to withstand the stall torque of the motor without failure. Output drive gearing shall consist of a worm shaft and worm gear pinion operating in an oil bath. The worm gear pinion shall be alloy bronze. Worm gear drive shall be self-locking to prevent creeping of the valve disc in an intermediate position. Heavy-duty grease shall protect gearing and sealed ball bearings of the main shaft for five years without changing. Motor reduction gearing shall be spur or planetary gearing and shall allow for field repair and change in gear ratio. For quarter turn applications, overtravel of the operator shall be prevented by internal mechanical stops cast into the actuator.

F. A mechanical dial position indicator shall be furnished to continuously indicate the position of the valve at and between the fully open and fully closed positions. The indicator shall be driven by gearing driven off of the main worm gear pinion and shall operate when the actuator is in either the electrical mode or manual mode.

G. A handwheel shall be permanently attached for manual operation. A gear assembly shall be provided between the handwheel and the worm shaft if required to reduce the force necessary to operate the handwheel to less than 40 pounds. A positive declutch mechanism shall engage the handwheel when required. When the actuator is set in the declutched position for handwheel operation, it shall return automatically to electric operation when actuator motor is energized. The handwheel shall not rotate during electric operation nor shall a fused motor prevent handwheel operation.

H. The drive motor shall be specifically designed for actuator service and shall be characterized by high starting torque and low inertia. Motors shall be 460 volts, three phase, 60 Hz AC reversible squirrel cage induction type motors and shall be specifically designed for modulating service where indicated on the Valve Schedule in Section 15390. Motors shall be totally enclosed, non-ventilated, with NEMA Class F insulation minimum (Class H for modulating actuators) and a maximum continuous temperature rating of 120 degree C (rise plus ambient). A 120 VAC space heater shall be provided in the motor compartment. The electric motor shall have a time rating of at least 15 minutes at 104°F (40°C) or twice the valve stroking time, whichever is longer, at an average load of at least 33% of maximum valve torque. Motor bearings shall be permanently lubricated by premium lubricant. The motor shall have plug and socket electrical connection to facilitate easy removal and replacement. The actuator shall include a device to ensure that the motor runs with the correct rotation for the required direction of valve travel with either phase sequence of the three-phase power supply.
connected to the actuator. The motor shall include single phase protection. A suitable thermal protection device shall be incorporated in the motor or motor starter circuits, connected to a tripping device. Fast acting fuses shall be provided to protect solid state components. The motor shall be capable of starting against the rated load in either the open or close direction when voltage to the motor terminals is plus or minus ten (10) percent of nameplate rating.

1. Open/Close actuators shall be furnished with electro-mechanical reversing starters.

2. Modulating actuators shall be furnished with solid state reversing starters utilizing thyristors.

I. Leads from the motor shall be brought to the control circuit (limit switch) compartment without external piping or conduit box. An adequately sized space heater shall be installed in the control circuit compartment to aid in the prevention of damage resulting from condensation. The following items shall be located in the control circuit compartment.

1. Torque limit switches shall be provided to de-energize the motor control circuit in the event of a stall when attempting to unseat a jammed valve and when torque is exceeded during valve travel. Each actuator shall have an open direction torque switch and a close direction torque switch. The torque switches shall be mechanically operated and able to be set in torque units. Torque switches shall be calibrated prior to the actuator’s assembly to the valve.

2. Travel limit switches shall be provided to de-energize the motor control circuit when the actuator reaches the limits of travel in the open and close directions. The limit switch drive shall be of the counter gear type and “in step” with the actuator output drive at all times in either the electrical or manual mode of operation. A minimum of six (6) contacts, three (3) normally open and three (3) normally closed, shall be supplied at each end of valve travel. Four (4) additional contacts shall be provided to report end of travel or any desired position between ends of travel.

J. Modulating actuators shall have a position feedback potentiometer mounted directly to the valve actuator gearing inside the gearing compartment. The potentiometer shall provide a 4-20 mA signal corresponding to valve position. Modulating valve actuators shall be designed to respond to either a 4-20mADC analog signal or a digital pulse signal as specified herein or as required to coordinate with the requirements of Division 17.

1. Modulating valve actuators designed to respond to a 4-20mADC signal shall be provided with a valve positioner which shall position the valve proportional to an externally generated 4-20mADC signal. The valve positioning control circuitry shall position the valve by comparing the command signal with the present valve position as indicated by the feedback potentiometer. The positioner shall be field adjustable to fail to the “open,” “closed,” or “last” position on loss of 4-20 mADC command signal.

2. Modulating valve actuators designed to respond to “pulse” open/close signals shall operate the valve during the time the open or close pulse signal is high.
Modulating actuators designed to respond to “pulse” open/close signals shall have the latching circuitry described above for open/close actuators disabled.

K. The electrical terminals shall be housed in a double sealed terminal compartment isolated from the rest of the actuator components. The actuators shall be designed to operate from a single 480VAC, 3-phase source. The actuators shall be furnished with fuses inside of the terminal compartment. A quantity of two – ¾ inch NPT conduit entries shall be furnished.

L. Actuators shall contain wiring and terminals for the following control functions. All dry contacts shall be rated for 5A at 250VAC.

1. Open, Close, and Stop commands from external dry contacts (utilizing internal 120VAC power supply) and/or from an external signal of 12V to 120V. The inputs for the open, close, stop signals shall be field selectable to be respond to either maintained or momentary remote signals. In momentary mode, the actuator shall have internal latching circuitry that causes the operator to drive the valve to its limit of travel upon receipt of the momentary contact signal unless a stop signal is received.

2. Emergency override input from a normally closed or normally open contact. The actuator shall either open or close (field selectable) upon receiving the emergency override input.

3. Remote Local-Off-Remote selector switch, Open/Close pushbuttons, and Open/Closed pilot lights for a remote manual control station (see below). The remote Local-Off-Remote selector switch and Open/Close pushbuttons shall be a dry contact input to the actuator control circuitry. The Open/Closed pilot lights shall be powered from the valve actuator control power.

4. Four (4) unpowered contacts shall be provided which can be selected to indicate valve “Opened” and “Closed” position, “Remote” status of the actuator, and fail status of the actuator. The fail status contacts shall activate upon motor overtemperature and actuator overtorque as a minimum.

5. Terminals for 4-20mADC position command and 4-20mADC position feedback as described above for modulating actuators.

M. Local Controls

1. Actuators shall be furnished with a Local-Off-Remote selector switch; Open, Close, and Stop pushbuttons for local control; a red lamp indicating closed and a green lamp indicating open. L-O-R switch shall be padlockable in any of the three positions.

   a. When the LOR is in the “Local” position, open/close control shall be by the open and close pushbuttons on the actuator. The stop push button shall stop the actuator travel.

   b. When the LOR is in the “Off” position, the actuator shall not operate.
2. When the LOR is in the “Remote” position, the actuator shall be controlled by remote inputs from the PLC or from the remote manual controls station.

2. The local controls shall be arranged so that the direction of travel can be reversed without the necessity of stopping the actuator.

N. Remote Manual Control Station

1. Where indicated in the Valve Schedule in Section 15390 – Schedules, manual actuator controls shall be furnished in a separate NEMA 4X stainless steel enclosure (NEMA 7 if located in a classified area). Manual control station controls shall include Hand–Off-Auto Selector switch; Open, Stop, and Close pushbuttons; a red lamp indicating closed and a green lamp indicating open.

a. When the HOA is in the “Hand” position, open/close control shall be by the open and close pushbuttons on the remote manual control station. The stop push button shall stop actuator travel.

b. When the HOA is in the “Off” position, the actuator shall not operate.

c. When the HOA is in the “Auto” position, the actuator shall be controlled by remote inputs to the valve actuator from the PLC.

2.04 ELECTRIC OPERATORS FOR PVC/CPVC VALVES

A. Automatic electric operators shall be provided for PVC/CPVC valves where specified and/or as shown on the Drawings. Operators shall operate on 120 volt AC, single phase, 60 hertz power and be equipped with solid state electronic internal controls. Motors shall be brushless, capacitor-run, reversing type, suitable for high duty cycle applications and shall be specifically designed for open/close service. Motors shall be provided with integral thermal overload protection with auto-reset. Operator gears and shafts shall be constructed of heat treated high-alloy steel. Operator output shaft shall be electro-less nickel plated. Operator gear trains shall be permanently lubricated. The gear train shall withstand operator stall torque. Operator enclosures shall be NEMA 4. Operators shall be provided with internally wired, thermostatically controlled enclosure heaters to maintain an enclosure temperature of at least 40 degrees F. Operators shall be provided with positive visual position indication markings permanently affixed to the operator body and final output shaft. Operator drive output shall be provided with a declutchable manual override. A manual lever shall be provided for manual valve positioning. Operators shall be failsafe, utilizing a mechanical spring with a clutch mechanism to uncouple the motor during spring return operation, allowing the spring to relax and either open or close the valve. Selection of either fail-opened or fail-closed shall be made by selection of field wiring terminals.

B. Independently adjustable cam-operated position limit switches shall be provided with dry contacts for remote fully opened and fully closed valve position indication. Operators shall respond to external dry contact open/close controls. The actuator shall have internal latching circuitry that causes the operator to drive the valve to its limit of travel upon receipt of the momentary contact open or close signal unless a stop signal is received. The all actuator control circuitry, including latching circuitry, shall be internal to the valve actuator. Valve control circuits and components mounted in a separate...
enclosure external to the valve actuator assembly will not be permitted. Connections for external remote controls shall be powered from an internal 24VDC or 120VAC power supply. Limit switches shall be rated for 15 amps at 120 VAC. Valve remote status shall also be provided as specified in Section 17950. The Contractor shall coordinate operator controls with the functional requirements specified in Section 17950 – Functional Control Descriptions.

2.06 SPARE PARTS

A. Spare parts shall be provided in accordance with Section 11000, Equipment General Provisions.

PART 3 -- EXECUTION

3.01 MANUFACTURER'S FIELD SERVICES

A. The services of a qualified manufacturer's technical representative shall be provided in accordance with Section 11000, Equipment General Provisions and shall include the following site visits for electric actuators:

<table>
<thead>
<tr>
<th>Service</th>
<th>Number of Trips</th>
<th>Number of Days/Trip</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation and Testing</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Startup and Training</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

3.02 INSTALLATION

A. All valve actuators shall be installed in accordance with the manufacturer's published recommendations and the applicable specification sections for valves, and motor controls.

B. Valve actuators shall be factory coated in accordance with the manufacturer's standard paint system.

3.03 SHOP TESTING

A. Shop testing shall be in accordance with Section 11000, Equipment General Provisions and with the following additional requirements:

1. Conduct a complete functional check of each unit. Correct any deficiencies found in shop testing prior to shipment.

2. Submit written certification that:
   a. Shop tests for the electrical system and all controls were successfully conducted;
   b. Electrical system and all controls provide the functions specified and required for proper operation of the valve operator system.
3. Each actuator shall be performance tested and individual test certificates shall be supplied free of charge. The test equipment shall simulate each typical valve load and the following parameters should be recorded:

a. Current at maximum torque setting
b. Torque at maximum torque setting
c. Flash Test Voltage
d. Actuator Output Speed or Operating Time
e. In addition, the test certificate should record details of specification, such as gear ratios for both manual and automatic drive, closing direction, and wiring diagram code number.
f. Verification of actuator torque rating with valve.

3.04 FIELD TESTS

A. Field testing shall be in accordance with Section 11000, Equipment General Provisions and with the following additional requirements:

1. Valve actuators shall be field-tested together with the associated valves.
2. Test all valves at the operating pressures at which the particular line will be used.
3. Test all valves for control operation as directed.
4. Field testing shall include optimization of opening and closing times of the valves. Valve opening and closing times shall be adjusted based on process requirements to optimize operation of the valves. Final valve opening and closing times as determined by field tests shall be approved by the Engineer prior to final acceptance of the system.

B. Preliminary Field Tests

1. General: Preliminary field tests shall be conducted prior to start-up and shall include a functional check of the entire valve operator system and all system components.
2. Scope: Preliminary field tests shall demonstrate that the valve operator system performs according to specifications and that all equipment, valves, controls, alarms, interlocks, etc., function properly.
3. Based on results of preliminary field tests, the Contractor shall make any adjustments required to settings, etc., to achieve the required valve closing time and operation, as specified or otherwise directed.

C. Final Field Tests

1. Final field tests shall be conducted in accordance with the latest revision of
AWWA C500.

2. Final field tests shall be conducted simultaneously with the start-up and field testing of the pumps.

3. Final field tests shall be conducted for the full range of operating modes and conditions specified and as directed by the Engineer. Each of the valves shall be tested at minimum, maximum, and normal head/flow conditions, and under all specified conditions of opening and closing.

4. **Certification of Equipment Compliance**: After the final field tests are completed and passed, submit affidavit according to Section 11000.

- END OF SECTION -
SECTION 15106
DIAPHRAGM VALVES

PART 1 -- GENERAL

1.01 THE REQUIREMENT
   A. Reference Section 15000, Basic Mechanical Requirements.
   B. Valves intended for chemical service shall be constructed of materials suitable for the intended service.

PART 2 -- PRODUCT

2.01 NOT USED

2.02 DIAPHRAGM VALVES (PVC/CPVC)
   A. Diaphragm Valves (PVC/CPVC) - shall have solid Class 12454-B PVC or Class 23447-B CPVC construction of the body and bonnet. The valves shall have a position indicator and adjustable travel stop. Diaphragm valves shall have flanged ends. The diaphragm shall be constructed of Teflon. Valves intended for chemical service shall be constructed of materials suitable for the intended service. Diaphragm valves shall be similar to Type G, as manufactured by ASAHI/AMERICA, or equal.

2.03 NOT USED

PART 3 -- EXECUTION

(NOT USED)

- END OF SECTION -
SECTION 15325
SPRINKLER SYSTEMS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Section includes complete fire sprinkler system including fire department connections.

B. Furnish all labor, materials, equipment services and appurtenances required to install a fully functioning fire protection system.

C. The site location for the fire sprinkler system is the Calcium Chloride Canopy. The work shall include a wet pie type sprinkler system with 100 percent coverage of the containment area. The area shall be designed for Group H Division 7 occupancy and Ordinary Hazard Group 2 as shown in National Fire Protection Act (NFPA) Section 13.

D. The system shall employ automatic sprinklers attached to a piping ring and connected to a potable water supply that discharges immediately from the sprinklers in the event of a fire. The sprinklers will activate the water flow.

E. The system shall include a backflow preventer, DDCVA, alarm check valve, water flow indicators, drain valves and pressure gauges.

F. The system shall be tested with the California fire department present.

G. System shall meet Building code, NFPA 13, Authority Having Jurisdiction approval.

H. Coordinate system shutdown with client representative.

1.02 SUBMITTALS

A. Shop Drawings: Indicate pipe layout, supports, components, accessories, sizes, hydraulic calculations, alarm wiring diagram, and field test report.

B. Product Data: Submit data for pipe materials used, valves, and manufacturer’s catalog sheet for equipment indicating rough-in size, finish, accessories, and power requirements.

C. Manufacturer’s Certificate: Certify system has been tested and meets or exceeds specified requirements.

D. Fire-hydrant flow test report.

1.03 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of sprinkler heads.

B. Operation and Maintenance Data: Submit description of components of system, servicing requirements, record drawings, inspection data, and parts lists.
1.04 QUALITY ASSURANCE

A. Perform Work in accordance with:
   1. Sprinkler Systems: NFPA 13; NFPA 24

B. Maintain one copy of each document on site.

C. Design fire sprinkler system under direct supervision of Professional Engineer experienced in design of this Work and licensed in the State of California.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS

A. Steel Pipe: ASTM A53, Grade B, black.
   4. Mechanical Grooved Couplings: Malleable iron housing, “C” shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.

2.02 GATE VALVES

A. Up to and including 2 inches: Bronze body and trim, rising stem, hand wheel, solid wedge or disc, threaded ends.

B. Over 2 inches: Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, hand wheel, OS&Y, solid bronze or cast iron wedge, flanged or grooved ends.

C. Each gate valve shall be wired and sealed in the open position and fitted with a supervisory switch.

D. Valves shall be listed for fire protection service note.

2.03 CHECK VALVES

A. Up to and including 2 inches: Bronze body and swing disc, rubber seat, threaded ends.

B. Over 2 inches: Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, flanged ends.

C. 4 inches and over: Iron body, bronze disc with stainless steel spring, resilient seal and threaded, wafer or flanges ends.

2.04 DRAIN VALVES

A. Bronze compression stop with hose threaded nipple and cap.
B. Brass valve with cap and chain, 3/4 inch hose threaded.

2.05 SPRINKLER HEADS

A. Furnish materials in accordance with California Fire Code and NFPA 13.

B. Suspended Ceiling Type: Semi-recessed pendant type with brass finish, and matching escutcheon.

C. Exposed Area Type: Standard upright type with brass finish.

D. Sidewall Type: Semi-recessed horizontal sidewall type chrome plated finish with matching escutcheon.

E. Nominal sprinkler head temperature rating shall be 165F.

F. All sprinklers shall be installed with a corrosion resistant coating.

G. Guards: Finish to match sprinkler head.

2.06 SPRINKLER PIPING SPECIALTIES

A. Furnish materials in accordance with California Fire Code and NFPA 13.

B. Wet Pipe Sprinkler Alarm Valve: Check type valve with electrically or hydraulically operated alarms, with pressure retard chamber and variable pressure trim.

C. Electric Alarm: Electrically operated red enameled gong with pressure alarm switch.

D. Water Flow Switch: Vane type switch with two contacts.

2.07 FIRE DEPARTMENT CONNECTION

A. Type: Free standing type with ductile iron pedestal red enamel finish.

B. Outlets: Two way with threaded size to suit fire department hardware; threaded dust cap and chain of matching material and finish.

C. Drain: 3/4 inch automatic drip, to outside.

D. Label: “Standpipe – Fire Department Connection.”

2.08 PIPE SUPPORTS

A. Refer to specification 15020-Pipe Supports for Pipe Support Details.

B. Pipe system shall be supported and seismically restrained per NFPA13

2.09 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. AMETEK; U.S. Gauge Division.
2. Ashcroft, Inc.
4. WIKA Instrument Corporation.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

D. Pressure Gage Range: 0 to 250 psig minimum.

E. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.

F. Air System Piping Gage: Include retard feature and "AIR" or "AIR/WATER" label on dial face.

2.10 INDICATOR POSTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Valve, Inc.
2. Clow Valve Company; a division of McWane, Inc.
3. Crane Co.; Crane Valve Group; Stockham Division.
4. Kennedy Valve; a division of McWane, Inc.
5. Mueller Co.; Water Products Division.
6. NIBCO INC.
7. Tyco Fire & Building Products LP.

B. Standard: UL 789.

C. Operation: Wrench.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The sprinkler system shall be installed as per requirements with the NFPA.

B. Ream pipe and tube ends to full inside diameter. Remove burrs and bevel plain end ferrous pipe.

C. Remove scale and foreign material, inside and outside, before assembly.

D. Install sleeves where penetrating footings, floors, or walls. Seal pipe and sleeve penetration to maintain fire resistance equivalent to fire separation of footings, floors, or walls.

E. Install piping in concealed spaces above finished ceiling.

F. Install pipe runs to minimize obstruction to other work.

G. Install gate valves for shut-off or isolating service.
H. Install inspector test connection and fire department connection.

I. Install drain valves at main shut-off valves, low points of piping and apparatus.

J. Protection:
   1. Apply temporary tape or paper cover to sprinkler heads to protect from painting.
   2. Protect concealed sprinkler head cover plates from painting.

K. Interface sprinkler system with building fire and smoke alarm system.

L. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent Siamese connectors to allow full swing of fire department wrench handle.

M. Flush entire piping system of foreign matter.

N. Hydrostatically test entire system per NFPA. Schedule test to be witnessed by Fire Marshal and Architect/Engineer.

O. Provide complete and functional pre-action fire suppression system, and satisfy all demands of Fire Marshal for this system.

P. Install guards on all sprinklers.

Q. The system shall have a flow switch alarm to indicate when the system is activated

R. The system shall be inspected by an authorized person under NFPA prior to testing.

S. Upon completion of the test, a sprinkler approval form shall be filed with the local California Fire Control Marshall.

T. Flush piping and clean debris from sprinkler system before commissioning.

- END OF SECTION -
PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Reference Section 15000, Basin Mechanical Requirements.

1.02 PIPING SCHEDULES

A. Piping requirements for this Section are outlined on the Drawings and in the Piping Schedules. In the absence of a specified test pressure, pipe shall be tested at the greater of: 1) 150 percent of working pressure as determined by the Engineer or 2) 10 psig, unless the Schedule indicates no test is required.

B. If the pipe material is not shown on the Piping Schedule or otherwise specified, the following materials shall be used.

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Material</th>
<th>Type of Joint</th>
<th>Class/Design</th>
<th>Test Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-in and larger</td>
<td>CPVC</td>
<td>Socket</td>
<td>Sch 80</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Socket</td>
<td>Sch 80</td>
<td></td>
</tr>
<tr>
<td>Less than 4-in</td>
<td>PVC/CPVC (2)</td>
<td>Socket</td>
<td>Sch 80</td>
<td></td>
</tr>
</tbody>
</table>

(1) Test at 150 percent of working pressure or 10 psi, whichever is greater.

1.03 VALVE SCHEDULES

A. All valves shall be tagged by the manufacturer according to the control valve designations listed in the Schedule.

B. Valves not listed in the valve schedule(s) shall be manually operated, unless otherwise shown on the Drawings.

1.04 GATE SCHEDULES

A. Gates shall be tagged by the manufacturer according to locations listed in the Schedule.
### CHEMICAL PIPING SCHEDULE

<table>
<thead>
<tr>
<th>PIPE DESIGNATIONS</th>
<th>MATERIAL</th>
<th>BURIED PIPING</th>
<th>EXPOSED PIPING</th>
<th>DESIGN PRESSURE (PSI)$^1$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>TYPE OF JOINT</td>
<td>CLASS/DESIGN</td>
<td>TYPE OF JOINT</td>
</tr>
<tr>
<td>CC</td>
<td>CALCIUM CHLORIDE</td>
<td>&lt; 4&quot; CPVC</td>
<td>SOCKET</td>
<td>SCH 80</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SECONDARY CONTAINMENT</td>
<td>SOCKET</td>
<td>SCH 80</td>
</tr>
</tbody>
</table>

1) Restraint system design pressure shall be equal to the sum of working pressure and surge pressure and shall be used to determine the size, number, material, and dimensions of tabs and threaded-rods for piping specified or shown to have threaded-rods for thrust restraint.

2) Secondary Containment systems shall be tested in accordance with specific manufacturers recommendations. If the pipe cannot be hydrostatically tested, then use of nitrogen or air at maximum of 5 psi gauge pressure shall be allowed. The Contractor must use a pressure regulator to not exceed the 5 psi and over-pressurize the pipe. Note that the test shall be performed in a safe manner, referring to manufacturers instructions, and the area shall be cleared of all personnel during the test period.

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<table>
<thead>
<tr>
<th>TAG NO.</th>
<th>VALVE TYPE</th>
<th>OPERATOR TYPE</th>
<th>SIZE (in.)</th>
<th>FLOW</th>
<th>MAX DIFFERENTIAL PRESSURE (psi)</th>
<th>CLASS</th>
<th>SERVICE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOV-0117</td>
<td>DIAGPHRAM</td>
<td>OPEN/CLOSE</td>
<td>2</td>
<td>25 GPH</td>
<td>30</td>
<td>150</td>
<td>CC</td>
<td>CALCIUM CHLORIDE</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td>TAG NO.</td>
<td>VALVE TYPE</td>
<td>OPERATOR TYPE</td>
<td>SIZE (in.)</td>
<td>MATERIAL</td>
<td>MAX DIFFERENTIAL PRESSURE (psi)</td>
<td>CLASS</td>
<td>SERVICE</td>
<td>LOCATION</td>
</tr>
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</tr>
<tr>
<td>DPV-9101</td>
<td>DIAGPHRAM</td>
<td>OPEN/CLOSE</td>
<td>1 1/2</td>
<td>CPVC</td>
<td>N/A</td>
<td>N/A</td>
<td>CC</td>
<td>CALCIUM CHLORIDE</td>
</tr>
<tr>
<td>DPV-9102</td>
<td>DIAGPHRAM</td>
<td>OPEN/CLOSE</td>
<td>1 1/2</td>
<td>CPVC</td>
<td>N/A</td>
<td>N/A</td>
<td>CC</td>
<td>CALCIUM CHLORIDE</td>
</tr>
<tr>
<td>DPV-9103</td>
<td>DIAGPHRAM</td>
<td>OPEN/CLOSE</td>
<td>1 1/2</td>
<td>CPVC</td>
<td>N/A</td>
<td>N/A</td>
<td>CC</td>
<td>CALCIUM CHLORIDE</td>
</tr>
<tr>
<td>DPV-9104</td>
<td>DIAGPHRAM</td>
<td>OPEN/CLOSE</td>
<td>1 1/2</td>
<td>CPVC</td>
<td>N/A</td>
<td>N/A</td>
<td>CC</td>
<td>CALCIUM CHLORIDE</td>
</tr>
<tr>
<td>BCV-9101</td>
<td>BALL CHECK</td>
<td>CHECK</td>
<td>1 1/2</td>
<td>CPVC</td>
<td>N/A</td>
<td>N/A</td>
<td>CC</td>
<td>CALCIUM CHLORIDE</td>
</tr>
<tr>
<td>BCV-0111</td>
<td>BALL CHECK</td>
<td>CHECK</td>
<td>2</td>
<td>CPVC</td>
<td>N/A</td>
<td>N/A</td>
<td>CC</td>
<td>CALCIUM CHLORIDE</td>
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<tr>
<td>DPV-0114</td>
<td>DIAGPHRAM</td>
<td>OPEN/CLOSE</td>
<td>2</td>
<td>CPVC</td>
<td>N/A</td>
<td>N/A</td>
<td>CC</td>
<td>CALCIUM CHLORIDE</td>
</tr>
<tr>
<td>DPV-0115</td>
<td>DIAGPHRAM</td>
<td>OPEN/CLOSE</td>
<td>2</td>
<td>CPVC</td>
<td>N/A</td>
<td>N/A</td>
<td>CC</td>
<td>CALCIUM CHLORIDE</td>
</tr>
<tr>
<td>DPV-0118</td>
<td>DIAGPHRAM</td>
<td>OPEN/CLOSE</td>
<td>2</td>
<td>CPVC</td>
<td>N/A</td>
<td>N/A</td>
<td>CC</td>
<td>CALCIUM CHLORIDE</td>
</tr>
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<td>DPV-0119</td>
<td>DIAGPHRAM</td>
<td>OPEN/CLOSE</td>
<td>2</td>
<td>CPVC</td>
<td>N/A</td>
<td>N/A</td>
<td>CC</td>
<td>CALCIUM CHLORIDE</td>
</tr>
</tbody>
</table>
PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish all labor, materials, tools, and equipment, and perform all work and services necessary for, or incidental, to the furnishing and installation of all electrical work as shown on the Drawings, and as specified in accordance with the provisions of the Contract Documents and completely coordinate with the work of other trades involved in the general construction. Although such work is not specifically shown or specified, all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure, and complete installation shall be furnished and installed as part of this work. The Contractor shall obtain approved Shop Drawings showing wiring diagrams, connection diagrams, roughing-in and hook up details for all equipment and comply therewith. All electrical work shall be complete and left in operating condition in accordance with the intent of the Drawings and the Specifications for the electrical work.

B. Reference Section 17000, Control and Information System Scope and General Requirements for scope of work details as they relate to the Division 17 Subcontractor.

C. The electrical scope of work for this project primarily includes, but is not limited to, the following:

1. Furnish and install new 120 V sump pump motor controller as indicated on the Project Drawings.

2. Furnish and install all aboveground raceway systems including conduit, fittings, boxes, supports, and other pertinent components associated with new and existing equipment as indicated on the Project Drawings.

3. Furnish and install all underground raceway systems including conduit, fittings, other pertinent components associated with new and existing equipment as indicated on the Project Drawings.

4. Furnish and install all low voltage wire and cable resulting in a complete and operable electrical system for new and existing equipment as indicated on the Project Drawings.

5. Furnish and install new lighting systems and wiring devices as indicated on the Project Drawings.

6. Other electrical work as specified herein and indicated on the Project Drawings.

D. All material and equipment must be the product of an established, reputable, and approved manufacturer; must be new and of first class construction; must be designed
and guaranteed to perform the service required; and must bear the label of approval of the Underwriters Laboratories, Inc., where such approval is available for the product of the listed manufacturer as approved by the Engineer.

E. When a specified or indicated item has been superseded or is no longer available, the manufacturer's latest equivalent type or model of material or equipment as approved by the Engineer shall be furnished and installed at no additional cost to the Owner.

F. Where the Contractor's selection of equipment of specified manufacturers or additionally approved manufacturers requires changes or additions to the system design, the Contractor shall be responsible in all respects for the modifications to all system designs, subject to approval of the Engineer. The Contractor's bid shall include all costs for all work of the Contract for all trades made necessary by such changes, additions or modifications or resulting from any approved substitution.

G. Furnish and install all stands, racks, brackets, supports, and similar equipment required to properly serve the equipment which is furnished under this Contract, or equipment otherwise specified or indicated on the Drawings.

H. All electrical components and systems, including electrical equipment foundations, shall be designed to resist operational forces as well as lateral sway and axial motion from seismic and thermal forces. Seismic support design shall be in accordance with Section 01350 – Seismic Anchorage and Bracing.

1.02 EQUIPMENT LOCATION

A. The Drawings show the general location of feeders, transformers, outlets, conduits, and circuit arrangements. Because of the small scale of the Drawings, it is not possible to indicate all of the details involved. The Contractor shall carefully investigate the structural and finish conditions affecting all of his work and shall arrange such work accordingly; furnishing such fittings, junction boxes, and accessories as may be required to meet such conditions. The Contractor shall refer to the entire Drawing set to verify openings, special surfaces, and location of other equipment, or other special equipment prior to roughing-in for panels, switches, and other outlets. The Contractor shall verify all equipment dimensions to ensure that proposed equipment will fit properly in spaces indicated.

B. Where outlets are shown near identified equipment furnished by this or other Contractors, it is the intent of the Specifications and Drawings that the outlet be located at the equipment to be served. The Contractor shall coordinate the location of these outlets to be near the final location of the equipment served whether placed correctly or incorrectly on the Drawings.

1.03 LOCAL CONDITIONS

A. The Contractor shall examine the site and become familiar with conditions affecting the work. The Contractor shall investigate, determine, and verify locations of any overhead or buried utilities on or near the site, and shall determine such locations in conjunction with all public and/or private utility companies and with all authorities having jurisdiction. All costs, both temporary and permanent to connect all utilities, shall be included in the Bid. The Contractor shall be responsible for scheduling and coordinating with the local utility for temporary and permanent services.
B. In addition, the Contractor shall relocate all duct banks, lighting fixtures, receptacles, switches, boxes, and other electrical equipment as necessary to facilitate the Work included in this project. Costs for such work shall be included in the Bid.

1.04 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions, Section 01300, Submittals and the requirements of the individual specification sections, the Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings
2. Operation and Maintenance Manuals
3. Spare Parts List
5. Reports of Certified Field Tests.
6. Manufacturer’s Representative’s Certification.

B. Submittals shall be sufficiently complete in detail to enable the Engineer to determine compliance with Contract requirements.

C. Submittals will be approved only to the extent of the information shown. Approval of an item of equipment shall not be construed to mean approval for components of that item for which the Contractor has provided no information.

D. Some individual Division 16 specification sections may require a Compliance, Deviations, and Exceptions (CD&E) letter to be submitted. If the CD&E letter is required and shop drawings are submitted without the letter, the submittal will be rejected. The letter shall include all comments, deviations and exceptions taken to the Drawings and Specifications by the Contractor AND Equipment Manufacturer/Supplier. This letter shall include a copy of this specification section. In the left margin beside each and every paragraph/item, a letter "C", "D", or "E" shall be typed or written in. The letter "C" shall be for full compliance with the requirement. The letter "D" shall be for a deviation from the requirement. The letter "E" shall be for taking exception to a requirement. Any requirements with the letter "D" or "E" beside them shall be provided with a full typewritten explanation of the deviation/exception. Handwritten explanation of the deviations/exceptions is not acceptable. The CD&E letter shall also address deviations, and exceptions taken to each Drawing related to this Specification Section.

E. Seismic support design for all nonstructural electrical components (conduit, raceways, freestanding equipment, etc.) shall be in accordance with all applicable federal, state and local building code requirements and Section 01350 – Seismic Anchorage and Bracing.

1.05 APPLICABLE CODES AND REQUIREMENTS

A. Conformance
1. All work, equipment and materials furnished shall conform with the existing rules, requirements and specifications of the following:

a. Insurance Rating Organization having jurisdiction
c. California Electric Code
d. The National Electric Manufacturers Association (NEMA)
e. The Institute of Electrical and Electronic Engineers (IEEE)
f. The Insulated Cable Engineers Association (ICEA)
g. The American Society of Testing Materials (ASTM)
h. The American National Standards Institute (ANSI)
i. California Occupational Safety Hazards Title 8 (CAL/OSHA)
j. The National Electrical Contractors Association (NECA) Standard of Installation
k. National Fire Protection Association (NFPA)
l. International Electrical Testing Association (NETA)
m. All other applicable Federal, State and local laws and/or ordinances.

2. All material and equipment shall bear the inspection labels of Underwriters Laboratories, Inc., if the material and equipment is of the class inspected by said laboratories.

B. Nonconformance

1. Any paragraph of requirements in these Specifications, or Drawings, deviating from the rules, requirements and Specifications of the above organizations shall be invalid and their (the above organizations) requirements shall hold precedent thereto. The Contractor shall be held responsible for adherence to all rules, requirements and specifications as set forth above. Any additional work or material necessary for adherence will not be allowed as an extra, but shall be included in the Bid. Ignorance of any rule, requirement, or Specification shall not be allowed as an excuse for nonconformity. Acceptance by the Engineer does not relieve the Contractor from the expense involved for the correction of any errors which may exist in the drawings submitted or in the satisfactory operation of any equipment.

C. Certification

1. Upon completion of the work, the Contractor shall obtain certificate(s) of inspection and approval from the National Board of Fire Underwriters or similar inspection organization having jurisdiction and shall deliver same to the Engineer and the Owner.

1.06 PERMITS AND INSPECTIONS
A. The Contractor shall reference the General Conditions and Section 01010, Summary of Work.

B. NOT USED

1.07 TESTS

A. Contractor shall refer to each individual specification section for detailed test requirements. Upon completion of the installation, the Contractor shall perform testing per the requirements listed in the applicable Project Specifications. Testing shall be performed with, and to the satisfaction of, the Owner and Engineer.

B. The Contractor shall perform all field tests and shall provide all labor, equipment, and incidentals required for testing. All defective material and workmanship disclosed shall be corrected by the Contractor at no cost to the Owner. The Contractor shall show by demonstration in service that all circuits and devices are in good operating condition and demonstrate that electrical and control devices and equipment will function at least five (5) times without failure.

C. The Contractor shall complete the installation and field testing of the electrical installation prior to the start-up and testing of all other equipment. During the period between the completion of electrical installation and the start-up and testing of all other equipment, the Contractor shall make all components of the Work available for performing preliminary and final testing.

D. Before each test commences, the Contractor shall submit a detailed test procedure, test engineer resume, manpower, and test scheduling information for the approval by the Engineer. In addition, the Contractor shall furnish detailed procedures for calibrating or testing any equipment provided by the Contractor required for field testing the new installation or other systems.

1.08 NOT USED

1.09 NOT USED

1.10 NOT USED

1.11 SCHEDULES AND FACILITY OPERATIONS

A. All testing that requires temporary shutdown of facility equipment must be coordinated with the Owner/Engineer so as not to affect proper facility operations.

B. At the end of the workday, all equipment shall be restored to full operation and ready for immediate use should a facility emergency arise. In addition, should an emergency condition occur during testing the equipment shall be placed back in service immediately and turned over to Owner personnel if required by the Owner.

C. In the event of accidental shutdown of Owner equipment, the Contractor shall notify Owner personnel immediately to allow for an orderly restart of affected equipment.
D. Maintaining the operation of critical and necessary facilities during the duration of the construction period is essential and required. The Contractor shall furnish and install temporary equipment as required to maintain facility operation.

1.12 MATERIALS HANDLING

A. Materials arriving on the job site shall be stored in such a manner as to keep material free of rust and dirt and so as to keep material properly aligned and true to shape. Rusty, dirty, or misaligned material will be rejected. Electrical conduit shall be stored to provide protection from the weather and accidental damage. Rigid non-metallic conduit shall be stored on even supports and in locations not subject to direct sun rays or excessive heat. Cables shall be sealed, stored, and handled carefully to avoid damage to the outer covering or insulation and damage from moisture and weather. Adequate protection shall be required at all times for electrical equipment and accessories until installed and accepted. Materials damaged during shipment, storage, installation, or testing shall be replaced or repaired in a manner meeting with the approval of the Engineer. If space heaters are provided in a piece of electrical equipment, they shall be temporarily connected to a power source during storage. The Contractor shall store equipment and materials in accordance with Section 01550, Site Access and Storage.

1.13 WARRANTIES

A. Unless otherwise specified in an individual specification section, all equipment and electrical construction materials furnished and installed under Division 16 shall be provided with a warranty in accordance with the Project Specifications.

1.14 TRAINING

A. Unless otherwise specified in an individual specification section, all training for equipment furnished and installed under Division 16 shall be provided in accordance with the requirements of the Project Specifications.

PART 2 -- PRODUCTS

2.01 PRODUCT REQUIREMENTS

A. Unless otherwise indicated, the materials to be provided under this Specification shall be the products of manufacturers regularly engaged in the production of all such items and shall be the manufacturer's latest design. The products shall conform to the applicable standards of UL and NEMA, unless specified otherwise. International Electrotechnical Commission (IEC) standards are not recognized. Equipment designed, manufactured, and labeled in compliance with IEC standards is not acceptable.

B. All items of the same type or ratings shall be identical. This shall be further understood to include products with the accessories indicated.

C. All equipment and materials shall be new, unless indicated or specified otherwise.

D. The Contractor shall submit proof if requested by the Engineer that the materials, appliances, equipment, or devices that are provided under this Contract meet the
requirements of Underwriters Laboratories, Inc., in regard to fire and casualty hazards. The label of or listing by the Underwriters Laboratories, Inc., will be accepted as conforming to this requirement.

2.02 SUBSTITUTIONS

A. Unless specifically noted otherwise, any reference in the Specifications or on the Drawings to any article, service, product, material, fixture, or item of equipment by name, make, or catalog number shall be interpreted as establishing the type, function, and standard of quality and shall not be construed as limiting competition. The Contractor, in such cases may, at his option use any article, device, product, material, fixture, or item of equipment which in the judgment of the Engineer, expressed in writing, is equal to that specified.

2.03 CONCRETE

A. The Contractor shall furnish all concrete required for the installation of all electrical work. Concrete shall be Class A unless otherwise specified. Concrete and reinforcing steel shall meet the appropriate requirements of Division 3 of the Specifications.

B. The Contractor shall provide concrete equipment pads for all free standing electrical apparatus and equipment located on new or existing floors or slabs. The Contractor shall provide all necessary anchor bolts, channel iron sills, and other materials as required. The exact location and dimensions shall be coordinated for each piece of equipment well in advance of the scheduled placing of these pads. Equipment pads shall be 4 inches high unless otherwise indicated on the Drawings and shall conform to standard detail for equipment pads shown on the Contract Drawings. Equipment pads shall not have more than 3" excess concrete beyond the edges of the equipment.

C. The Contractor shall provide concrete foundations for all free standing electrical apparatus and equipment located outdoors or where floors or slabs do not exist and/or are not or provided by others under this Contract. The Contractor shall provide all necessary anchor bolts, channel iron sills, and other materials as required. The location and dimensions shall be coordinated for each piece of equipment well in advance of the scheduled placing of the foundations. Equipment foundations shall be constructed as detailed on the Drawings or if not detailed on the Drawings shall be 6 inches thick minimum reinforced with #4 bars at 12-inch centers each way placed mid-depth. Concrete shall extend 6 inches minimum beyond the extreme of the equipment base and be placed on a compacted stone bed (#57 stone or ABC) 6 inches thick minimum.

2.04 NOT USED

PART 3 -- EXECUTION

3.01 CUTTING AND PATCHING

A. Coordination

1. The Work shall be coordinated between all trades to avoid delays and unnecessary cutting, channeling and drilling. Sleeves shall be placed in concrete for passage of conduit wherever possible.
B. Damage
   1. The Contractor shall perform all chasing, channeling, drilling and patching
      necessary to the proper execution of his Contract. Any damage to the building,
      structure, or any equipment shall be repaired by qualified mechanics of the trades
      involved at the Contractor's expense. If, in the Engineer's judgment, the repair of
      damaged equipment would not be satisfactory, then the Contractor shall replace
      damaged equipment at his own expense.

C. Existing Equipment
   1. Provide a suitable cover or plug for openings created in existing equipment as the
      result of work under this Contract. For example, provide round plugs in equipment
      enclosures where the removal of a conduit creates a hole and the enclosure. Covers
      and plugs shall maintain the NEMA rating of the equipment enclosure. Covers
      and plugs shall be watertight when installed in equipment located outdoors.

3.02 EXCAVATION AND BACKFILLING
   A. The Contractor shall perform all excavation and backfill required for the installation of all
      electrical work. All excavation and backfilling shall be in complete accordance with the
      applicable requirements of Division 2.

3.03 CORROSION PROTECTION
   A. Wherever dissimilar metals, except conduit and conduit fittings, come into contact, the
      Contractor shall isolate these metals as required with neoprene washers, nine (9) mil
      polyethylene tape, or gaskets.

- END OF SECTION -
SECTION 16111

CONDUIT

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install conduits and conduit fittings to complete the installation of all electrically operated equipment as specified herein, indicated on the Drawings, and as required.

B. Requirements for conduit clamps, support systems, and anchoring are not included in this Section. Reference Section 16190, Electrical Supporting Devices, for these requirements.

C. Reference Section 16000, Basic Electrical Requirements.

1.02 CODES AND STANDARDS

A. Conduits and conduit fittings shall be designed, manufactured, and/or listed to the following standards as applicable:

1. American National Standards Institute (ANSI)
   a. ANSI B1.20.1 – Pipe Threads, General Purpose
   b. ANSI C80.1 – Electrical Rigid Steel Conduit
   c. ANSI FB 1 – Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable

2. Underwriters Laboratories (UL)
   a. UL 6 - Electrical Rigid Metal Conduit-Steel
   b. UL 360 – Standard for Liquid-tight Flexible Metal Conduit
   c. UL 467 – Grounding and Bonding Equipment
   d. UL 514B – Conduit, Tubing, and Cable Fittings
   e. UL 651 – Standard for Schedule 40 and 80 Conduit and Fittings
   f. UL 1479 – Standard for Fire Tests of Penetration Fire Stops
   g. UL 1660 – Liquid-tight Flexible Nonmetallic Conduit

3. National Electrical Manufacturer's Association (NEMA)
   a. NEMA RN 1 – PVC Externally Coated Galvanized Rigid Steel Conduit
b. NEMA TC-2 – Electrical PVC Conduit  
c. NEMA TC-3 – PVC Fittings for Use with Rigid PVC Conduit and Tubing  

B. Others  
1. ACI-318 – Building Code Requirements for Structural Concrete  

1.03 SUBMITTALS  
A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300 – Submittals, the Contractor shall obtain from the equipment manufacturer and submit the following:  
   1. Shop Drawings  
B. Each submittal shall be identified by the applicable specification section.  

1.04 SHOP DRAWINGS  
A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.  
B. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal.  
C. Shop drawings shall include but not be limited to:  
   1. Product data sheets for conduits and fittings.  
   2. Conduit identification methods and materials.  
   3. Evidence of training for all personnel that will install PVC coated rigid metal conduit.  

1.05 DEFINITIONS  
A. Conduits are categorized by the circuit type of the wiring to be installed inside. Conduits are defined as follows:  
   1. Power Conduits – Conduits that carry AC or DC power wiring from a source to a load. Conduits that carry lighting and receptacle wiring.  
   2. Control Conduits – Conduits that carry AC or DC discrete control wiring between devices and/or equipment. Conduits that carry fiber optic cables between devices and/or equipment.  
   3. Instrumentation Conduits – Conduits that carry AC or DC analog signal wiring between devices and/or equipment.
B. Conduit categories are indicated on the Drawings by the leading letter of the conduit tag. Conduit tag leading letters are defined as follows:

1. P – Power Conduit
2. C – Control Conduit
3. I – Instrumentation Conduit

PART 2 – PRODUCTS

2.01 GENERAL

A. Conduit and conduit fitting products are specified in the text that follows this article. Reference Part 3 herein for the application, uses and installation requirements of these conduits and conduit fittings.

B. All metallic conduit fittings shall be UL 514B and UL 467 Listed, and constructed in accordance with ANSI FB 1. All metallic conduit fittings for use in Class I Division I hazardous areas shall be UL 1203 Listed. All non-metallic fittings shall be UL 651 Listed and constructed in accordance with NEMA TC-3.

C. Flexible conduit couplings for use in Class I Division I hazardous areas shall have threaded stainless steel end fittings and a flexible braided core. Flexible braid shall be constructed of stainless steel where available in the conduit trade size required for the application. Where stainless steel braid is not available, the braid shall be provided with a PVC coating. No other braid types or materials are acceptable.

D. Where threading is specified herein for conduit fitting connections, the fittings shall be manufactured to accept conduit that is threaded to ANSI B1.20.1 requirements.

E. Conduit expansion fittings for all conduit materials of construction shall be capable of 4 inches of movement along the axis of the conduit for trade sizes 2 inches or less. Expansion fittings shall be capable of 8 inches of movement along the axis of the conduit for trade sizes greater than 2 inches.

F. Conduit deflection fittings for all conduit materials of construction shall be provided with a flexible neoprene outer jacket that permits up to ¾ inch of expansion/contraction along the axis of the conduit as well as up to ¾ inch of parallel misalignment between the conduit axes. Outer jacket shall be secured to the conduit hubs by stainless steel clamps.

G. Conduit seals shall either be Listed and labeled for 40% fill, or conduit reducing fittings and a trade size larger conduit seal shall be provided to achieve 25% or less fill within the seal. Percentage fill calculation shall be based on the conductors to be installed. Conduit seals shall be provided with breathers and/or drains where required by the NEC.

H. Conduit insulating bushings shall be constructed of plastic and shall have internal threading.
I. Additional conduit and conduit fitting requirements are specified in the articles that follow based on the specific conduit material of construction to be used.

2.02 RIGID GALVANIZED STEEL (RGS) CONDUIT AND ASSOCIATED FITTINGS

A. Conduit

1. Conduit shall be hot dip galvanized on the inside and outside, and made of heavy wall high strength ductile steel. Conduit shall be manufactured in accordance with ANSI C80.1, and shall be UL 6 Listed.

2. Conduit shall be provided with factory-cut 3/4 inch per foot tapered threads at each end in accordance with ANSI B1.20.1. Threads shall be cut prior to galvanizing to ensure corrosion protection adequately protects the threads. Conduit shall be provided with a matching coupling on one end and a color-coded thread protector on the other.

B. Conduit Bodies for use with Rigid Galvanized Steel

1. Conduit bodies shall be constructed of an electro-galvanized malleable iron alloy which is coated with an acrylic paint finish. Conduit bodies shall have integral threaded conduit hubs.

2. Conduit bodies for Class I Division I hazardous areas shall be provided with integrally threaded covers constructed of an electro-galvanized malleable iron alloy which is coated with an acrylic paint finish.

3. Conduit bodies for all other areas shall be provided with covers that are affixed in place by stainless steel screws which thread directly into the conduit body. Covers that utilize wedge nuts or any other method of attachment to the conduit body are not acceptable. Covers shall be constructed of an electro-galvanized malleable iron alloy which is coated with an acrylic paint finish. Covers shall be provided with matching gasket.
C. Conduit Couplings, Nipples, and Unions for use with Rigid Galvanized Steel

1. Couplings and nipples shall be threaded and shall be constructed of hot dipped galvanized steel. Split-type couplings that use compression to connect conduits are not acceptable.

2. Unions shall be threaded, rain-tight, and constructed of an electro-galvanized malleable iron alloy which is coated with an acrylic paint finish.

D. Conduit Expansion and Deflection Fittings for use with Rigid Galvanized Steel

1. Conduit expansion fittings and conduit deflection fittings shall be constructed of an electro-galvanized malleable iron alloy which is coated with an acrylic paint finish. Expansion and deflection fittings shall have threaded conduit connections.

2. Expansion fittings shall have an integral bonding jumper and deflection fittings shall have an external bonding jumper.

E. Conduit Seals for use with Rigid Galvanized Steel

1. Conduit seals shall be constructed of an electro-galvanized malleable iron alloy which is coated with an acrylic paint finish. Conduit seals shall have threaded conduit connections.

F. Conduit Termination Fittings for use with Rigid Galvanized Steel

1. Conduit hubs shall be constructed of stainless steel and shall have threaded connections to the conduit and enclosure. Hubs shall have a plastic insulated throat and shall be watertight when assembled to an enclosure.

2. Conduit locknuts shall be constructed of zinc plated steel. Locknuts shall have internal threading. Locknuts with integral gasket or seal are not acceptable. Locknuts shall have integral bonding screw where required for proper bonding.

3. Conduit bonding bushings shall be constructed of zinc plated malleable iron. Bonding bushings shall have a threaded conduit connection. Bonding bushing shall be provided with properly sized set screw for connecting bonding conductor and an integral plastic insulator rated for 150 degrees C located in the throat.

2.03 RIGID NONMETALLIC CONDUIT AND ASSOCIATED FITTINGS

A. Conduit

1. Conduit shall be Schedule 40 or 80 (dependent on application) polyvinyl chloride (PVC) construction, manufactured in accordance with NEMA TC-2, UL 651 Listed, and suitable for conductors with 90 degree C insulation.

B. Conduit Bodies for use with Rigid Nonmetallic Conduit
1. Conduit bodies shall be constructed of PVC. Conduit hubs shall be integral to the conduit body and shall be smooth inside to accept a glued conduit connection.

2. Conduit body shall be provided with cover that is affixed in place by stainless steel screws which thread directly into the conduit body. Covers that utilize wedge nuts or any other method of attachment to the conduit body are not acceptable. Covers shall be provided with matching gasket.

C. Conduit Couplings and Unions for use with Rigid Nonmetallic Conduit

1. Conduit couplings and unions shall be constructed of PVC and shall be smooth inside to accept a glued conduit connection.

D. Conduit Expansion and Deflection Fittings for use with Rigid Nonmetallic Conduit

1. Conduit expansion fittings and conduit deflection fittings shall be constructed of PVC and shall be smooth inside to accept a glued conduit connection.

E. Conduit Termination Fittings for use with Rigid Nonmetallic Conduit

1. Conduit hubs shall be constructed of PVC and shall be smooth inside to accept a glued conduit connection. Hubs shall have external threads and an accompanying PVC locknut, and shall be watertight when assembled to an enclosure.

2. Conduit locknuts shall be constructed of zinc plated steel. Locknuts shall have internal threading. Locknuts constructed of PVC and locknuts with integral gasket or seal are not acceptable.

3. Conduit end bells shall be constructed of PVC and shall be smooth inside to accept a glued conduit connection. End bell shall have a smooth inner surface that curves outward towards the edge of the fitting.

2.04 PVC COATED RIGID GALVANIZED STEEL CONDUIT AND ASSOCIATED FITTINGS

A. General

1. Where an external coating of polyvinyl chloride (PVC) is specified for conduit and fittings, the coating shall be 40 mil (minimum) thickness. Where an internal coating of urethane is specified for conduit and fittings, the coating shall be 2 mil (minimum) thickness.

2. All conduit fittings shall have a sealing sleeve constructed of PVC which covers all connections to conduit. Sleeves shall be appropriately sized so that no conduit threads will be exposed after assembly.

B. Conduit

1. Conduit shall be hot dip galvanized on the inside and outside, and made of heavy wall high strength ductile steel. Conduit shall be manufactured in accordance with ANSI C80.1, and shall be UL 6 Listed.
2. Conduit shall be provided with factory-cut 3/4 inch per foot tapered threads at each end in accordance with ANSI B1.20.1. Threads shall be cut prior to galvanizing to ensure corrosion protection adequately protects the threads. Conduit shall be provided with a matching coupling on one end and a color-coded thread protector on the other.

3. Conduit shall be coated on the exterior with a PVC jacket and coated on the interior with a layer of urethane. Conduit shall be manufactured in accordance with NEMA RN-1.

C. Conduit Bodies for use with PVC Coated Rigid Galvanized Steel Conduit

1. Conduit bodies shall be constructed of an electro-galvanized malleable iron alloy which is coated on the exterior with a PVC jacket and coated on the interior with a layer of urethane. Conduit bodies shall have integral threaded conduit hubs.

2. Conduit bodies for Class I Division I hazardous areas shall be provided with integrally threaded covers constructed of an electro-galvanized malleable iron alloy which is coated on the exterior with a PVC jacket and coated on the interior with a layer of urethane.

3. Conduit bodies for all other areas shall be constructed of an electro-galvanized malleable iron alloy which is coated on the exterior with a PVC jacket and coated on the interior with a layer of urethane. Covers shall be affixed in place by stainless steel screws which thread directly into the conduit body and have a plastic encapsulated head. Covers that utilize wedge nuts or any other method of attachment to the conduit body are not acceptable. Covers shall be provided with matching gasket.

D. Conduit Couplings, Nipples, and Unions for use with PVC Coated Rigid Galvanized Steel Conduit

1. Couplings and nipples shall be threaded and shall be constructed of hot dipped galvanized steel which is coated on the exterior with a PVC jacket and coated on the interior with a layer of urethane. Split-type couplings that use compression to connect conduits are not acceptable.

2. Unions shall be threaded, rain-tight, and constructed of an electro-galvanized malleable iron alloy which is coated on the exterior with a PVC jacket and coated on the interior with a layer of urethane.

E. Conduit Expansion and Deflection Fittings for use with PVC Coated Rigid Galvanized Steel Conduit

1. Conduit expansion fittings and conduit deflection fittings shall be constructed of an electro-galvanized malleable iron alloy which is coated on the exterior with a PVC jacket and coated on the interior with a layer of urethane. Expansion and deflection fittings shall have threaded conduit connections.

2. Expansion fittings shall have an integral bonding jumper and deflection fittings shall have an external bonding jumper.
F. Conduit Seals for use with PVC Coated Rigid Galvanized Steel Conduit

1. Conduit seals shall be constructed of an electro-galvanized malleable iron alloy which is coated on the exterior with a PVC jacket. The seal shall be coated on the interior with a layer of urethane. Conduit seals shall have threaded conduit connections.

2. Conduits seals shall not limit the percent cross-sectional cable capacity of the raceway system. An expanded seal (e.g. 40 percent fill seal) shall be used when the total cross-sectional area of cables in the raceway exceeds 25 percent.

G. Conduit Termination Fittings for Use with PVC Coated Rigid Galvanized Steel Conduit

1. Conduit hubs shall be constructed of an electro-galvanized malleable iron alloy which is coated on the exterior with a PVC jacket and coated on the interior with a layer of urethane. Hubs shall have threaded connections to the conduit and enclosure. Hubs shall have a plastic insulated throat and shall be watertight when assembled to an enclosure.

2. Conduit bonding bushings shall be constructed of zinc plated malleable iron which is coated on the exterior with a PVC jacket and coated on the interior with a layer of urethane. Bonding bushings shall have a threaded conduit connection. Bonding bushing shall be provided with properly sized set screw for connecting bonding conductor and an integral plastic insulator rated for 150 degrees C located in the throat.

2.05 NOT USED

2.06 LIQUID TIGHT FLEXIBLE METAL CONDUIT (LFMC) AND ASSOCIATED FITTINGS

A. Conduit

1. Conduit shall be manufactured using a single strip of hot dip galvanized high strength steel alloy, helically formed into a continuously interlocked flexible metal conduit. Trade size 1-1/4 inch and smaller conduits shall be provided with an integrally woven copper bonding strip.

2. Conduit shall be covered with an outside PVC jacket that is UV resistant, moisture-proof, and oil-proof. Conduit shall be UL 360 Listed.

B. Conduit Termination Fittings for use with LFMC

1. Conduit termination fittings shall be constructed of either 304 stainless steel or an electro-galvanized malleable iron alloy which is coated on the exterior with a 40 mil (minimum) PVC jacket and coated on the interior with a 2 mil (minimum) layer of urethane. PVC coated fittings shall have a sealing sleeve constructed of PVC which covers the connection to conduit.

2. Termination fittings shall have a threaded end with matching locknut and sealing ring for termination to equipment, and shall have an integral external bonding lug...
where required for proper bonding. Termination fittings shall have a plastic insulated throat and shall be watertight when assembled to the conduit and equipment.

2.07 LIQUID TIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC) AND ASSOCIATED FITTINGS

A. Conduit

1. Conduit shall be constructed of rigid polyvinyl chloride (PVC), fabricated to provide flexibility. Conduit shall be covered with an outside PVC jacket that is UV resistant, moisture-proof, and oil-proof. Conduit shall be UL 1660 Listed.

B. Conduit Termination Fittings for use with LFNC

1. Conduit termination fittings shall be constructed PVC and shall have a threaded end with matching locknut and sealing ring for termination to equipment. Termination fittings shall be watertight when assembled to the conduit and equipment.

2.08 NOT USED

2.09 NOT USED

2.10 CONDUIT BENDS

A. Rigid conduit bends, both factory fabricated and field fabricated, shall meet the same requirements listed in the articles above for the respective conduit type and material of construction.

B. Conduit bend radii for standard radius bends shall be no less than as follows:

<table>
<thead>
<tr>
<th>TRADE SIZE (inches)</th>
<th>3/4</th>
<th>1</th>
<th>1-1/4</th>
<th>2</th>
<th>2-1/2</th>
<th>3</th>
<th>3-1/2</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIN. RADIUS (inches)</td>
<td>4-1/2</td>
<td>5-3/4</td>
<td>7-1/4</td>
<td>8-1/4</td>
<td>9-1/2</td>
<td>10-1/2</td>
<td>13</td>
<td>15</td>
<td>16</td>
<td>24</td>
</tr>
</tbody>
</table>

C. Conduit bend radii for long radius bends shall be no less than as follows:

<table>
<thead>
<tr>
<th>TRADE SIZE (inches)</th>
<th>3/4</th>
<th>1</th>
<th>1-1/4</th>
<th>1-1/2</th>
<th>2</th>
<th>2-1/2</th>
<th>3</th>
<th>3-1/2</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIN. RADIUS (inches)</td>
<td>N/A</td>
<td>12</td>
<td>18</td>
<td>24</td>
<td>30</td>
<td>30</td>
<td>36</td>
<td>36</td>
<td>48</td>
<td>48</td>
<td>60</td>
</tr>
</tbody>
</table>

2.11 MISCELLANEOUS
A. Conduit Periphery Sealing

1. The sealing of the exterior surface of conduits to prevent water and/or air from passing around the conduit periphery from one space to another (where required) shall be through the use of one of the following:

   a. A conduit sleeve and pressure bushing sealing system. Acceptable products are FSK by OZ-GEDNEY, Link-Seal by Crouse-Hinds, or Engineer approved equal.

   b. A conduit sleeve that is two trade sizes larger than the conduit being sealed, with 2-hour fire rated UL 1479 Listed caulk filling the entire void between the conduit and sleeve. This method is only suitable for penetrations in non-fire rated walls and floors between spaces within buildings. This method shall not be used for the sealing of conduits leaving a building and/or structure.

2. Conduit penetrations through fire-rated walls and floors shall be made with an approved UL 1479 Listed product specifically intended for the trade size of the conduit.

B. Primer and Cement

1. Nonmetallic conduit shall be cleaned with primer and connected to fittings with the manufacturer's recommended cement that is labeled Low VOC.

C. Galvanizing Compounds

1. Galvanizing compounds for field application shall be the cold-applied type, containing no less than 93% pure zinc.

D. Conduit Interior Sealing

1. The sealing of the inside of conduits against water ingress shall be achieved through the use of one of the following:

   a. Two-part expanding polyurethane foam sealing compound, dispensed from a single tube which mixes the two parts as it is injected into the conduit. Expanding foam shall be compatible with the conduit material of construction as well as the outer jacket of the cables in the conduit. Acceptable products are Q-Pak 2000 by Chemque, FST by American Polywater Corporation, or Hydra-seal S-60 by Duraline.

   b. Inflatable bag that provides seal around cables and around inside diameter of conduit. Provide appropriate quantity of additional fittings for applications with three or more cables in the conduit to be sealed. Acceptable products are Rayflate by Raychem, or Engineer approved equal. This sealing method is only applicable to conduits trade size 2 inch and larger.
c. Neoprene sealing ring provided with the required quantity and diameter of holes to accommodate the cables in each conduit. Sealing ring shall be compressed by two stainless steel pressure plates. Acceptable products are type CSB by OZ-GEDNEY, or Engineer approved equal. This sealing method is only applicable to metallic conduits containing 4 or less cables.

2. The use of aerosol-based expanding foam sealants or any other method of sealing against water ingress not listed above is not acceptable.

E. Pull Rope

1. Pull ropes for empty and/or spare conduits shall be woven polyester, 1/2 inch wide, with a minimum tensile strength of 1250 lbs.

2. Pull ropes for the Contractors use in installing conductors shall be the size and strength required for the pull, and shall be made of a non-metallic material.

PART 3 – EXECUTION

3.01 GENERAL

A. Minimum trade size for all rigid conduits shall be 3/4 inch in exposed applications and 1 inch in embedded applications. Conduits installed within ductbanks shall be allowed to be increased in size to trade size 2 inch, at the Contractor’s option, to accommodate the saddle size of the ductbank spacers. However, no combining of circuits shall be allowed in the larger conduits.

B. Minimum trade size for flexible conduits (where specifically allowed herein) shall be 1/2 inch in all applications.

C. Some conduit routing is not shown on the Drawings. Conduits shall be installed concealed wherever practical and within the limitations specified herein. All other conduits not capable of being installed concealed shall be installed exposed.

D. Conduit routing for certain electrical and control equipment is shown on the Drawings. The line type used on the Drawings indicates which conduits shall be installed concealed and which shall be installed exposed.

E. Empty and/or spare conduits shall be provided with pull ropes which have no less than 12 inches of slack at each end.

F. Nonmetallic conduits for installations requiring less than a factory length of conduit shall be field cut to the required length. The cut shall be made square, cleaned of debris, and primer shall be applied to ready each joint for fusing. Conduits shall then be fused together with the conduit manufacturer’s approved cement compound.

G. Metallic conduits for installations requiring less than a factory length of conduit shall be field cut to the required length. The cut shall be made square, be cleaned of all debris
and be de-burred, then threaded. Conduit threading performed in the field shall be ¾ inch per foot tapered threads in accordance with ANSI B1.20.1.

H. Conduits shall be protected from moisture, corrosion, and physical damage during construction. Install dust-tight and water-tight conduit fittings on the ends of all conduits immediately after installation and do not remove until conductors are installed.

I. Conduits shall be installed to provide no less than 12 inches clearance from pipes that have the potential to impart heat upon the conduit. Such pipes include, but are not limited to, hot water pipes, steam pipes, exhaust pipes, and blower air pipes. Clearance shall be maintained whether conduit is installed in parallel or in crossing of pipes.

J. Where non-metallic instrumentation conduits are installed exposed, the following clearances to other conduit types shall be maintained:

1. Instrumentation conduits installed parallel to conduits with conductors energized at 480V or above shall be 18 inches.
2. Instrumentation conduits installed parallel to conduits with conductors energized at 240V and below shall be 12 inches.
3. Instrumentation conduits installed at right angles to conductors energized at 480V and below shall be 6 inches.
4. Instrumentation conduits installed at right angles to conductors energized at voltages above 480V shall be 12 inches.

K. Where conduit fittings do not include an integral insulated bushing, an insulated bushing shall be installed at all conduit termination points.

L. Conduits which serve multi-section equipment shall be terminated in the section where wiring terminations will be made.

M. Conduits shall not penetrate the floors or walls inside liquid containment areas without specific written authorization from the Engineer. Liquid containment areas are indicated on the Drawings.

N. In no case shall conduit be supported or fastened to another pipe or be installed in a manner that would prevent the removal of other pipes for repairs. Spring steel fasteners may only be used to affix conduits containing lighting branch circuits within EMT conduits to structural steel members.

O. All field fabricated threads for rigid galvanized steel conduit shall be thoroughly coated with two coats of galvanizing compound, allowing at least two minutes to elapse between coats for proper drying.

P. The appropriate specialized tools shall be used for the installation of PVC coated conduit and conduit fittings. No damage to the PVC coating shall occur during installation. Conduit and conduit fittings with damaged PVC coating shall be replaced at the Contractor's cost. The use of PVC coating touch-up compounds is not permitted.
Q. Conduits which emerge from within or below concrete encasement shall be PVC coated rigid galvanized steel where the conduit is not protected by an equipment enclosure that surrounds the conduit on all sides at the point where it emerges from the encasement.

3.02 CONCEALED AND EMBEDDED CONDUITS

A. Conduits are permitted to be installed concealed and/or embedded with the following requirements:

1. Conduits shall not be installed horizontally when concealed within CMU walls, only vertical installation is acceptable.

2. Conduits installed embedded within concrete floors or walls shall be located so as not to affect the designed structural strength of the floor or wall. Embedded conduits shall be installed in accordance with Standard Detail N on Drawing S-04 and ACI-318.

3. Where conduit bends emerge from concrete embedment, none of the curved portion of the bend shall be visible. Only the straight portion of the bend shall be visible.

4. Where multiple conduits emerge from concrete embedment or from concealment below a concrete floor, ample clear space shall be provided between conduits to allow for the appropriate and required conduit termination fittings to be installed.

5. Conduits installed embedded within concrete encasement of any kind shall be installed such that conduit couplings for parallel conduits are staggered so that they are not side by side.

B. Conduits are NOT permitted to be installed concealed and/or embedded for the following situations:

1. Conduits shall not be installed embedded within any water-bearing floors or walls. Conduits shall not be installed embedded within any liquid containment area floors or walls.

2. Conduits shall not be installed concealed within CMU walls or gypsum walls that are adjacent to Class I and II hazardous areas (Division I and Division II).

3. Conduits shall not be installed concealed within CMU walls or gypsum walls that are adjacent to indoor Type 1 or Type 2 chemical storage/transfer areas.

3.03 CONDUIT USES AND APPLICATIONS

A. Rigid Conduit

1. Rigid conduit for non-hazardous areas shall be furnished and installed in the materials of construction as follows:
<table>
<thead>
<tr>
<th>INSTALLATION AREA DESIGNATION/ SCENARIO</th>
<th>CONDUIT CATEGORY BY WIRING/CIRCUIT TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Power and Control</td>
</tr>
<tr>
<td>Exposed in indoor wet process areas</td>
<td>PVC coated rigid galvanized steel conduit</td>
</tr>
<tr>
<td>Exposed in indoor dry process areas</td>
<td>Rigid galvanized steel conduit</td>
</tr>
<tr>
<td>Exposed in indoor dry non-process areas</td>
<td>Rigid galvanized steel conduit</td>
</tr>
<tr>
<td>Exposed in indoor Type 1 chemical storage/transfer areas</td>
<td>Schedule 80 rigid non-metallic PVC conduit</td>
</tr>
<tr>
<td>Exposed in indoor Type 2 chemical storage/transfer areas</td>
<td>PVC coated rigid galvanized steel conduit</td>
</tr>
<tr>
<td>Exposed in outdoor areas</td>
<td>PVC coated rigid galvanized steel conduit</td>
</tr>
<tr>
<td>Concealed within underground direct-bury or concrete-encased ductbanks</td>
<td>Schedule 40 rigid non-metallic PVC conduit</td>
</tr>
<tr>
<td>Concealed within non-elevated (i.e. &quot;slab-on-grade&quot; construction) concrete slabs</td>
<td>Schedule 40 rigid non-metallic PVC conduit</td>
</tr>
<tr>
<td>Concealed within elevated concrete slabs</td>
<td>PVC coated rigid galvanized steel conduit</td>
</tr>
<tr>
<td>Concealed below concrete slabs (within earth or fill material)</td>
<td>Schedule 40 rigid non-metallic PVC conduit</td>
</tr>
<tr>
<td>Concealed within concrete walls</td>
<td>Schedule 40 rigid non-metallic PVC conduit</td>
</tr>
<tr>
<td>Concealed within CMU walls</td>
<td>PVC coated rigid galvanized steel conduit</td>
</tr>
<tr>
<td>Emerging from concealment within or below a concrete floor and transitioning to exposed conduit (Reference Detail 1611102)</td>
<td>PVC coated rigid galvanized steel conduit</td>
</tr>
</tbody>
</table>

2. The tables for the materials of construction for rigid conduits are intended to exhaustively cover all possible scenarios and installation areas under this Contract. However, if a scenario or installation area is found that is not explicitly governed by these tables, it shall be assumed for bid purposes that the conduit material of construction is to be rigid galvanized steel. This discrepancy shall be brought to the attention of the Engineer (in writing) immediately for resolution.

B. Conduit Bends

1. All conduit bends shall be the same material of construction as the rigid conduit listed in the tables above, with the following exceptions:
a. All 90 degree bends or combinations of adjacent bends that form a 90 degree bend where concealed within concrete or below a concrete slab shall be PVC-coated rigid galvanized steel.

2. Field fabricated bends of metallic conduit shall be made with a bending machine and shall have no kinks. Field fabricated standard radius and long radius bends shall have minimum bending radii in accordance with the associated tables in Part 2 herein.

3. Field bending of non-metallic conduits is not acceptable, factory fabricated bends shall be used.

4. Long radius bends shall be furnished and installed for underground installations and the following specific applications, all other bends shall be standard radius:
   a. All conduits containing fiber optic cable.
   b. All conduits containing shielded VFD cable.
   c. Where specifically indicated on the Drawings.

C. Flexible Conduit

1. Flexible conduit shall only be installed for the limited applications specified herein. Flexible conduit shall not be installed in any other application without written authorization from the Engineer. Acceptable applications are as follows:
   a. Connections to motors and engine-generator sets (and similar vibrating equipment)
   b. Connections to solenoid valves and limit switches
   c. Connections to lighting fixtures installed in suspended ceilings
   d. Connections to lighting transformers
   e. Connections to pre-fabricated equipment skids
   f. Connections to HVAC equipment
   g. Connections to instrument transmitters and elements
   h. Where specifically indicated in the Standard Details

2. Flexible conduit length shall be limited to three (3) feet, maximum. Flexible conduit shall not be installed buried or embedded within any material.

3. Flexible conduit for non-hazardous areas shall be furnished and installed in the materials of construction as follows:
### FLEXIBLE CONDUIT FOR NON-HAZARDOUS AREAS

<table>
<thead>
<tr>
<th>INSTALLATION AREA DESIGNATION/SCENARIO</th>
<th>CONDUIT CATEGORY BY WIRING/CIRCUIT TYPE</th>
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<tr>
<td></td>
<td>Power and Control</td>
</tr>
<tr>
<td></td>
<td>Instrumentation</td>
</tr>
<tr>
<td>Exposed in indoor wet process areas</td>
<td>Liquid-tight flexible metal conduit</td>
</tr>
<tr>
<td></td>
<td>Same as Power and Control</td>
</tr>
<tr>
<td>Exposed in indoor dry process areas</td>
<td>Liquid-tight flexible metal conduit</td>
</tr>
<tr>
<td></td>
<td>Same as Power and Control</td>
</tr>
<tr>
<td>Exposed in indoor dry non-process areas</td>
<td>Liquid-tight flexible metal conduit</td>
</tr>
<tr>
<td></td>
<td>Same as Power and Control</td>
</tr>
<tr>
<td>Exposed in indoor Type 1 chemical</td>
<td>Liquid-tight flexible non-metallic</td>
</tr>
<tr>
<td>storage/transfer areas</td>
<td>conduit</td>
</tr>
<tr>
<td></td>
<td>Same as Power and Control</td>
</tr>
<tr>
<td>Exposed in indoor Type 2 chemical</td>
<td>Liquid-tight flexible metal conduit</td>
</tr>
<tr>
<td>storage/transfer areas</td>
<td>Same as Power and Control</td>
</tr>
<tr>
<td>Exposed in outdoor areas</td>
<td>Liquid-tight flexible metal conduit</td>
</tr>
<tr>
<td></td>
<td>Same as Power and Control</td>
</tr>
</tbody>
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3.04 CONDUIT FITTING USES AND APPLICATIONS

A. General

1. Conduit fittings shall be furnished and installed in the materials of construction as indicated in Part 2, herein. Conduit fitting materials of construction are dependent on the material of construction used for the associated conduit.

2. Conduit fittings shall be provided in the trade size and configuration required to suit the application.

B. Conduit Bodies

1. Conduit bodies shall be installed where wire pulling points are desired or required, or where changes in conduit direction or breaking around beams is required.

2. Where conduit bodies larger than trade size 2 inches are intended to be used as a pull-through fitting during wire installation, oversized or elongated conduit bodies shall be used. Oversized or elongated conduit bodies shall not be required if the conduit body is intended to be used as a pull-out point during wire installation.

C. Conduit Nipples and Unions

1. Conduits with running threads shall not be used in place of 3-piece couplings (unions) or close nipples. After installation of a conduit fitting of any kind, there shall be no more than ¼ inch of exposed threads visible. Factory fabricated all-thread nipples may be used between adjacent enclosures, however, the same restriction applies regarding the length of exposed threads that are visible.
D. Conduit Expansion and Deflection Fittings

1. Conduit expansion fittings shall be installed where required by the NEC and where indicated on the Drawings. Expansion fittings shall also be installed for exposed straight metallic conduit runs of more than 75 feet, in both indoor and outdoor locations. Expansion fittings for runs of non-metallic conduit shall be installed in accordance with the NEC.

2. Conduit deflection fittings shall be installed where required by the NEC and where conduits are installed (exposed and concealed) across structural expansion joints.

E. Not Used

F. Conduit Termination Fittings

1. Where conduits terminate at enclosures with a NEMA 4, 4X, or 3R rating and the enclosure does not have integral conduit hubs, an appropriately sized watertight conduit hub shall be installed to maintain the integrity of the enclosure. The use of locknuts with integral gasket in lieu of watertight conduit hubs is not acceptable.

2. Where conduits terminate at enclosures that do not require conduit hubs, a two-locknut system shall be used to secure the conduit to the enclosure. One locknut shall be installed on the outside of the enclosure, and the other inside, drawn tight against the enclosure wall. The locknut on the interior of the enclosure shall be the type with integral bonding lug, or a conduit bonding bushing may be used in place of the locknut.

3. Conduits shall not be installed such that conduit fittings penetrate the top of any enclosure located outdoors, except in cases where specifically required by the serving electric utility. Conduits which serve outdoor equipment or an enclosure from above shall instead be routed into the side of the enclosure at the bottom. The conduit termination fitting shall be provided with a conduit drain to divert moisture from the raceway away from the enclosure.

3.05 MISCELLANEOUS

A. Conduit Periphery Sealing

1. All conduit penetrations through exterior walls shall be sealed around the periphery using the appropriate products specified in Part 2 herein to prevent air and/or water entry into the structure.

2. All conduit penetrations through interior walls and floors shall be sealed through the use of with conduit sleeves and caulk as specified in Part 2 herein. Alternatively, mortar may be used to seal around the conduit periphery.

3. Conduit penetrations through fire-rated walls as floors shall be made with the appropriate fire rated penetration product.

B. Conduit Interior Sealing
1. All conduits (including spares) entering a structure below grade shall be sealed on the interior of the conduit against water ingress. Sealing shall be at an accessible location in the conduit system located within the building structure and shall be via one of the methods specified in Part 2 herein. If conduit sealing cannot be achieved at an accessible location within the building structure, sealing shall be placed in the conduits in the nearest manhole or handhole outside the structure.

3.06 CONDUIT IDENTIFICATION

A. Exposed conduits shall be identified at the source, load, and all intermediate components of the raceway system. Examples of intermediate components include but are not limited to junction boxes, pull boxes, and disconnect switches. Identification shall be by means of an adhesive label with the following requirements:

1. Labels shall consist of an orange background with black text. Text for the label shall be the conduit number as indicated in the conduit and wire schedules.

2. In addition, at the source end of the conduit, a second line of text shall be included to indicate the load equipment name. This second line shall consist of the word “TO:” and the text in the ‘TO’ column of the conduit and wire schedule (e.g. TO: MCC-1). At the load end of the conduit, a second line of text shall be included to indicate the source equipment name. This second line shall consist of the word “FROM:” and the text in the ‘FROM’ column of the conduit and wire schedule (e.g. FROM: SWGR-MS). This requirement applies only to the source and load ends of the conduit, and not anywhere in between.

3. For conduits trade sizes 3/4 inch through 1-1/2 inch, the text shall be a minimum 18 point font. For conduits trade size 2 inch and larger, the text shall be a minimum 24 point font.

4. Label height shall be 3/4 inch minimum, and length shall be as required to fit required text. The label shall be installed such that the text is parallel with the axis of the conduit. The label shall be oriented such that the text can be read without the use of any special tools or removal of equipment.

5. Labels shall be installed after each conduit is installed and, if applicable, after painting. Labels shall be printed in the field via the use of a portable label printing system. Handwritten labels are not acceptable.

6. Labels shall be made of permanent vinyl with adhesive backing. Labels made of any other material are not acceptable.

B. Conduits that are not exposed but installed beneath free standing equipment enclosures shall be identified by means of a plastic tag with the following requirements:

1. The tag shall be made of white Tyvek material, and have an orange label with black text, as described above, adhered to it. Text for the label shall be the conduit number as indicated in the conduit and wire schedules.

2. The tag shall be affixed to the conduit by means of a nylon cable tie. The tag shall be of suitable dimensions to achieve a minimum text size of 18 points.
C. Conduits for lighting and receptacle circuits shall not require identification.

D. Any problems or conflicts with meeting the requirements above shall immediately be brought to the attention of the Engineer for a decision.

3.07 TESTING

A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. All conduit installed below grade or concrete encased shall be tested to ensure continuity and the absence of obstructions by pulling through each conduit a swab followed by a mandrel 85% of the conduit inside diameter. After testing, all conduits shall be capped after installation of a suitable pulling rope.

3.08 TRAINING OF INSTALLATION PERSONNEL

A. All Contractor personnel that install PVC coated RGS conduit shall be trained by the PVC coated RGS conduit manufacturer. Training shall include proper conduit system assembly techniques, use of tools appropriate for coated conduit systems, and field bending/cutting/threading of coated conduit. Training shall have been completed within the past 24 months prior to the Notice to Proceed on this Contract to be considered valid. Contractor personnel not trained within this timeframe shall not be allowed to install coated conduit, or shall be trained/re-trained as required prior to commencement of conduit installation.
SECTION 16118

UNDERGROUND ELECTRICAL

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install underground duct systems, electric manholes, and electric handholes as specified herein and as indicated on the Drawings. The work shall be complete and shall include excavation, concrete construction, backfilling, and all materials, items, and components required for a complete system.

B. The provisions of this Division are applicable to all underground conduit work. All work shall be coordinated with that of the various utility companies and other Contractors.

C. Reference Section 16000, Basic Electrical Requirements; Section 16111, Conduit; Section 16170, Grounding and Bonding; the applicable sections of Division 2, Sitework; Section 03200, Reinforcing Steel; and 03300, Cast-In-Place Concrete.

1.02 CODES AND STANDARDS

A. Products specified herein shall be designed, manufactured, and/or listed to the following standards as applicable:

1. AASHTO H20

2. ANSI/SCTE 77-2010 – Specification for Underground Enclosure Integrity

1.03 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the equipment manufacturer and submit Shop Drawings. Each submittal shall be identified by the applicable Specification Section.

1.04 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal.

D. Shop drawings shall include but not be limited to, the following:
1. Product data sheets.

2. Outline and dimensional drawings including detailed sections of the manholes and/or handholes.

3. Materials specifications and structural calculations for the manholes sealed by a Professional Engineer in the California.

1.05 IDENTIFICATION

A. Each electric manhole and handhole cover shall be lettered with the word “Electric”, the manhole or handhole identification number (e.g. EHH-1, etc.), manufacturer’s name or trademark, and such other information as the manufacturer may consider necessary, or as specified, for complete identification.

PART 2 -- PRODUCTS

2.01 MANUFACTURERS

A. The material covered by this Specification is intended to be standard material of proven performance as manufactured by reputable concerns. Material shall be fabricated, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as specified herein and indicated on the Drawings.

2.02 DUCT SYSTEM

A. The underground duct system shall be comprised of conduits, conduit bends, and conduit fittings as specified in Section 16111, Conduit. Conduits shall be encased in reinforced concrete envelopes, unless otherwise specified herein or indicated on the Drawings.

B. Base and intermediate conduit spacers shall be furnished to provide a minimum of two-inch (2”) separation between conduits. Conduit spacers shall be provided in the proper size as required for the conduit that they secure. For example, a 4” conduit spacer shall not be used to secure a 2” conduit. Conduit spacers shall be as manufactured by Carlon Electrical Products Company, Aeroquip Corporation, Underground Devices, Incorporated, or equal.

2.03 ELECTRIC MANHOLES

A. The concrete manholes shall be complete with metal frames and covers of size and location as specified herein and shown on the Drawings.

B. Manhole frames and covers shall be Neenah R-1640C1, or equal, with Type A anchor ring. Entire manhole assembly shall be AASHTO H20 heavy duty rated. Covers shall be furnished with drop handles.

C. All electric manholes shall be provided with non-metallic cable racks. Cable racks shall be rated for the application, with a minimum loading capacity of 450lbs per rack arm. Cable rack system shall be Heavy Duty type as manufactured by Underground Devices, Incorporated or equal.
2.04 ELECTRIC HANDHOLES

A. The electric handholes shall be a precast polymer concrete enclosure suitable for use as part of an underground electric raceway system. The enclosure shall meet or exceed the requirements of ANSI/SCTE 77-2010.

B. The enclosure and cover design and test load rating shall be Tier 15. Covers shall be provided with cover hooks.

C. The enclosure shall be the straight side design to allow easy adjustment of box to grade. The box shall be stackable for increased depth.

D. Handhole opening size shall be as required to suit the application, 6” X 8”, minimum.

E. The electric handholes shall be manufactured by Hubbell, Pencell Plastics equivalent, Highline Products equivalent, or equal.

PART 3 -- EXECUTION

3.01 GENERAL

A. The underground duct system, manholes, and handholes shall be installed as specified herein, indicated on the Drawings, and in accordance with manufacturers’ instructions.

3.02 DUCT SYSTEM

A. All underground conduit shall be encased in concrete and shall be reinforced. Encasement and reinforcement shall be as indicated in the standard details. Concrete shall be furnished and installed in accordance with Section 03300. Reinforcing steel shall be furnished and installed in accordance with Section 03200. Concrete electrical duct banks shall contain red dye; the red dye shall be mixed into the concrete mix before being poured. Red dye applied to the top of concrete encasement after placement of concrete is not acceptable.

B. Concrete pours shall be complete from handhole to handhole and from manhole to manhole where practicable. Partial pours in general shall not be permitted. Where a complete pour is impractical, written authorization shall be obtained from the Engineer for the partial pour.

C. Conduit ductbank elevations at the manholes and handholes shall be based on minimum ductbank cover as indicated in the standard details, or deeper to avoid conflicts with other obstacles. Where deviation is necessary to clear unforeseen obstacles, the elevations may be changed after authorization by the Engineer.

D. Slope all conduits continuously away from structures and buildings with a minimum slope of 3” per 100’ unless otherwise indicated on the Drawings.

E. The minimum clearance from the top of the concrete encasement and finished grade shall be as indicated in the standard details, except where otherwise accepted in writing by the Engineer or shown on the Drawings.
F. Care shall be exercised during excavation for the duct banks to prevent digging too deep. Backfilling of low spots with earth fill will not be permitted unless thoroughly compacted and acceptable to the Engineer.

G. If a specific ductbank arrangement is shown on the Drawings, the conduits in that ductbank shall be arranged as shown. Where no specific ductbank arrangement is shown on the Drawings, the Contractor shall arrange conduits within each ductbank based on field conditions. Spare conduits shown going from ductbanks into buildings or structures shall be stubbed up in the location(s) as indicated on the Drawings.

H. A minimum of one (1) ground rod, furnished in accordance with Section 16170, shall be driven adjacent to each manhole, handhole, or other concrete box. A No. 4/0 AWG bare copper ground cable shall be connected between this rod and the copper ground strap using a silicon bronze connector. All ground rods shall be interconnected by means of the No. 4/0 AWG bare copper ground cable located within each duct bank. The ends of these cables shall also be connected to substation and/or building ground buses where the conduits terminate.

I. Care shall be exercised and temporary plugs shall be installed during installation to prevent the entrance of concrete, mortar, or other foreign matter into the conduit system. Conduit spacers shall be utilized to support conduit during the pouring of concrete to prevent movement and misalignment of the conduits. Conduit spacers shall be installed in accordance with manufacturer's instructions unless otherwise noted. Horizontal spacing of conduit spacers along ductbank shall be as indicated on the Standard Details.

J. Where connections to existing underground conduits are indicated, excavate to the maximum depth necessary. After addressing the existing conductors, cut the conduits and remove loose concrete from the conduits before installing new concrete encased ducts. Provide a reinforced concrete collar, poured monolithically with the new duct line, to take the shear at the joint of the duct lines.

K. Construct concrete-encased conduits connecting to underground structures to have a flared section adjacent to the manhole to provide shear strength. Construct underground structures to provide shear strength. Construct underground structures to provide for keying the concrete encasement of the duct line into the wall of the structure. Use vibrators when this portion of the encasement is poured to ensure a seal between the encasement and the wall of the structure.

L. Six (6) inches above all duct banks, the Contractor shall furnish and install a two (2) inch wide red plastic electrical hazard tape. Tapes shall be metallic detectable type and shall have a continuous message in bold black letters: “ELECTRIC LINE BURIED BELOW.” Tape shall be Detectable Identoline by Brady, or equal.

M. The Contractor shall perform all earthwork including excavation, backfill, bedding, compaction, shoring and bracing, grading and restoration of surfaces and seeded areas disturbed during the execution of the work.

N. All conduit joints in the duct system shall be staggered such that adjacent conduits do not have joints in the same location.

3.03 ELECTRIC MANHOLES
A. Electric manholes shall be installed to a sufficient depth to accommodate the required grading of ducts as well as maintaining a minimum distance of 14” from the bottom of the lowest duct centerline entrances to finished floor line and/or highest duct centerline entrance to the roof. All manholes shall be built on, or placed over a 6” layer of well-tamped gravel.

B. Duct envelopes and conduit with bell ends shall enter at approximately right angles to the walls, except as may otherwise be shown on the Drawings.

C. All concrete work and fully assembled manholes shall be completely watertight and shall be furnished with sloped floors that pitch towards a sump pit. The outside surfaces shall be coated with an approved asphaltic waterproofing compound (all sides, bottom, and roof). Precast concrete manholes may be installed; however, all requirements of this section and other divisions of the Specifications and the details shown on the Drawings shall apply.

D. Install pulling eye irons imbedded in walls opposite each duct entrance securely fastened to manhole reinforcing rods. All hardware shall be hot-dipped galvanized steel. Copper bars shall be provided in the walls for grounding. No. 4/0 AWG bare copper cables shall be connected to these bars and all non-current carrying metal parts shall be grounded to these copper bars.

E. All cables shall be well supported on walls by nonmetallic cable racks. The cable racks shall be heavy-duty type for medium and low voltage power cables and light duty type for control, signal, communications and similar small conductors. All racks shall be rigidly attached to the wall and equipped with adjustable rack arms.

3.04 ELECTRIC HANDHOLES

A. Electric handholes shall be installed to a sufficient depth to accommodate the required grading of ducts as well as maintaining a minimum distance of 9” from the bottom of the lowest duct centerline entrances to finished floor line and/or highest duct centerline entrance to roof. All handholes shall be built on, or placed over a 6” layer of well-tamped gravel.

B. Duct envelopes and conduit with bell ends shall enter at approximately right angles to the walls, except as may otherwise be shown on the Drawings.

C. All fully assembled handholes shall be completely watertight.

D. All individual cables and/or bundles of conductors shall be identified and “dressed” along the wall of the enclosure. Cable racks as specified herein shall be provided if any handhole dimension exceeds 24 inches.

3.05 TESTING

A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Field tests
a. Field tests for all completed duct systems shall consist of pulling a swab through each conduit followed by a mandrel equal in size to 85% of the conduit inside diameter.

b. After testing, all conduits shall be capped after installation of a suitable pull rope. All field tests shall be witnessed by the Engineer.

- END OF SECTION -
SECTION 16123

LOW VOLTAGE WIRE AND CABLE

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, install, connect, test, and place in satisfactory operating condition, all low voltage wire and cable indicated on the Drawings and as specified herein and/or required for proper operation. The work of connecting cables to equipment and devices shall be considered a part of this Section. All appurtenances required for the installation of wire and cable systems shall be furnished and installed by the Contractor.

B. The scope of this Section does not include internal wiring factory installed by electrical equipment manufacturers.

C. Reference Section 16000 – Basic Electrical Requirements and Section 16130 – Boxes.

1.02 CODES AND STANDARDS

A. Low voltage wire, cable, and appurtenances shall be designed, manufactured, and/or listed to the following standards as applicable:

1. Underwriters Laboratories (UL)
   a. UL 13 – Standard for Power-Limited Circuit Cables
   b. UL 44 – Thermoset-Insulated Wires and Cables
   c. UL 83 – Thermoplastic-Insulated Wires and Cables
   d. UL 1277 – Standard for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members
   e. UL 1581 – Reference Standard for Electrical Wires, Cables, and Flexible Cords
   f. UL 1685 – Standard for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables
   g. UL 2250 – Standard for Instrumentation Tray Cable
   h. UL 2556 – Wire and Cable Test Methods

   a. ASTM B3 – Standard Specification for Soft or Annealed Copper Wire
b. ASTM B8 – Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

c. ASTM B33 – Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes

d. ASTM D69 – Standard Test Methods for Friction Tapes

e. ASTM D4388 – Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes

3. Insulated Cable Engineers Association (ICEA)


b. ICEA T-29-250 – Conducting Vertical Cable Tray Flame Tests with Theoretical Heat Input Rate of 210,000 B.T.U./Hour

4. Institute of Electrical and Electronics Engineers (IEEE)

a. IEEE 1202 – Standard for Flame Testing of Cables

1.03 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300 – Submittals, the Contractor shall obtain from the wire and cable manufacturer and submit the following:

1. Shop Drawings

2. Reports of Field Tests

B. Each submittal shall be identified by the applicable specification section.

1.04 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed material's compliance with the Contract Documents.

B. Partial, incomplete, or illegible Submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. Product data sheets for wire and cable, terminations, and pulling lubricant.

2. Cable pulling calculations (if required).

3. Wiring identification methods and materials.
D. The shop drawing information shall be complete and organized in such a way that the Engineer can determine if the requirements of these specifications are being met. Copies of technical bulletins, technical data sheets from "soft-cover" catalogs, and similar information which is "highlighted" or somehow identifies the specific equipment items the Contractor intends to provide are acceptable and shall be submitted.

1.05 CABLE PULLING CALCULATIONS

A. Prior to the installation of the wire and cable specified herein, the Contractor shall submit cable pulling calculations for engineer review and approval when all of the following are true:

1. The amount of cable to be installed will be greater than 200 linear feet between pull points.
2. The installation will have one or more bends.
3. The wire and cable is size #1/0 AWG and larger.

B. Cable pulling calculations shall be performed by a currently registered professional engineer in the California and shall define pulling tension and sidewall loading (sidewall bearing pressure values).

PART 2 -- PRODUCTS

2.01 MANUFACTURERS

A. The wire and cable to be furnished and installed for this project shall be the product of manufacturers who have been in the business of manufacturing wire and cable for a minimum of ten (10) years. Wire and cable shall be designed, constructed, and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as specified herein and indicated on the Drawings. Only one (1) manufacturer for each wire and cable type shall be permitted.

2.02 POWER AND CONTROL WIRE AND CABLE

A. Power cable installed between the output terminals of a VFD and its associated motor shall be a shielded cable suitable for use with VFDs. The conductor insulation shall be TC-ER (XHHW-2) and rated for 90°C in both wet and dry locations at 600V.

B. Power wire for all other loads and control wire (except lighting and receptacles) shall consist of copper conductors insulated with a cross-linked polyethylene (XLP) outer jacket. Conductor insulation shall be rated 90°C for dry and wet locations, and 600V. Insulated conductors for power and control shall be UL 44 Listed as NEC Type XHHW-2.

C. Wire for lighting and receptacles shall consist of copper conductors insulated with a nylon (or equivalent) outer jacket. Conductor insulation shall be rated 90°C for dry locations, 75°C for wet locations, and 600V. Insulated conductors shall be UL 83 Listed as NEC Type THHN/THWN.
D. Unless specified otherwise herein, conductors shall be stranded copper per ASTM B-8 and B-3, with Class B or C stranding contingent upon the size.

E. Power conductor size shall be no smaller than No. 12 AWG and Control conductor size shall be no smaller than No. 14 AWG.

F. Multi-conductor cable assemblies shall include a grounding conductor and an overall PVC jacket. The jacket shall be PVC and resistant to abrasion, sunlight, and flame in accordance with UL 1277. Multi-conductor cable assemblies shall be UL 1277 Listed as NEC Type TC (Power and Control Tray Cable).

G. Power wire and cable shall be as manufactured by the Okonite Company, the Southwire Company, General Cable, Encore Wire, or equal.

2.03 INSTRUMENTATION CABLE

A. For single-analog signal applications, instrumentation cable shall consist of a single, twisted pair or triad of individually insulated and jacketed copper conductors with an overall cable shield and jacket. Conductor insulation shall be rated 90°C in both wet and dry locations, and 600V. The jacket shall be PVC and resistant to abrasion, sunlight, and flame in accordance with UL 1277. Cable shall be UL 1277 Listed as NEC Type TC (Power and Control Tray Cable).

B. For multiple-analog signal applications, instrumentation cable shall consist of multiple, twisted pairs or triads (i.e. groups) of individually insulated and jacketed copper conductors with individual pair/triad shields (i.e. group shields) and an overall cable shield and jacket. Conductor insulation shall be rated 90°C in both wet and dry locations, and 600V. The jacket shall be PVC and resistant to abrasion, sunlight, and flame in accordance with UL 1277. Cable shall be UL 1277 Listed as NEC Type TC (Power and Control Tray Cable).

C. Cable and group shields shall consist of overlapped aluminum/polyester tape/foil providing 100% coverage. Instrumentation cables shall include an overall copper shield drain wire. Cables containing multiple twisted pairs or triads shall also include group shield drain wires.

D. Conductors, including drain wires, shall be tin or alloy coated (if available), soft, annealed copper, stranded per ASTM B-8, with Class B stranding unless otherwise specified.

E. Instrumentation signal conductor size shall be no smaller than No. 16 AWG.

F. Instrumentation cable shall be Okoseal-N Type P-OS (for single pair or triad applications) or Okoseal-N Type SP-OS (for multiple pair or triad applications) as manufactured by the Okonite Company, Belden equivalent, Southwire Company equivalent, or equal.

2.04 NOT USED

2.05 CONDUCTOR IDENTIFICATION

A. Conductors shall be identified using a color coding method. Color coding for individual power, control, lighting, and receptacle conductors shall be as follows:
1. 480/277V AC Power
   a. Phase A - BROWN
   b. Phase B - ORANGE
   c. Phase C - YELLOW
   d. Neutral – GREY

2. 120/208V or 120/240V AC Power
   a. Phase A - BLACK
   b. Phase B - RED
   c. Phase C - BLUE
   d. Neutral - WHITE

3. DC Power
   a. Positive Lead - RED
   b. Negative Lead - BLACK

4. DC Control
   a. All wiring - BLUE

5. 120 VAC Control
   a. 120 VAC control wire shall be RED except for a wire entering a motor control center compartment, motor controller, or control panel which is an interlock. This interlock conductor shall be color coded YELLOW. For the purposes of this Section, an interlock is defined as any wiring that brings voltage into the above mentioned equipment from a source outside that equipment.

6. 24 VAC Control
   a. All wiring - ORANGE

7. Equipment Grounding Conductor
   a. All wiring - GREEN

B. Individual conductors No. 2 AWG and smaller shall have factory color coded insulation. It is acceptable for individual conductors larger than No.2 AWG to be provided with factory color coded insulation as well, but it is not required. Individual conductors larger than No.2 AWG that are not provided with factory color coded insulation shall be identified by the use of colored tape in accordance with the requirements listed in Part 3 herein. Insulation...
colors and tape colors shall be in accordance with the color coding requirements listed above.

C. Conductors that are part of multi-conductor cable assemblies shall have black insulation. The conductor number shall be printed on each conductor’s insulation in accordance with ICEA S-58-679, Method 4. Each conductor No.2 AWG and smaller within the cable assembly shall also be identified with a heat shrink tag with color coded background. Each conductor larger than No.2 AWG within the cable assembly shall also be identified by the use of colored tape. Heat shrink tags and colored tape shall be in accordance with the requirements listed in Part 3 herein. Tape color and heat shrink tag background color shall be in accordance with the color coding requirements listed above.

2.06 CABLE PULLING LUBRICANTS

A. Cable pulling lubricants shall be non-hardening type and approved for use on the type of cable installed. Lubricant shall be Yellow #77 Plus by Ideal, Cable Gel by Greenlee, Poly-Gel by Gardner Bender, or equal.

PART 3 -- EXECUTION

3.01 WIRE AND CABLE INSTALLATION

A. General

1. Wire and Cable shall be installed as specified herein and indicated on the Drawings. Unless specifically indicated otherwise on the Drawings, wire and cable shall be installed in separate raceways according to wiring type. For example, power wiring shall not be combined with control wiring, and control wiring shall not be combined with instrumentation analog signal wiring.

2. Wire shall be furnished and installed as single conductor cables, with limited exceptions. Multi-conductor cable assemblies shall only be installed where indicated on the Drawings, required by the NEC, or after obtaining written permission from the Engineer.

3. Where instrumentation cables are installed in control panels, motor controllers, and other locations, the Contractor shall arrange wiring to provide maximum clearance between these cables and other conductors. Instrumentation cables shall not be installed in same bundle with conductors of other circuits.

4. Instrumentation cable shielding shall be continuous and shall be grounded at one point only.

B. Splices

1. Splices shall not be allowed in power or control wire and cable unless indicated on the drawings or approved in writing by the Engineer. If unique field conditions exist or pulling calculations indicate that splices may be required, the Contractor shall submit a detailed request indicating why splices are required to the Engineer. The Engineer shall be under no obligation to grant such request.
2. Splicing materials shall be barrel type butt splice connectors and heat shrink tubing as manufactured by 3M, Ideal, or equal. The use of screw-on wire connectors (wire nuts) shall only be permitted for lighting and receptacle circuits.

3. No splicing of instrumentation cable is permitted.

C. Wire and Cable Sizes

1. The sizes of wire and cable shall be as indicated on the Drawings, or if not shown, as approved by the Engineer. If required due to field routing, the size of conductors and respective conduit shall be increased so that the voltage drop measured from source to load does not exceed 3%.

D. Additional Conductor Identification

1. In addition to the color coding identification requirements specified in Part 2 herein, individual conductors shall be provided with heat shrinkable identification tags. Identification tags for individual conductors shall have a white background where the conductor insulation is colored. Identification tags for individual conductors shall have a colored background where the conductor insulation is black. Background color shall match that of the taping provided on the individual black conductors.

2. Multi-conductor cables shall be provided with heat shrinkable identification tags in accordance with Part 2 herein.

3. All wiring shall be identified at each point of termination. This includes but is not limited to identification at the source, load, and in any intermediate junction boxes where a termination is made. The Contractor shall meet with the Owner and Engineer to come to an agreement regarding a wire identification system prior to installation of any wiring. Wire numbers shall not be duplicated.

4. Wire identification shall be by means of a heat shrinkable sleeve with appropriately colored background and black text. Wire sizes #14 AWG through #10 AWG shall have a minimum text size of 7 points. Wire sizes #8 AWG and larger shall have a minimum text size of 10 points. Sleeves shall be of appropriate length to fit the required text. The use of handwritten text for wire identification shall not be permitted.

5. Sleeves shall be suitable for the size of wire on which they are installed. Sleeves shall not be heat-shrunk onto control cables. Tags shall remain loose on cable to promote easier identification. For all other applications, sleeves shall be tightly affixed to the wire and shall not move. Sleeves shall be heat shrunk onto wiring with a heat gun approved for the application. Sleeves shall not be heated by any means which employs the use of an open flame. The Contractor shall take special care to ensure that the wiring insulation is not damaged during the heating process.

6. Sleeves shall be installed prior to the completion of the wiring terminations and shall be oriented so that they can be easily read.

7. Sleeves shall be polyolefin as manufactured by Brady, Seton, Panduit, or equal.
8. Wire identification in manholes, handholes, pull boxes, and other accessible components in the raceway system where the wiring is continuous (no terminations are made) shall be accomplished by means of a tag installed around the bundled group of individual conductors or around the outer conductor jacket of a multi-conductor cable. Identification shall utilize a FROM-TO system. Each group of conductors shall consist of all of the individual conductors in a single conduit or duct. The tag shall have text that identifies the bundle in accordance with the ‘FROM’ and ‘TO’ column for that particular conduit number in the conduit and wire schedule. Minimum text size shall be 10 point. The tag shall be affixed to the wire bundle by the use of nylon wire ties, and shall be made of polyethylene as manufactured by Brady, Seton, Panduit, or equal.

9. Where colored tape is used to identify cables, it shall be wrapped around the cable with a 25% overlap and shall cover at least 2 inches of the cable.

E. Wiring Supplies

1. Rubber insulating tape shall be in accordance with ASTM D4388. Friction tape shall be in accordance with ASTM D69.

F. Training of Cable in Manholes, Handholes, and Vaults

1. The Contractor shall furnish all labor and material required to train cables around cable vaults, manholes, and handholes. Sufficient length of cable shall be provided in each handhole, manhole, and vault so that the cable can be trained and racked in an approved manner. In training or racking, the radius of bend of any cable shall be not less than the manufacturer's recommendation. The training shall be done in such a manner as to minimize chaffing.

2. Instrumentation cable shall be racked and bundled separate from AC wiring to maintain the required separation as follows:
   a. 18 inches for 480/277 VAC wiring
   b. 12 inches for 208/120 VAC wiring
   c. 6 inches for 24 VAC wiring

G. Conductor Terminations

1. Where wires are terminated at equipment which requires lugs, connections shall be made by solderless mechanical lug, crimp type ferrule, or irreversible compression type lugs. Reference individual equipment specification sections as applicable for additional termination requirements.

2. Where enclosure sizes and sizes of terminals at limit switches, solenoid valves, float switches, pressure switches, temperature switches, and other devices make terminations impractical due to the size of the field wiring, the Contractor shall terminate field wiring in an adjacent junction box per the requirements of Section 16130 – Boxes, complete with terminal strips. Contractor shall install the smaller wiring from the device to the junction box in a conduit, using the terminal strip as
the means for joining the two different wire sizes. Splicing of wires in lieu of using terminal strips is not acceptable.

3. The cables shall be terminated in accordance with the cable and/or termination product manufacturer's instructions for the particular type of cable.

4. To minimize oxidation and corrosion, wire and cable shall be terminated using an oxide-inhibiting joint compound recommended for "copper-to-copper" connections. The compound shall be Penetrox E as manufactured by Burndy Electrical, or equal.

5. All spare conductors shall be terminated on terminal blocks mounted within equipment or junction boxes. Unless otherwise noted, coiling up of spare conductors within enclosure is not acceptable.

H. Pulling Temperature

1. Cable shall not be installed when the temperature of the jacket is such that damage will occur due to low temperature embrittlement. When cable will be pulled with an ambient temperature of 40°F or less within a three (3) day period prior to pulling, the cable reels shall be stored three (3) days prior to pulling in a protected storage area with an ambient temperature of 55°F or more. Cable pulling shall be completed during the work day for which the cable is removed from the protected storage. Any cable reels with wire remaining on them shall be returned to storage at the completion of the workday.

3.02 FIBER OPTIC CABLE INSTALLATION

A. The Contractor shall install the fiber optic cable furnished by the General Contractor and/or the Instrumentation and Control Subcontractor. The cable shall be installed in its respective raceway system(s) as specified herein, indicated on the Drawings, and in accordance with the cable manufacturer's instructions. Reference Division 17 for additional information regarding the fiber optic cable.

3.03 TESTING

A. All testing shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Shop Test
   a. Wires and cables shall be tested in accordance with the applicable ICEA Standards. Wire and cable shall be physically and electrically tested in accordance with the manufacturer's standards.

2. Field Tests
   a. After installation, all wires and cables shall be tested for continuity. Testing for continuity shall be “test light” or “buzzer” style.
b. After installation, some wires and cables shall be tested for insulation levels. Insulation resistance between conductors of the same circuit and between conductor and ground shall be tested. Testing for insulation levels shall be as follows:

   i. For #8 AWG and larger 600V wire and cable, apply 1,000 VDC from a Megohmmeter for one (1) minute. Resistance shall be no less than 100 Megohms. Insulation testing is not required for power and control cables smaller than #8 AWG.

   ii. Instrumentation signal cable shall be tested from conductor to conductor, conductor to shield, and conductor to ground using a Simpson No. 260 volt-ohmmeter, or approved equal. The resistance value shall be 200 Megohms or greater.

B. Wires and cables shall be tested after required terminations are made, but before being connected to any equipment.

C. If tests reveal defects or deficiencies, the Contractor shall make the necessary repairs or shall replace the cable as directed by the Engineer, without additional cost to the Owner. All conductors of a multi-phase circuit shall be replaced if one conductor fails the required testing. If part of a multi-set (parallel conductors per phase) circuit fails testing, only the set containing failure shall be replaced.

D. All tests shall be made by and at the expense of the Contractor who shall supply all testing equipment. Test reports shall be submitted to the Engineer.
<table>
<thead>
<tr>
<th>Date:</th>
<th>Company:</th>
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<tbody>
<tr>
<td>Time:</td>
<td>Location:</td>
</tr>
<tr>
<td>Circuit:</td>
<td>Circuit Length:</td>
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<tr>
<td>Insulation Material:</td>
<td>Insulation Thickness:</td>
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<td>Type:</td>
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<tr>
<td>Number and Type of Joints:</td>
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<tr>
<td>Recent Operating History:</td>
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<td>Manufacturer:</td>
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<tr>
<td>State if Potheads or Terminals were grounded during test:</td>
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<td>List associated equipment included in test:</td>
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<td>Miscellaneous Information:</td>
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<td>Part Tested:</td>
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<tr>
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<td>Dry Bulb Temperature:</td>
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<td>Wet Bulb Temperature:</td>
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<tr>
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<td>Equipment Temperature:</td>
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<td>Relative Humidity:</td>
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<td>Absolute Humidity:</td>
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<tr>
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<th>Range:</th>
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<tbody>
<tr>
<td>Voltage:</td>
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| | 1/4 Minute | 5 Minutes |
| | 1/2 Minute | 6 Minutes |
| | 3/4 Minute | 7 Minutes |
| | 1 Minute | 8 Minutes |
| | 2 Minutes | 9 Minutes |
| | 3 Minutes | 10 Minutes |
| | 4 Minutes | 10/1 Minute Ratio |

Remarks:

- END OF SECTION -
SECTION 16130

BOXES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The scope of work under this Section includes furnishing and installing all pull boxes, junction boxes, and outlet boxes.

B. Requirements for other boxes and enclosures are not included in this Section. Reference each specific Division 16 equipment Section for requirements related to that equipment's respective enclosure.

C. Reference Section 16000, Basic Electrical Requirements, and Section 16111, Conduit.

1.02 CODES AND STANDARDS

A. Boxes shall be designed, manufactured, and/or listed to the following standards as applicable:

1. UL 514A - Metallic Outlet Boxes
2. UL 514C - Standard for Non-metallic Outlet Boxes, Flush Device Boxes, and Covers
3. UL 50 – Enclosures for Electrical Equipment, Non-environmental Considerations
4. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations
6. NEMA 250 – Enclosures for Electrical Equipment

1.03 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the equipment manufacturer(s) and submit the following:

1. Shop Drawings

B. Each submittal shall be identified by the applicable specification section.

1.04 SHOP DRAWINGS
A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete or illegible Submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

   1. Product data sheets for boxes, terminal strips, and all accessories

1.05 OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall submit operation and maintenance manuals in accordance with the procedures and requirements set forth in the General Conditions and Division 1.

B. As-built drawings showing dimensions, internal box layout, terminal strip information, and terminal strip identification information shall be provided for all junction boxes. As-built drawings are not required for pull boxes or outlet boxes.

1.06 IDENTIFICATION

A. Each pull and junction box shall be identified with the box name as indicated on the Contract Drawings (e.g. PPB-XXX, CJB-YYY) or as directed by the Engineer. A nameplate shall be securely affixed in a conspicuous place on each box. Nameplates shall be as specified in Section 16195, Electrical – Identification.

PART 2 -- PRODUCTS

2.01 MANUFACTURERS

A. The equipment covered by this Specification is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed, and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

2.02 PULL AND JUNCTION BOXES

A. General

   1. All pull and junction boxes shall be UL listed and labeled.

   2. Pull and junction boxes shall not be provided with eccentric or concentric knockouts.

   3. Pull and junction boxes mounted embedded in concrete shall be UL listed for embedment.

   4. Where metallic boxes are used they shall be of all welded construction. Tack welded boxes are not acceptable.
B. Pull Boxes

1. All pull boxes shall be provided with a matching gasketed cover. For covers with dimensions of 24 inches by 24 inches or less, the cover shall be held in place by machine screws. Other screw types are not acceptable. For covers with dimensions greater than 24 inches by 24 inches, the cover shall be hinged and held in place by screw-operated clamp mechanisms. Hinge pins shall be removable. Clamp mechanism material of construction shall match that of the associated box.

2. Pull boxes shall not have any wire terminations inside, other than those for grounding/bonding. A ground bar shall be provided with the necessary number of screw type terminals. Twenty (20) percent of the total amount of terminals otherwise required for the pull box (minimum of two) shall be provided as spare terminations. Boxes requiring any other wire terminations shall be furnished and installed in accordance with the requirements for junction boxes herein.

3. Pull boxes shall be 6 inches wide by 6 inches tall by 4 inches deep, minimum. For applications requiring larger boxes, the box shall be sized in accordance with the fill requirements and dimensional requirements of the NEC.

4. Barriers shall be provided in pull boxes to isolate conductors of different voltages, types, and functions. Barrier material of construction shall match that of the box. Isolation shall be provided between the following groups:
   a. Power wiring
   b. AC control wiring
   c. DC control wiring
   d. Instrumentation wiring

C. Junction and Termination Boxes

1. Junction and termination boxes used for lighting and receptacle circuits only shall be provided with a matching gasketed cover held in place by machine screws. Other screw types are not acceptable.

2. Junction and termination boxes for all uses other than lighting and receptacle circuits shall be provided with a hinged, gasketed cover. Hinge pins shall be removable. Cover shall be held in place by screw-operated clamp mechanisms. Clamp mechanism material of construction shall match that of the associated box.

3. Barriers shall be provided in junction and termination boxes to isolate conductors and terminal blocks of different voltages, types, and functions. Barrier material of construction shall match that of the box. Isolation shall be provided between the following groups:
   a. Power wiring
b. AC control wiring  
c. DC control wiring  
d. Instrumentation wiring  

4. Junction and termination boxes boxes used for lighting and receptacle circuits only shall be allowed to have screw-on (wire nut) type connectors for wire terminations/junctions.  

5. Termination boxes for all uses other than lighting and receptacle circuits shall be provided with terminal strips, consisting the necessary number of screw type terminals. Current carrying parts of the terminal blocks shall be of ample capacity to carry the full load current of the circuits connected, with a 10A minimum capacity. Terminal strips shall be rated for the voltage of the circuits connected. A separate ground bar shall be provided with the necessary number of screw type terminals. Twenty (20) percent of the total amount of terminals otherwise required for the junction box (minimum of two) shall be provided as spare terminations. When barriers are provided within the box, separate terminal strips shall be provided in each barrier area. Terminals shall be lettered and/or numbered to conform to the wiring labeling scheme in place on the project.  

6. Junction boxes shall be 6 inches wide by 6 inches tall by 4 inches deep, minimum. For applications requiring larger boxes, the box shall be sized in accordance with the fill requirements and dimensional requirements of the NEC. Terminal blocks (including spare terminals) shall be considered when sizing the junction box. 

D. Enclosure Types and Materials  

1. In non-hazardous locations, pull and junction boxes shall be furnished with the following enclosure type and material of construction, dependent upon the designation of the area in which they are to be installed. Area designations are indicated on the Drawings.  

<table>
<thead>
<tr>
<th>AREA DESIGNATION</th>
<th>ENCLOSURE TYPE AND MATERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indoor Wet Process Area</td>
<td>NEMA 4X, Type 304 Stainless Steel</td>
</tr>
<tr>
<td>Indoor Dry Process Area</td>
<td>NEMA 12, Painted Steel</td>
</tr>
<tr>
<td>Indoor Dry Non-process Area</td>
<td>NEMA 1, Painted Steel</td>
</tr>
<tr>
<td>Indoor Type 1 Chemical Storage/Transfer Area</td>
<td>NEMA 4X, Fiberglass or PVC</td>
</tr>
<tr>
<td>Indoor Type 2 Chemical Storage/Transfer Area</td>
<td>NEMA 4X, Type 304 Stainless Steel</td>
</tr>
<tr>
<td>Outdoor Chemical Containment Area</td>
<td>NEMA 4X, Fiberglass or PVC</td>
</tr>
<tr>
<td>All Other Outdoor Areas</td>
<td>NEMA 4X, Type 304 Stainless Steel</td>
</tr>
</tbody>
</table>

2. In hazardous locations, pull and junction boxes shall be furnished with the following enclosure type and material of construction, dependent upon the classification of the area in which they are to be installed. Area classifications are indicated on the Drawings.
AREA CLASSIFICATION | ENCLOSURE TYPE AND MATERIAL
--- | ---
Class 1, Division 1, Group D | NEMA 7, Die Cast Aluminum
Class 1, Division 2, Group D | NEMA 4X, Type 304 Stainless Steel

3. Non-metallic enclosures, NEMA 7 enclosures, and NEMA 9 enclosures shall be provided with threaded integral conduit hubs.

2.03 OUTLET BOXES

A. General

1. Outlet boxes shall be provided with a trim appropriate for the wiring device installed inside. Reference Section 16141, Wiring Devices, for outlet box trim requirements. An appropriate outlet box trim is required to achieve the NEMA rating of the outlet boxes as specified herein.

B. Surface Mount Outlet Boxes

1. Outlet boxes shall be the deep type, no less than 2.5 inches deep.

2. Outlet boxes shall be provided in single or multi-gang configuration as required, sized in accordance with the requirements of the NEC.

3. In non-hazardous locations, outlet boxes shall be furnished with the following enclosure type and material of construction, dependent upon the designation of the area in which they are to be installed. Area designations are indicated on the Drawings.

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<thead>
<tr>
<th>AREA DESIGNATION</th>
<th>ENCLOSURE TYPE AND MATERIAL</th>
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<td>Indoor Type 1 Chemical Storage/Transfer Area</td>
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<td>Indoor Type 2 Chemical Storage/Transfer Area</td>
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<td>Outdoor Chemical Containment Area</td>
<td>NEMA 4X, PVC</td>
</tr>
<tr>
<td>All Other Outdoor Areas</td>
<td>NEMA 4X, Cast Aluminum</td>
</tr>
</tbody>
</table>

4. In hazardous locations, outlet boxes shall be furnished with the following enclosure type and material of construction, dependent upon the classification of the area in which they are to be installed. Area classifications are indicated on the Drawings.

<table>
<thead>
<tr>
<th>AREA CLASSIFICATION</th>
<th>ENCLOSURE TYPE AND MATERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1, Division 1, Group D</td>
<td>NEMA 7, Die Cast Aluminum</td>
</tr>
<tr>
<td>Class 1, Division 2, Group D</td>
<td>NEMA 4X, Cast Aluminum; NEMA 7, Die Cast Aluminum</td>
</tr>
</tbody>
</table>
5. Outlet boxes shall be provided with integral threaded conduit hubs mounted external to the box. Boxes with threaded conduit hubs mounted internal to the box or as a part of the box wall are not acceptable.

C. Flush Mount Outlet Boxes

1. Outlet boxes shall be no less than 2-1/8 inches deep, and 4-11/16 inches square. Boxes shall be UL listed and labeled. Pre-punched single diameter conduit knockouts are acceptable, however, concentric and eccentric knockouts are not acceptable.

2. Outlet boxes mounted flush in CMU walls shall be made of galvanized, tack welded steel, and suitable for installation in masonry walls. Sectional type boxes are not acceptable for this application.

3. Outlet boxes mounted flush in gypsum walls shall be made of galvanized pressed steel. Tack welded boxes are not acceptable for this application. Sectional type boxes are not acceptable for this application.

4. Outlet boxes mounted cast into concrete shall be concrete tight, and shall be made of galvanized steel or PVC.

PART 3 -- EXECUTION

3.01 INSTALLATION

A. Pull and Junction Boxes

1. Pull boxes and junction boxes shall be solidly attached to structural members prior to installation of conduit and set true and plumb. Boxes shall not be supported by their associated conduits.

2. Wooden plugs are not permitted for securing boxes to concrete. Appropriately rated anchors specifically suited for use in concrete shall be used.

3. Box penetrations for conduits shall be made with a punch tool, and penetrations shall be of the size required for the conduit entry and/or hub. Oversized penetrations in boxes are not acceptable.

4. Watertight conduit hubs shall be provided for boxes where a NEMA 4X enclosure rating is specified. Reference Section 16111, Conduit, for conduit hub requirements.

5. Pull and junction boxes may be installed flush mounted in gypsum, concrete or CMU walls where appropriate provided that covers are easily removed or opened.

6. Pull and junction boxes shall be provided in the enclosure type and material of construction required for the area in which it is installed. Reference the requirements in Part 2 herein, and the area designations indicated on the Drawings.
B. Outlet Boxes

1. Outlet boxes shall be solidly attached to structural members prior to installation of conduit and set true and plumb. Boxes shall not be supported by their associated conduits.

2. Wooden plugs are not permitted for securing boxes to concrete. Appropriately rated anchors specifically suited for use in concrete shall be used.

3. Flush mounted outlet boxes shall be arranged and located so that tile and grout lines fit closely around the boxes, and so placed that the cover or device plate shall fit flush to the finished wall surface.

4. Outlet boxes shall be flush mounted in finished areas and other areas where practical. Flush mounted outlet boxes shall not be installed in hazardous areas and type 1 or 2 chemical storage/transfer areas.

5. For the below-named items, mounting heights from finished floor, or finished grade to top is applicable, depending on the type of wiring device to be installed in the outlet box. Mounting heights for outlet boxes shall be as follows, unless otherwise specified herein, indicated on the Drawings, or required by the Americans with Disability Act (ADA):
   
a. Light switches and wall mounted occupancy sensors, 48 inches
   b. Receptacles in indoor dry process/non-process areas, 16 inches
   c. Receptacles in indoor wet process areas and all indoor chemical storage/transfer areas, 48 inches
   d. Receptacles in outdoor locations, 24 inches
   e. Ceiling mounted occupancy sensors, as indicated on the Drawings

6. Outlet boxes shall be provided in the material of construction required for the area in which it is installed. Reference the requirements in Part 2 herein, and the area designations indicated on the Drawings.

- END OF SECTION -
PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install grounding systems complete in accordance with the minimum requirements established by Article 250 of the NEC. Article 250 of the NEC shall be considered a minimum requirement for compliance with the Specification.

B. Grounding of all instrumentation and control systems shall be furnished and installed in accordance with the manufacturer/system requirements and IEEE 1100. Conflicts shall be promptly brought to the attention of the Engineer.

C. In addition to the NEC requirements, newly constructed building structural steel columns and metallic chemical storage tanks shall be permanently and effectively grounded.

D. Reference Section 16000, Basic Electrical Requirements

1.02 CODES AND STANDARDS

A. Equipment and materials covered under this Section shall be designed, manufactured, and/or listed to the following standards as applicable:

1. UL 467 – Grounding and Bonding Equipment


3. IEEE 1100 – Recommended Practice for Power and Grounding Electronic Equipment

1.03 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings

2. Reports of certified field tests.

B. Each submittal shall be identified by the applicable specification section.
1.04 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:
   1. Product data sheets.
   2. Drawings and written description of how the Contractor intends to furnish and install the grounding system.

PART 2 -- PRODUCTS

2.01 MANUFACTURERS

A. The equipment covered by these specifications shall be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed, and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

2.02 GROUND RODS AND GRID

A. Ground rods shall be rolled to a commercially round shape from a welded copper-clad steel manufactured by the molten-welding process or by the electro-formed process (molecularly bonded). They shall have an ultimate tensile strength of 75,000 pounds per square inch (psi) and an elastic limit of 49,000 psi. The rods shall be not less than 3/4 inch in diameter by 10 feet in length; and the proportion of copper shall be uniform throughout the length of the rod. The copper shall have a minimum wall thickness of 0.010 inch at any point on the rod. Ground rods shall be UL 467 listed. The ground rods shall be manufactured by Erico Products, Blackburn, or equal.

B. Except where specifically indicated otherwise, all exposed non current-carrying metallic parts of electrical equipment and metallic raceway systems shall be grounded.

C. The system ground shall connect to the main service equipment and shall be extended to a ground grid surrounding the structure.

D. A grounded conductor (neutral) bonding jumper shall be installed in only one location for each service or separately derived system. The bonding jumper shall be located at the source or the first immediate distribution point (e.g. service disconnect) downstream from the source. The neutral and ground buses shall be kept isolated from each other except where the bonding jumper is installed.
E. Where ground fault protection is employed, care shall be taken so that the connection of
the ground and neutral does not interfere with the correct operation of the ground fault
protection system.

F. The metallic water service shall be connected to the grounding system at its point of
entrance to the structure. Connection to the water pipe shall be made by a suitable ground
clamp or lug connection to a plugged tee. If flanged pipes are encountered, connection
shall be made with the lug bolted to the street side of the flanged connection.

2.03 FITTINGS

A. Grounding connections to equipment shall be bolted. Cable end connections shall be
made by hydraulic crimp or exothermically welded. Split bolt type connectors are not
acceptable. Fittings shall be UL 467 listed.

2.04 EQUIPMENT GROUNDING CONDUCTORS

A. An insulated equipment grounding conductor shall be furnished and installed for all
alternating current (AC) circuits. Insulation shall be of the same type as the ungrounded
conductors in the raceway and shall be green in color. Equipment grounding conductors
shall be furnished and installed in all conduits with AC power and control circuits and shall
be sized per NEC Article 250. Conduits and other methods approved by the NEC as
suitable for equipment grounding conductors are not acceptable.

2.05 SYSTEM GROUND CONDUCTOR

A. Unless otherwise specified, equipment casings and structural building steel shall be
connected to the System ground or ground grid by a System Ground Conductor. The
System Ground Conductor shall be soft-drawn, bare annealed copper, concentric
stranded, as specified. The minimum sizes shall be as follows, where American Wire Gage
(AWG) conductor sizes are not shown or specified on the Drawings:

1. 5 and 15 kV switchgear 4/0 AWG
2. 5 kV-480V transformers 4/0 AWG
3. 480V switchgear 2/0 AWG
4. 480V switchboards 2/0 AWG
5. 480V MCC 2/0 AWG
6. Large motors 250 hp & > 2/0 AWG
7. Lighting & Power panels 2 AWG
8. Exposed metal cabinets 2 AWG
9. Electrical equipment 2 AWG
10. Buildings and enclosure 2 AWG
11. Fences and gates 2 AWG

12. Motors 25 hp to 250 hp 2 AWG

B. For all control panels, disconnect switches, and other electrical enclosures, equipment grounds and bonding jumpers shall be terminated individually on a ground bar or mechanical lugs. No wire nuts will be permitted.

2.06 EXOTHERMIC WELDS

A. All exothermic welding shall be completed per welding kit manufacturer’s instructions. Exothermic welds shall be CadWeld by Erico or ThermoWeld.

PART 3 -- EXECUTION

3.01 INSTALLATION

A. Metal surfaces where grounding connections are to be made shall be clean and dry. Steel surfaces shall be ground or filed to remove all scale, rust, grease, and dirt. Copper and galvanized steel shall be cleaned with emery cloth to remove oxide before making connections.

B. Ground Grid

1. A main ground grid shall be provided if required and as shown on the Drawings. Ground rods shall be driven straight down into the earth or, if objects are encountered, at an angle to avoid the obstruction.

2. The ground rods shall be interconnected by the use of copper cable exothermically welded to the rods. For newly constructed structures, the grounding cables shall be installed after the excavations for the building have been completed and prior to the pouring of concrete for the footings, mats, etc. Copper "pigtails" shall be connected to the ground grid and shall enter the buildings and structure from the outside and shall be connected to steel structures, and equipment as described in this Section and as required to provide a complete grounding system. The copper pigtails shall be exothermically welded to the ground grid, and connected to building reinforcement steel by hydraulic crimp.

3. Grounding conductors shall be continuous between points of connection; splices are not be permitted.

4. Where conductors are exposed and subject to damage from personnel, traffic, etc., conductors shall be installed in metal raceway. The raceway shall be bonded to the grounding system.

5. Where subsurface conditions do not permit use of driven ground rods to obtain proper ground resistance, rods shall be installed in a trench or plate electrodes shall be provided, as applicable and necessary to obtain proper values of resistance.
6. Buried exothermic welds and ground ring shall not be backfilled until inspected by Engineer.

C. Raceways

1. Conduit which enters equipment such as switchgear, motor control centers, transformers, panelboards, variable frequency drives, instrument and control panels, and similar equipment shall be bonded to the ground bus or ground lug, where provided, and as otherwise required by the NEC.

3.02 TESTING

A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Witnessed Shop Tests
   a. None required.

2. Field Tests
   a. Field testing shall be done in accordance with the requirements specified in the General Conditions, Division 1, and NETA Acceptance Testing Specifications, latest edition.
   b. Fall of potential tests shall be performed on the ground grid per IEEE81 recommendations by a third party, independent testing firm. A fall of potential plot shall be submitted at the conclusion of testing for Engineer review. Documentation indicating the location of the rod and grounding system as well as the resistance and soil conditions at the time the measurements were made shall be submitted. Testing shall show that the ground grid has 5 ohms resistance or less. Due to soil conditions and/or unforeseen field conditions, ground resistances greater than 5 ohms may be acceptable if specifically approved in writing by the Engineer. Ground resistance measurements shall be made in normally dry weather not less than 48 hours after rainfall and with the ground grid under test isolated from other grounds.
   c. Continuity tests for the grounding electrode conductor shall be performed. Test will be accepted when a resistance of less than 1 ohm is shown for this conductor.

- END OF SECTION -
SECTION 16190
SUPPORTING DEVICES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install structural supports for mounting and installing all conduit, electrical equipment, lighting, alarm systems, instrumentation, and communications equipment furnished under this Contract.

B. Equipment shall be installed strictly in accordance with recommendations of the manufacturer and best practices of the trade resulting in a complete, operable, and safe installation. The Contractor shall obtain written installation manuals from the equipment manufacturer prior to installation.

C. Reference Section 16000, Basic Electrical Requirements.

1.02 CODES AND STANDARDS

A. Equipment and materials covered under this Section shall be designed, manufactured, and/or listed to the following standards as applicable:


1.03 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop drawings

2. Structural support calculations (if required)

B. Each submittal shall be identified by the applicable Specification section.
1.04 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal. Contractor shall provide copies of submittals in Portable Document Format (PDF) copies before and after Owner or Engineer reviews and revises.

C. Shop drawings shall include but not be limited to:

1. Product data sheets.
2. Complete assembly, layout, installation, and foundation drawings with clearly marked dimensions.

PART 2 -- PRODUCTS

2.01 MANUFACTURERS

A. The equipment covered by this Specification is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed, and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

2.02 MATERIALS

A. Support channel shall be 1-5/8" by 1-5/8" minimum, with 12 gage material thickness.

B. Support channel, support channel fittings, and threaded rod shall be furnished with the following material of construction, dependent upon the designation of the area in which they are to be installed. Area designations are indicated on the Drawings.

<table>
<thead>
<tr>
<th>AREA DESIGNATION</th>
<th>MATERIAL OF CONSTRUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indoor Wet Process Area</td>
<td>Type 304 Stainless Steel</td>
</tr>
<tr>
<td>Indoor Dry Process Area</td>
<td>Type 304 Stainless Steel</td>
</tr>
<tr>
<td>Indoor Dry Non-process Area</td>
<td>Type 304 Stainless Steel</td>
</tr>
<tr>
<td>Indoor Type 1 Chemical Storage/Transfer Area</td>
<td>Fiberglass</td>
</tr>
<tr>
<td>Indoor Type 2 Chemical Storage/Transfer Area</td>
<td>Type 304 Stainless Steel</td>
</tr>
<tr>
<td>Outdoor Chemical Containment Area</td>
<td>Fiberglass</td>
</tr>
<tr>
<td>All Other Outdoor Areas</td>
<td>Type 304 Stainless Steel</td>
</tr>
<tr>
<td>All Hazardous Areas</td>
<td>Type 304 Stainless Steel</td>
</tr>
</tbody>
</table>
C. Fastening hardware (bolts, nuts, washers, and screws) shall be furnished with the following material of construction, dependent upon the designation of the area in which they are to be installed. Area designations are indicated on the Drawings.

<table>
<thead>
<tr>
<th>AREA DESIGNATION</th>
<th>MATERIAL OF CONSTRUCTION</th>
</tr>
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</tr>
<tr>
<td>All Hazardous Areas</td>
<td>Type 304 Stainless Steel</td>
</tr>
</tbody>
</table>

PART 3 -- EXECUTION

3.01 INSTALLATION

A. Concrete or Masonry Inserts

1. The Contractor shall be responsible for the furnishing and installation of all anchor bolts, masonry inserts, and similar devices required for installation of equipment furnished under this Contract.

2. If a time delay for the arrival of any special inserts or equipment drawings, etc. occurs, the Contractor may, if permitted by the Engineer, make arrangements for providing approved recesses and openings in the concrete or masonry and, upon subsequent installation, the Contractor shall be responsible for filling in such recesses and openings. Any additional costs that may be incurred by this procedure shall be borne by the Contractor.

3. The Contractor shall furnish leveling channels for all switchgear, switchboards, motor control centers, and similar floor mounted equipment. The leveling channels shall be provided for embedment in the equipment housekeeping pads. Coordination of the installation of these channels with the concrete pad is essential and required. Pad height shall be as required to maintain concrete coverage of the reinforcement bars while not causing associated equipment to exceed the maximum mounting height requirements of the NEC.

B. Support Fastening and Locations

1. All equipment fastenings to columns, steel beams, and trusses shall be by beam clamps or welded. No holes shall be drilled in the steel.

2. All holes made in reflected ceilings for support rods, conduits, and other equipment shall be made adjacent to ceiling grid bars where possible, to facilitate removal of ceiling panels.
3. Support channel shall be provided wherever required for the support of starters, switches, panels, and miscellaneous equipment.

4. All equipment, devices, and raceways that are installed on the dry side of a water bearing wall shall not be installed directly onto the wall. Support channel shall be used to allow ventilation air to pass behind the equipment, devices, or raceway.

5. All supports shall be rigidly bolted together and braced to make a substantial supporting framework. Where possible, control equipment shall be grouped together and mounted on a single framework.

6. Aluminum support members shall not be installed in direct contact with concrete. Stainless steel or non-metallic "spacers" shall be used to prevent contact of aluminum with concrete.

7. Actual designs for supporting framework should take the nature of a picture frame of support channels and bracket with a plate for mounting the components. The Contractor is responsible for the design of supporting structure; he shall submit design details to the Engineer for acceptance before proceeding with the fabrication.

8. Wherever dissimilar metals come into contact, the Contractor shall isolate these metals as required with neoprene washers, nine (9) mil polyethylene tape, or gaskets.

9. For all installations where fiberglass supporting materials are required, the Contractor shall submit structural calculations and the details of the proposed system of support. Structural calculations shall be signed and sealed by a registered professional engineer in the California.

10. For the following installations where conduits are provided with a support system suspended from the above or attached to a vertical structure, the Contractor shall submit structural calculations and details of the proposed system of support. Structural calculations shall be signed and sealed by a registered professional engineer in the California.

   a. A quantity of twelve (12) or more conduits trade size 1” and smaller are proposed for a conduit support rack.

   b. A quantity of eight (8) or more conduits trade sizes 1 ½” to 2 1/2” are proposed for a conduit support rack.

   c. A quantity of four (4) or more conduits trade sizes 3” and larger are proposed for a conduit support rack.

11. Single conduits installed exposed along walls and ceilings shall be secured to the wall or ceiling with a one-hole conduit clamp and clamp-back. Where multiple conduits are installed exposed together, support channel and conduit clamps shall be used.

- END OF SECTION -
SECTION 16195

ELECTRICAL - IDENTIFICATION

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. All electrical equipment shall be properly identified in accordance with these Specifications and the Contract Drawings. All switchgear, switchboards, motor control centers, variable frequency drives, lighting and distribution panelboards, combination starters, control panels, pull and junction boxes, enclosures, disconnect switches, control stations, and similar equipment shall be identified in the manner described, or in an equally approved manner.

B. The types of electrical identification specified in this section include, but are not limited to, the following:

1. Operational instructions and warnings.
2. Danger signs.
3. Equipment/system identification signs.

1.02 SIGNS

A. "DANGER-HIGH-VOLTAGE" signs shall be securely mounted on the entry doors of all electrical rooms.

1.03 LETTERING AND GRAPHICS

A. The Contractor shall coordinate names, abbreviations, and other designations used in the electrical identification work with the corresponding designations shown, specified or scheduled. Provide numbers, lettering, and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of the electrical systems and equipment.

1.04 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the equipment manufacturer and submit shop drawings. Each submittal shall be identified by the applicable specification section.
1.05 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. Product data sheets.

PART 2 -- PRODUCTS

2.01 MANUFACTURERS

A. The material covered by these Specifications is intended to be standard material of proven performance as manufactured by reputable concerns. Material shall be fabricated, constructed, and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as specified herein and shown on the Drawings.

2.02 NAMEPLATES

A. Nameplates shall be engraved, high pressure plastic laminate, white with black lettering.

B. Nameplates shall be attached to NEMA 4X enclosures utilizing UL-recognized mounting kits designed to maintain the overall UL Type rating of the enclosure. Mounting kit fasteners shall be stainless steel Type AHK10324X as manufactured by Hoffman, or equal.

2.03 HIGH VOLTAGE SIGNS

A. Standard "DANGER" signs shall be of baked enamel finish on 20 gage steel; of standard red, black and white graphics; 14 inches by 10 inches size except where 10 inches by 7 inches is the largest size which can be applied where needed, and except where a larger size is needed for adequate identification.

2.04 CONDUIT IDENTIFICATION

A. Conduit identification shall be as specified in Section 16111, Conduit.

2.05 WIRE AND CABLE IDENTIFICATION

A. Field installed wire and cable identification shall be as specified in Section 16123 and Low Voltage Wire and Cable.

B. A plastic laminate nameplate shall be provided at each panelboard, motor control center, switchgear assembly, and switchboard assembly. This nameplate shall be used to clearly
convey the conductor identification means used at that piece of equipment (i.e. Phase A=Brown, Phase B=Orange, C = Yellow).

C. Wiring identification for factory installed wiring in equipment enclosures shall be as specified in the respective section.

2.06 BOX IDENTIFICATION

A. Pull, junction and device box identification shall be as specified in Section 16130 – Boxes.

PART 3 -- EXECUTION

3.01 NAMEPLATES

A. Nameplates shall be attached to the equipment enclosures with (2) two stainless steel sheet metal screws for nameplates up to 2-inches wide. For nameplates over 2-inches wide, four (4) stainless steel sheet metal screws shall be used, one (1) in each corner of the nameplate. The utilization of adhesives is not permitted.

3.02 OPERATIONAL IDENTIFICATION AND WARNINGS

A. Wherever reasonably required to ensure safe and efficient operation and maintenance of the electrical systems and electrically connected mechanical systems and general systems and equipment, including prevention of misuse of electrical facilities by unauthorized personnel, install plastic signs or similar equivalent identification, instruction, or warnings on switches, outlets, and other controls, devices, and covers or electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for the intended purposes. Signs shall be attached as specified above for nameplates.

3.03 POWER SOURCE IDENTIFICATION

A. After installation of all field equipment (i.e. valves, motors, fans, unit heaters, instruments, etc) install nameplates at each power termination for the field equipment. Nameplate data shall include equipment designation (tag number), power source (MCC number, panelboard, etc), circuit number, conduit number from schedule and voltage/phase.

B. Contractor to coordinate with the Engineer and the Owner regarding exact nameplate placement during construction.

C. Nameplates shall be as specified herein.

- END OF SECTION -
SECTION 16481

INDIVIDUAL MOTOR CONTROLLERS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install separately mounted, individual motor controllers for 120 volt single phase, and 208 and 480 volt three phase motors as specified herein and indicated on the Drawings. Individual motor controllers specified in this Section include magnetic motor starters and manual motor starters.

B. Reference Section 16000, Basic Electrical Requirements; Section 16123, Low Voltage Cable; Section 16195, Electrical Identification; and Section 16902, Electric Controls and Relays.

1.02 CODES AND STANDARDS

A. Individual motor controllers shall be designed, manufactured, and/or listed to the following standards as applicable:

1. UL 508 – Standard for Industrial Control Panels

2. NEMA 250 – Enclosures for Electrical Equipment

1.03 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings.

2. Spare Parts.

3. Reports of Certified Shop and Field Tests.

4. Operation and Maintenance Manuals.

5. Manufacturer's Field Startup Report.

6. Manufacturer's Representatives Installation Certification.

B. Each submittal shall be identified by the applicable specification section.
1.04  SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. A Compliance, Deviations, and Exceptions (CD&E) letter. If the shop drawings are submitted without this CD&E letter, the submittal will be rejected. The letter shall include all comments, deviations and exceptions taken to the Drawings and Specifications by the Contractor AND Equipment Manufacturer/Supplier. This letter shall include a copy of this specification section. In the left margin beside each and every paragraph/item, a letter "C", "D", or "E" shall be typed or written in. The letter "C" shall be for full compliance with the requirement. The letter "D" shall be for a deviation from the requirement. The letter "E" shall be for taking exception to a requirement. Any requirements with the letter "D" or "E" beside them shall be provided with a full typewritten explanation of the deviation/exception. Handwritten explanation of the deviations/exceptions is not acceptable. The CD&E letter shall also address deviations, and exceptions taken to each Drawing related to this Specification Section.

2. Product data sheets.

3. Complete layout and installation drawings with clearly marked dimensions for each type/size/rating of individual motor controller. For RVSS starters, in free-standing enclosures, show conduit stub-up area locations on the Drawings.

4. Custom wiring diagrams for each individual motor controller. Standard wiring diagrams that are not custom created by the manufacturer for the individual motor controllers for this project are not acceptable. One wiring diagram which is typical for an equipment group (e.g. sump pump) is not acceptable. Each wiring diagram shall include wire identification and terminal numbers. Indicate all devices, regardless of their physical location, on the diagrams. Identify on each respective wiring diagram specific equipment names and equipment numbers consistent with those indicated on the Drawings.

5. Bill of material list for each individual motor controller.

6. Nameplate schedule for each individual motor controller.

7. Manufacturer’s installation instructions.

8. Time-current curves for each type and size protective device if requested by the Engineer.

9. Approximate total shipping weight of each RVSS.
D. The shop drawing information shall be complete and organized in such a way that the Engineer can determine if the requirements of these Specifications are being met. Copies of technical bulletins, technical data sheets from "soft-cover" catalogs, and similar information which is "highlighted" or somehow identifies the specific equipment items that the Contractor intends to provide are acceptable and shall be submitted.

E. Prior to completion and final acceptance of the project, the Contractor shall furnish and install "as-built" wiring diagrams for individual motor controller. These final drawings shall be plastic laminated and securely placed inside each individual motor controller unit door and included in the O&M manuals.

1.05 OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall submit operation and maintenance manuals in accordance with the procedures and requirements set forth in the General Conditions and Division 1.

1.06 SPARE PARTS

A. All spare parts as recommended by the equipment manufacturer shall be furnished to the Owner by the Contractor. The Contractor shall furnish the following additional spare parts:

1. One (1) solid state overload relay for each type, size, and rating used.

2. One (1) motor circuit protector & motor contactor for each type, size, and rating used.

3. One (1) spare control power transformer for each type and size used.

4. Two (2) spare fuses for each size and type used.

B. The spare parts shall be packed in containers suitable for long term storage, bearing labels clearly designating the contents and the pieces of equipment for which they are intended.

C. Spare parts shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such spare parts until completion of the work, at which time they shall be delivered to the Owner.

D. Spare parts lists, included with the shop drawing submittal, shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.

E. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size, shall have the same parts number.

1.07 IDENTIFICATION

A. Each equipment item shall be identified with a nameplate. The nameplate shall be engraved with the equipment name and/or number with which it is associated. Equipment identification shall be in accordance with Section 16195, Electrical - Identification.
PART 2 -- PRODUCTS

2.01 MANUFACTURERS

A. The equipment covered by this Specification is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

2.02 INDIVIDUAL MAGNETIC MOTOR STARTERS

A. Individual magnetic motor starters shall be combination type complete with motor circuit protectors (MCP's). Starters shall be rated 480 VAC, 3-pole, sized for the intended load unless otherwise indicated. In no case shall a starter smaller than a NEMA Size 1 be used. Each starter shall be furnished with a minimum of two spare auxiliary contacts.

B. In non-hazardous locations, motor starters shall be furnished with the following enclosure type and material of construction, dependent upon the designation of the area in which they are to be installed. Area designations are indicated on the Drawings.

<table>
<thead>
<tr>
<th>AREA DESIGNATION</th>
<th>ENCLOSURE TYPE AND MATERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indoor Wet Process Area</td>
<td>NEMA 4X, Type 304 Stainless Steel</td>
</tr>
<tr>
<td>Indoor Dry Process Area</td>
<td>NEMA 12, Painted Steel</td>
</tr>
<tr>
<td>Indoor Dry Non-process Area</td>
<td>NEMA 1, Painted Steel</td>
</tr>
<tr>
<td>Indoor Type 1 Chemical Storage/Transfer Area</td>
<td>NEMA 4X, Fiberglass</td>
</tr>
<tr>
<td>Indoor Type 2 Chemical Storage/Transfer Area</td>
<td>NEMA 4X, Type 304 Stainless Steel</td>
</tr>
<tr>
<td>All Outdoor Areas</td>
<td>NEMA 4X, Type 304 Stainless Steel</td>
</tr>
</tbody>
</table>

C. In hazardous locations, motor starters shall be furnished with the following enclosure type and material of construction, dependent upon the classification of the area in which they are to be installed. Area classifications are indicated on the Drawings.

<table>
<thead>
<tr>
<th>AREA CLASSIFICATION</th>
<th>ENCLOSURE TYPE AND MATERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1, Division 1, Group D</td>
<td>NEMA 7, Die Cast Aluminum</td>
</tr>
<tr>
<td>Class 1, Division 2, Group D</td>
<td>NEMA 7, Die Cast Aluminum</td>
</tr>
<tr>
<td>Class 2, Division 1, Group F</td>
<td>NEMA 9, Die Cast Aluminum</td>
</tr>
<tr>
<td>Class 2, Division 2, Group F</td>
<td>NEMA 9, Die Cast Aluminum</td>
</tr>
</tbody>
</table>

D. Starters shall be provided with all coils and controls for 120 VAC operation, unless otherwise indicated on the Drawings.
E. The motor controller manufacturer is advised to review the total Contract Documents for additional requirements for space heaters, power factor correction capacitors, and similar equipment which may not be specified in this Division or shown on the Drawings. Control power transformers shall be fused on both the primary and secondary sides. The minimum control power transformer VA requirements are as shown below. Control power transformers shall be sized as required for the connected loads, plus 25% spare capacity.

<table>
<thead>
<tr>
<th>Size</th>
<th>VA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1-150 VA</td>
</tr>
<tr>
<td>2</td>
<td>150 VA</td>
</tr>
<tr>
<td>3</td>
<td>200 VA</td>
</tr>
<tr>
<td>4</td>
<td>300 VA</td>
</tr>
<tr>
<td>5</td>
<td>500 VA</td>
</tr>
</tbody>
</table>

F. Each starter shall be supplied with a manual reset overload relay. Manual reset shall be accomplished by a door mounted overload reset pushbutton. The relays shall be solid state type, with at least one isolated normally open and one isolated normally closed auxiliary contact that operates when a trip condition has occurred. Relays shall be self-powered, have a visible trip indicator, have a trip test function, and have selectable Class 10 or 20 operation. Overload relays shall be set for Class 10 operation unless otherwise directed by the Engineer. Overload relay shall have phase loss protection built in to trip the unit and protect the motor against single phasing. The Contractor shall provide the overload relay model with the correct current range for each application. Overload relay shall have adjustable current range dial. Eutectic alloy and bi-metallic type overload relays are not acceptable.

G. Control Devices

1. Furnish and install control devices as required and/or shown on the Drawings. The following control devices shall be provided as specified in Section 16902, Electric Controls and Relays:
   a. Pilot devices (switches, indicating lights, etc.)
   b. Relays and timers
   c. Control Terminal blocks

H. All control wiring shall be No. 14 AWG (minimum) labeled at each end in accordance with the wiring numbers shown on the accepted shop drawings. Power wiring shall be sized to suit the maximum horsepower rating of unit; No. 12 AWG (minimum). Wiring shall be type MTW rated for 105ºC. Wire color coding shall be as specified in Section 16123, Low Voltage Cable.

I. Each motor starter coil shall be equipped with a surge-suppression device for protection of the solid state equipment (e.g. programmable logic controller) wired as part of the control circuit.

J. Individual magnetic motor starters shall be as manufactured by Eaton using NEMA rated Freedom Series starters and contactors, the General Electric Company equivalent, the Square D Company equivalent, or Siemens Energy & Automation, Inc. equivalent.
2.03 INDIVIDUAL MANUAL MOTOR STARTERS

A. Individual manual motor starters in enclosures as specified above shall be furnished and installed for outdoor and indoor exposed work. Furnish and install manual motor starters in outlet boxes with flush wall plates as required for concealed work.

B. Furnish and install manual motor starters with pilot lights and overload heater elements of correct rating based on motor nameplate data.

C. Manual motor starters shall be equipped with either a push button or toggle operator with reset device or mechanism accessible without opening the enclosure.

D. Individual manual motor starters for motors one (1) horsepower and less shall be Eaton Type MS, the General Electric Company equivalent, the Square D Company equivalent, Allen-Bradley equivalent, or Siemens Energy & Automation, Inc. equivalent.

E. Individual manual motor starters for integral horsepower motors shall be Eaton Type B100 or B101, the General Electric Company equivalents, the Square D Company equivalents, Allen-Bradley equivalent, or Siemens Energy and Automation, Inc. equivalents.

2.04 NOT USED

PART 3 -- EXECUTION

3.01 INSTALLATION

A. All individual motor starters shall be installed as indicated on the Drawings and as recommended by the equipment manufacturer.

B. Individual motor starters shall be provided in the enclosure type and material of construction required for the area in which it is installed. Reference the requirements in Part 2 herein, and the area designations indicated on the Drawings.

3.02 TESTING

A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Witnessed Shop Tests
   a. None required.

2. Field Tests
   a. Field testing shall be done in accordance with the requirements specified in the General Conditions, Division 1, and NETA acceptance testing specifications, latest edition.

3.03 SERVICES OF MANUFACTURER'S REPRESENTATIVE
A. The Contractor shall provide the services of a qualified manufacturer's factory-trained technical representative who shall adequately supervise the installation and startup of the RVSS equipment furnished under this Contract. The manufacturer's representative shall certify in writing that the equipment has been installed in accordance with the manufacturer's recommendations. No further testing or equipment startup may take place until this certification is accepted by the Owner.

B. The manufacturer's technical representative shall perform all startup and field acceptance testing as specified herein.

C. The Contractor shall provide training for the Owner's personnel. Training shall be conducted by the manufacturer's factory-trained representative who shall instruct Owner's personnel in operation and maintenance of all equipment provided under this Section. Training shall be provided for two (2) sessions of two (2) hours each. Training shall not take place until after the motor controllers have been installed and tested. Training shall be conducted at times coordinated with the Owner.

D. The services of the manufacturer's representative shall be provided for a period of not less than as follows:

1. One (1) trip of two (2) working days during installation of the motor controllers.

2. One (1) trip of two (2) working days to perform startup and field acceptance testing of the motor controllers.

3. One (1) trip of one (1) working day two (2) months before the warranty expiration to identify any issues to be corrected under warranty.

4. One (1) trip of one (1) working day to perform training as specified herein.

E. Any additional time required to achieve successful installation and operation shall be at the expense of the Contractor.

- END OF SECTION -
SECTION 16500

LIGHTING

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install all lighting fixtures, labor, and material, in accordance with the preceding Specifications, the requirements of this Section, and as shown on the Drawings.

B. Lighting shall be in accordance with the latest requirements of the Illuminating Engineering Society, and all lighting fixtures shall have the Underwriters Laboratories, Inc. label of approval.

C. All wiring shall be placed in conduit and shall comply with the Specifications for conduit, outlet boxes, pull and junction boxes, wires and cables, grounding, and other Sections as set forth in these Specifications and as noted herein.

D. Reference Section 16000, Basic Electrical Requirements, and Section 16170, Grounding and Bonding.

1.02 CODES AND STANDARDS

A. The equipment specified herein shall comply with the following codes and standards, where applicable.

1. Underwriter’s Laboratories, Inc. (UL):
   a. UL 924 – Emergency Lighting and Power Equipment
   b. UL 935 – Fluorescent Lamp Ballasts
   c. UL 844 – Luminaires for Use in Hazardous (Classified) Locations
   d. UL 1029 – High Intensity Discharge Lamp Ballasts
   e. UL 1598 – Luminaires

   a. ANSI C82.11 – High Frequency Fluorescent Lamp Ballasts
   b. ANSI C82.77 – Lighting Equipment - Voltage Surge Requirements

1.03 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings
2. Operation and Maintenance Manuals
3. Spare Parts Lists

B. Each submittal shall be identified by the applicable specification section.

1.04 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete or illegible submittals will be returned to the Contractor for resubmittal without review.

C. Shop drawings shall include but not be limited to:

1. Product data sheets.
2. Catalog cuts for each fixture type showing performance and construction details of standard fixtures, and complete working drawings showing all proposed construction details of special or modified standard fixtures.
3. Photometric curves.
4. Lamp and LED data including efficiency (Efficacy lumens/watt) information.
5. Ballast and LED Driver information
6. Catalog data including applicable coefficients of utilization tables, isolux chart of illumination on a horizontal plane, beam efficiency, horizontal and vertical beam spread, and beam lumens.
7. Manufacturer’s warranty information
8. Custom wiring diagrams for each individual lighting contactor. Standard wiring diagrams that are not custom created by the manufacturer for the individual lighting contactors for this project are not acceptable. One wiring diagram which is typical for all lighting contactors is not acceptable. Each wiring diagram shall include wire identification and terminal numbers. Indicate all devices, regardless of their physical location, on the diagrams. Identify on each respective wiring diagram specific equipment names and equipment numbers consistent with those indicated on the Drawings.
D. Shop drawings shall be submitted to the Engineer for review and acceptance for all fixtures before fixtures and poles are manufactured. Substitutions will be permitted only if acceptable to the Engineer.

E. Manufacturer's catalog number and description in the fixture schedule on the Contract Documents establishes a level of quality, style, finish, etc. The use of a catalog number describing the various types of fixtures shall be used as a guide only, and does not exclude all the required accessories or hardware that may be required for a complete installation.

1.05 OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall submit Operation and Maintenance Manuals in accordance with the procedures and requirements set forth in the General Conditions and Division 1.

1.06 SPARE PARTS

A. All spare parts as recommended by the equipment manufacturer shall be furnished to the Owner by the Contractor. The following minimum spare parts shall be furnished:

1. A minimum of one (1) ballast for every ten (10) ballasts (of the same model) installed.

2. A minimum of one (1) LED driver for every ten (10) drivers (of the same type) installed.

B. The spare parts shall be packed in containers suitable for long term storage, bearing labels clearly designating the contents and the pieces of equipment for which they are intended.

C. Spare parts shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such spare parts until completion of the work, at which time they shall be delivered to the Owner.

D. Spare parts lists, included with the shop drawing submittal, shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.

E. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size, shall have the same parts number.

1.07 LIGHTING CONTROLS

A. The lighting systems shall be controlled as specified herein and indicated on the Drawings.

B. Lighting contactors shall be furnished and installed for specific lighting control applications as specified herein and indicated on the Drawings.

1.08 WARRANTY
A. The manufacturer’s warranty shall in no event be for a period of less than five (5) years from date of delivery of fixtures to the project site and shall include repair labor, travel expense necessary for repairs at the jobsite, shipping costs, expendables used during the course of repair, or complete replacement of the failed lighting unit.

B. Warranty for LED fixtures shall be provided for the entire fixture and shall include all parts and accessories. Warranty for non-LED fixtures shall be provided for the entire fixture and shall include all parts and accessories except the replaceable bulb. Submittals received without written warranties as specified shall be rejected in their entirety.

PART 2 -- PRODUCTS

2.01 MANUFACTURERS

A. The equipment covered by this Specification is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed, and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

2.02 FIXTURES

A. Each fixture shall bear the Underwriters Laboratories, Inc. label. All lighting fixtures shall be furnished complete with lamps of the size and type as indicated on the Drawings and all fittings and hardware necessary for a complete installation. Lighting fixtures shall have all parts and fittings necessary to completely and properly install the fixtures.

B. Fixture leads shall be as required by NEC and shall be grounded by the equipment grounding conductor in the conduit.

C. All glassware shall be high quality, homogeneous in texture, uniform in quality, free from defects, of uniform thickness throughout, and properly annealed. Edges shall be well rounded and free from chips or rough edges.

D. HID fixture housings shall be finished with a seven-stage phosphate pretreatment and thermal-set, electrostatically applied polyester paint. Color shall be as indicated in the fixture schedule or as selected by the Engineer.

E. Indoor metal halide fixtures shown in non-hazardous locations shall be furnished with a tungsten/halogen lamp and time delay relay as specified in the fixture schedule or indicated on the Drawings. For hazardous locations where this feature is not available, emergency fixtures shall be provided with a time delay feature.

F. Emergency fixtures shall be UL 924 listed and have a minimum 90 minutes battery back-up.

G. Fixtures for use in hazardous locations shall be UL 844 Listed.

H. Fixtures specified to be damp or wet locations rated shall be UL 1598 listed.
I. Fluorescent fixtures shall be complete with housing, louvers (if required), and accessories of the types and quantities specified herein and indicated on the Drawings.

J. Fixtures shall be as specified in the Drawings per the fixture schedule below.

<table>
<thead>
<tr>
<th>FIXTURE TYPE</th>
<th>WATTAGE</th>
<th>DESCRIPTION</th>
<th>MFR AND MODEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>LP1</td>
<td>45 W (max)</td>
<td>Pendant-mounted, 120 VAC, LED light fixture, color temperature of 5000K, lineal ribbed frosted acrylic lens, wide distribution, gasketed fiberglass housing, stainless steel latches, 4ft, 60000 lumen minimum, and wet location Listed.</td>
<td>Holophane EMS LED Series, Cooper Vaportite LED Series, or Lithonia FEM LED Series.</td>
</tr>
</tbody>
</table>

2.03 NOT USED

2.04 NOT USED

2.05 LED DRIVERS

A. Drivers shall have a voltage range of (120-277) +/- 10% at a frequency 60Hz.

B. All drivers shall be designed to a power factor >90% with a total harmonic distortion THD <20% at full load.

C. Case temperature shall be rated for -40°C through +80°C.

D. Drivers shall have overheat protection, self-limited short circuit protection and overload protected.

E. Drivers shall be furnished with a fused primary.

F. Drivers shall have an output current ripple <30%

G. Drivers shall be manufactured by Advance, Universal or equal.

H. Drivers shall be UL Listed for damp location, UL1012, UL935, ROHS.

I. Drivers shall meet FCC 47 Sub Part 15.

J. All drivers shall be provided with ANSI/IEEE C62.41 Category C (10kV/5kA) surge protection.

2.06 NOT USED

2.07 LEDs

A. Luminaires provided with LED technology shall utilize high brightness LEDs with a group binning code of P and/or Q.
B. Color Temperature: as specified in fixture schedule.
C. Junction point shall be designed and manufactured to allow adequate heat dissipation.
D. LEDs shall be rated for 50,000 hours of life, minimum (based on IESNA L70).

2.08 POLES
A. Poles shall be designed to withstand calculated wind force based on wind velocity in accordance with the provisions of the California Building Code.
B. Pole mounted fixtures shall be mounted on poles as designated in the fixture schedule or as indicated on the Drawings. Poles shall have adequate handholes and weatherproof receptacles where indicated. All anchor bolts and nuts shall be stainless steel.

2.09 LIGHTING CONTROLS
A. Lighting contactors shall be as manufactured by Eaton or Square D Company, no substitutions allowed. Lighting contactors shall be heavy duty industrial type with 30A minimum rating and shall have the number of contacts required. Contactor ampere rating shall be increased as required to suit the application. Contactor coil voltage shall be as indicated on the Drawings. Contactors shall be the electrically or mechanically held type as indicated on the Drawings. Contactors shall include fused integral control power transformers. Any auxiliary relays, or other devices required for proper operation shall be included.
B. In non-hazardous locations, lighting contactors shall be furnished with the following enclosure type and material of construction, dependent upon the designation of the area in which they are to be installed. Area designations are indicated on the Drawings.

<table>
<thead>
<tr>
<th>AREA DESIGNATION</th>
<th>ENCLOSURE TYPE AND MATERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indoor Wet Process Area</td>
<td>NEMA 4X, Type 304 Stainless Steel</td>
</tr>
<tr>
<td>Indoor Dry Process Area</td>
<td>NEMA 12, Painted Steel</td>
</tr>
<tr>
<td>Indoor Dry Non-process Area</td>
<td>NEMA 1, Painted Steel</td>
</tr>
<tr>
<td>Indoor Type 1 Chemical Storage/Transfer Area</td>
<td>NEMA 4X, Fiberglass</td>
</tr>
<tr>
<td>Indoor Type 2 Chemical Storage/Transfer Area</td>
<td>NEMA 4X, Type 304 Stainless Steel</td>
</tr>
<tr>
<td>All Outdoor Areas</td>
<td>NEMA 4X, Type 304 Stainless Steel</td>
</tr>
</tbody>
</table>

C. In hazardous locations, lighting contactors shall be furnished with the following enclosure type and material of construction, dependent upon the classification of the area in which they are to be installed. Area classifications are indicated on the Drawings.

<table>
<thead>
<tr>
<th>AREA CLASSIFICATION</th>
<th>ENCLOSURE TYPE AND MATERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1, Division 1, Group D</td>
<td>NEMA 7, Die Cast Aluminum</td>
</tr>
<tr>
<td>Class 1, Division 2, Group D</td>
<td>NEMA 7, Die Cast Aluminum</td>
</tr>
<tr>
<td>Class 2, Division 1, Group F</td>
<td>NEMA 9, Die Cast Aluminum</td>
</tr>
</tbody>
</table>
D. Photocells shown on the Drawings that are not integral to a fixture provided by the (lighting manufacturer) shall be provided by the Contractor. Photocells shall be rated for 120 VAC, 1800W, and be provided with 1/2" or 3/4" threads for box mounting. Photocells shall be Model K4121C by Intermatic, or equal.

PART 3 -- EXECUTION

3.01 INSTALLATION

A. Lighting fixtures shall be located symmetrically with building lines as shown on the Drawings. The Contractor shall furnish and install the lighting fixtures to allow "convenient" access for maintenance such as cleaning, relamping, and other activities. The fixtures shall be installed to be accessed by a 12 ft. (max.) ladder. Where fixtures are shown in locations on the Drawings where maintenance would be difficult, the Contractor shall notify the Engineer for direction.

B. The Contractor shall provide and install all inserts, conduit, structural supports as required, lamps, ballasts, poles, wiring, and any other items required for a complete system. Contractor shall properly adjust and test, to the satisfaction of the Engineer, the entire lighting system. The Contractor shall provide pigtails and flexible conduit connected to an outlet box where necessary or required resulting in a neat and complete installation.

C. The Contractor shall protect all fixtures at all times from damage, dirt, dust, and the like. Before final acceptance, all fixtures and devices shall be cleaned of all dust, dirt or other material, be fully re-lamped (except LED fixtures) and in operating condition to the satisfaction of the Engineer.

D. The Contractor shall furnish and install all pendant trapezes and pendant stem hangers with durable swivel or equivalent trapeze hanger permitting normal fixture motion and self-alignment. Fixture pendants shall be Appleton Type UNJ ball type flexible hanger at the fixture and supports from an Appleton JBLX junction box with JBLX hub cover, or equal. Pendant lengths shall be adequate and adjusted to provide uniformity of installation heights above the reference datum. Stems shall be one-piece, with matching canopies and fittings.

E. Fixtures located on the exterior of the building shall be provided with neoprene gasket and non-ferrous metal screws finished to match the fixtures.

F. The finish or exposed metal parts of lighting fixtures and finish trims of all recessed lighting fixtures shall be as directed by the Engineer.

G. The Contractor shall furnish and install recessed fixtures with a separate junction box concealed and located as to be accessible when fixture is removed.

H. The Contractor shall furnish and install all boxes for lighting fixtures such that the box is not the sole support of the fixture. The boxes shall be offset to allow maintenance such
that access to wiring within the box can be attained without having to consider supporting (holding) the fixture.

I. All lighting units, when installed, shall be set true and be free of light leaks, warps, dents, and other irregularities. All hangers, cables, supports, channels, and brackets of all kinds for safely erecting this equipment in place, shall be furnished and erected in place by the Contractor.

J. The Contractor shall install fixtures at mounting heights indicated on the Drawings or as instructed by the Engineer. In areas with exposed ducts and/or piping, installation of lighting fixtures shall be adapted to field conditions as determined by the Engineer.

K. The Contractor shall support each lighting fixture securely. Each fixture shall be secured to the building structure. The Contractor shall not secure fixtures to the work of other trades, unless specified or noted otherwise, and shall not support fixtures from plaster. The Contractor shall furnish and install all steel members and supports as required to fasten and suspend fixtures from the structure.

L. In all mechanical equipment areas, the Contractor shall install lighting fixtures on the ceiling after all piping and equipment therein has been installed. Exact locations for such fixtures may be determined by the Engineer on the site during the course of the work.

M. Upon completion of work, and after the building area is broom clean, all fixtures shall be made clean and free of dust and all other foreign matter both on visible surfaces, and on surfaces that affect the lighting performance of the fixture including diffusers, lenses, louvers, reflectors, and lamps.

N. All fixtures that require physical adjustment shall be so adjusted in accordance with the directions of the Engineer. The Contractor shall also adjust angular direction of fixtures and/or lamps, as directed.

O. Lamp replacement for all fixtures shall require no special tools. All optical control surfaces such as lenses and reflectors shall be safely and securely attached to fixtures and shall be easily and quickly removed and replaced for cleaning without the use of special tools. No fixture part that may be removed, for maintenance, shall be held in place by metal tabs that must be bent to remove said part.

P. The Contractor shall furnish and install time switches and photocells as specified herein or indicated on the Drawings. Time switches shall be provided with a manual bypass switch controlling the lights locally and remotely. Time switches shall control contactors, relays, or direct controlling of one, two, or three lighting circuits, as indicated. The Contractor shall furnish and install photocells as specified herein or indicated on the Drawings for automatic "ON/OFF" switching of outdoor lighting.

Q. Lighting contactors shall be provided in the enclosure type and material of construction required for the area in which it is installed. Reference the requirements in Part 2 herein, and the area designations indicated on the Drawings.

R. The Contractor shall furnish and install a concrete foundation for the pole mounted fixtures as indicated on the Drawings and as required. This applies to foundations for pole mounted fixtures located in the yard (i.e. site lighting) and foundations that are part of a
structure (e.g. filters). Foundation shall be approved by a professional structural engineer currently registered in the State of California. The wind and seismic design shall be in accordance with ASCE 7, the California Building Code, and Section 01350. Provide calculations signed and sealed by a Professional Structural Engineer for review.

S. One (1), ¾” diameter, 10'-0” long ground rod, furnish in accordance with Section 16170, shall be driven adjacent to each pole. The pole, anchor bolts, steel reinforcement bar in the base, and equipment grounding conductor shall all be bonded to the ground rod as indicated in the standard details.

3.02 TESTING

A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Certified Shop Tests
   a. The lighting fixtures shall be given routine factory tests in accordance with the requirement of ANSI, NEMA and Underwriters Laboratories standards.

2. Field Tests
   a. Field testing shall be done in accordance with the requirements specified in the General Conditions, Division 1, and NETA Acceptance Testing Specifications, latest edition.

- END OF SECTION -
PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, install, test, and place in satisfactory operation all electric controls and relays as specified herein and indicated on the Drawings.

B. Electrical control and relay systems shall be assembled using NEMA rated components. Components designed and built to International Electrotechnical Commission (IEC) standards are not recognized. Equipment designed, manufactured and labeled in compliance with IEC standards is not acceptable.

C. Reference Section 16000, Basic Electrical Requirements and Section 16195, Electrical Identification.

1.02 CODES AND STANDARDS

A. Products specified herein shall be in conformance with or listed to the following standards as applicable:

1. NEMA 250 – Enclosures for Electrical Equipment
2. UL 508A – Standard for Industrial Control Panels

1.03 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings
2. Spare Parts List

B. Each submittal shall be identified by the applicable specification section.
1.04 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete or illegible submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:
   1. Product data sheets.

D. The shop drawing information shall be complete and organized in such a way that the Engineer can determine if the requirements of these Specifications are being met. Copies of technical bulletins, technical data sheets from "soft-cover" catalogs, and similar information which is "highlighted" or somehow identifies the specific equipment items the Contractor intends to provide are acceptable and shall be submitted.

1.05 SPARE PARTS

A. All spare parts as recommended by the equipment manufacturer shall be furnished to the Owner by the Contractor. In addition to the manufacturer recommended spare parts, the following spare parts shall be provided for the local control stations:
   1. One (1) contact block of each type furnished on the project
   2. One (1) indicating light lens of each color furnished on the project
   3. One (1) LED lamp of each color furnished on the project

B. The spare parts shall be packed in containers suitable for long term storage, bearing labels clearly designating the contents and the pieces of equipment for which they are intended.

C. Spare parts shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such spare parts until completion of the work, at which time they shall be delivered to the Owner.

D. Spare parts lists, included with the shop drawing submittal, shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.

E. Parts shall be completely identified with a numerical system to facilitate parts control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size, shall have the same part number.
PART 2 -- PRODUCTS

2.01 CONTROL COMPONENTS

A. Manufacturers


B. Pilot Devices

1. General

a. All pilot devices shall be provided with a legend plate. Legend plates shall have a white background and black lettering and indicate the function of the respective pilot device. The text shown on the Drawings or indicated in the specifications shall be used as the basis for legend plate engraving (i.e. LOCAL-OFF-REMOTE, RUN, FAULT, etc).

b. All pilot devices shall be selected and properly installed to maintain the NEMA 250 rating of the enclosure in which they are installed. All pilot devices shall be UL 508 Listed.

c. All pilot devices shall be 30.5mm in diameter, unless otherwise indicated. 22mm devices are not acceptable.

d. Pilot devices for all electrical equipment under this Contract shall be of the same type and manufacturer unless otherwise specified herein or indicated on the Drawings.

e. In Class 1 Division 2 hazardous locations, pilot devices shall be the hermetically-sealed type, constructed in accordance with ANSI/ISA 12.12.01.

2. Pushbuttons

a. Pushbuttons shall be non-illuminated, black in color, and have momentary style operation unless otherwise indicated on the Drawings.

b. Pushbuttons shall have the quantity of normally closed and/or normally open contacts as indicated on the Drawings and as required. In addition to the required contacts, one (1) spare normally open and one (1) spare normally closed contact shall be installed at each pushbutton. Contacts shall be rated for 5A at 250VAC/DC (minimum), but no less than required for the application.

c. Pushbuttons shall be provided with a full guard around the perimeter of the button. Where a lockout style pushbutton is specified or indicated on the Drawings, provide a padlockable guard.
3. Selector Switches  
   a. Selector switches shall be non-illuminated, black in color, and have the number of maintained positions as indicated on the Drawings and as required. Handles shall be the extended type that provide a greater surface area for operation.
   b. Selector switches shall have the quantity of normally closed and/or normally open contacts as indicated on the Drawings and as required. In addition to the required contacts, one (1) spare normally open and one (1) spare normally closed contact shall be installed at each selector switch. Contacts shall be rated for 5A at 250VAC/DC (minimum), but no less than required for the application.
   c. Where indicated in the Drawings or Specifications, provide spring return positions.
   d. Selector switches shall be provided with an indexing component that fits into the keyed portion of the cutout for the device and prevents the switch from spinning when operated.

4. Indicating Lights  
   a. Indicating lights shall LED type, with the proper voltage rating to suit the application, and push-to-test feature.
   b. Indicating light lens colors shall be as required in equipment specifications and/or as indicated on the Drawings. If lens colors are not indicated, the following colors shall be used:
      i. Red - "Run", "On", "Open"
      ii. Green - "Off", "Closed"
      iii. Amber - "Alarm", "Fail"
      iv. White - "Control Power On"

5. Emergency Stop and Tagline Switches  
   a. Emergency stop switches shall be non-illuminated, red in color, with a minimum 35mm diameter mushroom head. Once activated, switch shall maintain its position and require a manual pull to release/reset.
   b. Tagline switches shall have a plunger that activates upon tension from the associated safety cable. Once activated, switch shall maintain its position and require a manual release/reset.
   c. Emergency stop and tagline switches shall have the quantity of normally closed and/or normally open contacts as indicated on the Drawings and as
required. In addition to the required contacts, one (1) spare normally open and one (1) spare normally closed contact shall be installed at each switch. Contacts shall be rated for 5A at 250VAC/DC (minimum), but no less than required for the application.

C. Relays and Timers

1. General
   a. Relays and timers shall be furnished with an integral pilot light for positive indication of coil energization.
   b. Relays and timers shall have tubular pin style terminals with matching 11-pin DIN rail mount socket. Spade or blade style terminals are not acceptable.
   c. Relays and timers for all electrical equipment under this Contract shall be of the same type and manufacturer unless otherwise specified herein or indicated on the Drawings.

2. Control and Pilot Relays
   a. Miniature or “ice-cube” type relays are not acceptable.
   b. Relays shall have coil voltage as required to suit the application and/or as indicated on the Drawings.
   c. Relays shall be provided with contacts rated for 10A (resistive), minimum, at 120/240 VAC and 28 VDC. Relays shall have 3-pole, double-throw (3PDT) contact arrangement.

3. Time Delay Relays
   a. Timers delay relays shall utilize electronic timing technology. Mechanical timing devices are not acceptable.
   b. Relays shall have coil voltage as required to suit the application and/or as indicated on the Drawings.
   c. Relays shall be provided with contacts rated for 10A (resistive), minimum, at 120/240 VAC and 28 VDC. Relays shall have double-pole double-throw (DPDT) contact arrangement.
   d. Time delay ranges shall be as indicated on the Drawings and/or as required to suit the application. Timing range shall be adjustable from the front of the relay. On delay and off delay timer configurations shall be provided as indicated on the Drawings and/or as required to suit the application.
4. Elapsed Time Meters
   a. Elapsed time meters shall be non-resettable type with no less than a 4 digit display. Coil voltage shall be as required to suit the application and/or as indicated on the Drawings.

D. Control Terminal Blocks
   1. Control terminal blocks shall be assembled on non-current carrying galvanized steel DIN mounting rails securely bolted to the enclosure or subpanel. Terminals shall be tubular screw type with pressure plate that will accommodate wire size range of #22 - #8 AWG.

   2. Control terminal blocks shall be single tier with a minimum rating of 600 volts and 20A. Separate terminal strips shall be provided for each type of control used (i.e. 120VAC vs. 24VDC). Quantity of terminals shall be provided as required to suit the application. In addition, there shall be a sufficient quantity of terminals for the termination of all spare conductors.

   3. Terminals shall be marked with a permanent, continuous marking strip, with each terminal numbered. One side of each terminal shall be reserved exclusively for incoming field conductors. Common connections and jumpers required for internal wiring shall not be made on the field side of the terminal.

2.02 LOCAL CONTROL STATIONS
   A. Local control stations shall be furnished and installed complete with pushbuttons, selector switches, indicating lights, and other devices as indicated on the Drawings.

   B. Specific devices installed in local control stations shall be provided in accordance with the requirements specified elsewhere in this Section.

   C. In non-hazardous locations, local control stations shall be furnished with the following enclosure type and material of construction, dependent upon the designation of the area in which they are to be installed. Area designations are indicated on the Drawings.

<table>
<thead>
<tr>
<th>AREA DESIGNATION</th>
<th>ENCLOSURE TYPE AND MATERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indoor Wet Process Area</td>
<td>NEMA 4X, Type 304 Stainless Steel</td>
</tr>
<tr>
<td>Indoor Dry Process Area</td>
<td>NEMA 12, Die Cast Zinc</td>
</tr>
<tr>
<td>Indoor Dry Non-process Area</td>
<td>NEMA 12, Die Cast Zinc</td>
</tr>
<tr>
<td>Indoor Type 1 Chemical Storage/Transfer Area</td>
<td>NEMA 4X, Fiberglass or Thermoplastic Polyester</td>
</tr>
<tr>
<td>Indoor Type 2 Chemical Storage/Transfer Area</td>
<td>NEMA 4X, Type 304 Stainless Steel</td>
</tr>
<tr>
<td>All Outdoor Areas</td>
<td>NEMA 4X, Type 304 Stainless Steel</td>
</tr>
</tbody>
</table>
D. In hazardous locations, local control stations shall be furnished with the following enclosure type and material of construction, dependent upon the classification of the area in which they are to be installed. Area classifications are indicated on the Drawings.

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<tr>
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<th>ENCLOSURE TYPE AND MATERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1, Division 1, Group D</td>
<td>NEMA 7, Die Cast Aluminum</td>
</tr>
<tr>
<td>Class 1, Division 2, Group D</td>
<td>NEMA 4X, Type 304 Stainless Steel</td>
</tr>
<tr>
<td>Class 2, Division 1, Group F</td>
<td>NEMA 9, Die Cast Aluminum</td>
</tr>
<tr>
<td>Class 2, Division 2, Group F</td>
<td>NEMA 9, Die Cast Aluminum</td>
</tr>
</tbody>
</table>

E. Non-metallic enclosures, NEMA 7 enclosures, and NEMA 9 enclosures shall be provided with threaded integral conduit hubs. Conduit hubs shall be external to the enclosure.

F. Local control stations for use in non-hazardous locations shall be UL-508 Listed. Local control stations for use in Class 1 Division 1 and Class 2 Divisions 1/2 hazardous locations shall be UL-1203 Listed. Local control stations for use in Class 1 Division 2 hazardous locations shall be in accordance with ANSI/ISA 12.12.01-2013.

G. Provide a nameplate on each local control station in accordance with Section 16195, Electrical Identification. The name and/or number of the equipment associated with each control station shall be engraved on the nameplate, followed by the words “LOCAL CONTROL STATION”.

PART 3 -- EXECUTION

3.01 INSTALLATION

A. Local control stations shall be provided in the enclosure type and material of construction required for the area in which it is installed. Reference the requirements in Part 2 herein, and the area designations indicated on the Drawings.

B. All control components shall be mounted in a manner that will 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. Component's mounting shall be oriented in accordance with the component manufacturer's and industries' standard practices.

C. Pilot devices shall be properly bonded to the equipment enclosure door where they are installed. If proper bonding cannot be achieved through the locknuts that affix the device in place, a green colored bonding screw shall be provided on the pilot device. The bonding screw shall be bonded to the equipment enclosure through the use of an insulated green bonding conductor.

D. Local control station covers shall be bonded to the local control station enclosure through the use of an insulated green bonding conductor.
E. Wiring to devices at each local control station shall be provided with enough slack to permit the local control station cover to be removed and pulled at least 6 inches away from the enclosure.

Terminal strips, relays, timers, and similar devices shall not be installed on the rear of the panel/cabinet doors.

- END OF SECTION -
SECTION 17000
CONTROL AND INFORMATION SYSTEM
SCOPE AND GENERAL REQUIREMENTS

PART 1 – GENERAL

1.01 SCOPE

A. The Contractor shall provide, through the services of an instrumentation and control system subcontractor, components, system installation services, as well as required and specified ancillary services in connection with the Instrumentation, Control and Information System.

B. The System includes materials, labor, tools, fees, charges, and documentation required to furnish, install, test and place in operation a complete and operable instrumentation, control and information system.

C. The system shall include measuring elements, signal converters, transmitters, local control panels, digital hardware and software, operator workstations, remote telemetry units, signal and data transmission systems, interconnecting wiring, and pertinent accessories.

D. The scope of the work to be performed under this Division includes but is not limited to the following:

1. The Contractor shall retain overall responsibility for the instrumentation and control system as specified herein. The work is to be done in accordance with the Owner’s current standards.

2. Furnish and install process instrumentation and associated taps and supports as scheduled or shown on the Drawings, unless otherwise noted or supplied by equipment vendors.

3. Furnish and install local control panels, field panels and associated cabinets and panels as shown on the Drawings and as specified in Division 17.

4. Furnish and install digital control system hardware and software as specified in Division 17. All new analog and digital input and output signals provided under this contract shall be landed on existing spare I/O located within the existing PLC control panels.

5. Final termination and testing of instrumentation and control system signal wiring and power supply wiring at equipment furnished under Division 17.

6. Furnish, install and terminate special cables for devices (e.g., instruments, printers, radios). Furnish and terminate control system communication network cables.

7. Furnish and install surge protection devices for digital equipment, local control panels, remote telemetry units, and instrumentation provided under this Division, including connections to grounding system(s) provided under Division 16.
8. Coordinate grounding requirements with the electrical subcontractor for digital equipment, local control panels, remote telemetry units, and instrumentation provided under this Division. Terminate grounding system cables at equipment provided under this Division.

9. Provide system testing, calibration, training and startup services as specified herein and as required to make systems fully operational.

E. It is the intent of the Contract Documents to construct a complete and working installation. Items of equipment or materials that may reasonably be assumed as necessary to accomplish this end shall be supplied whether or not they are specifically stated herein.

1.02 RELATED ITEMS

A. Field mounted switches, torque switches, limit switches, gauges, valve and gate operator position transmitters, sump pump controls, and other instrumentation and controls furnished with mechanical or electrical equipment not listed in the instrument schedule shall be furnished, installed, tested, and calibrated as specified under other Divisions unless otherwise indicated.

B. Additional and related work performed under Division 16 includes the following:

1. Instrument A.C. power source and disconnect switch for process instrumentation, A.C. grounding systems, and A.C. power supplies for equipment, control panels and accessories furnished under Division 17.

2. Conduit and raceways for instrumentation and control system signal wiring, grounding systems, special cables and communication network cables.

3. Instrumentation and control system signal wiring.

4. Install control system communication network cables.

5. Furnish and install grounding systems for digital equipment, local control panels, remote telemetry units, and instrumentation provided under Division 17. Grounding systems shall be complete to the equipment provided under Division 17, ready for termination by the instrumentation subcontractor.

6. Termination of instrumentation and control system signal wiring at equipment furnished under other divisions of the Specifications.

7. Final wiring and termination to A.C. grounding systems and to A.C. power sources (e.g., panelboards, motor control centers, and other sources of electrical power).

1.03 GENERAL INFORMATION AND DESCRIPTION

A. Where manufacturers are named for a particular item of equipment, it is intended as a guide to acceptable quality and performance and does not exempt such equipment from the requirements of these Specifications or Drawings.

B. In order to centralize responsibility, it is required that equipment (including field instrumentation and control system hardware and software) offered under this Division shall be furnished and installed by the instrumentation subcontractor, or under the
supervision of the instrumentation subcontractor, who shall assume complete responsibility for proper operation of the instrumentation and control system equipment, including that of coordinating signals, and furnishing appurtenant equipment.

C. The Contractor shall retain total responsibility for the proper detailed design, fabrication, inspection, test, delivery, assembly, installation, activation, checkout, adjustment and operation of the entire instrumentation and control system as well as equipment and controls furnished under other Divisions of the Specifications. The Contractor shall be responsible for the delivery of detailed drawings, manuals and other documentation required for the complete coordination, installation, activation and operation of mechanical equipment, equipment control panels, local control panels, field instrumentation, control systems and related equipment/systems and shall provide for the services of a qualified installation engineer to supervise activities required to place the completed facility in stable operation under full digital control.

D. The instrumentation and control system shall be capable of simultaneously implementing all real time control and information system functions, and servicing all operator service requests as specified, without degrading the data handling and processing capability of other system components.

E. Control system inputs and outputs are listed in the Input/Output Schedule. This information, together with the functional control descriptions, process and instrumentation diagrams, and electrical control schematics, describes the real time monitoring and control functions to be performed. In addition, the system shall provide various man/machine interface and data reporting functions as specified in the software sections of this Specification.

F. The mechanical, process, and electrical drawings indicate the approximate locations of field instruments, control panels, systems and equipment as well as field mounted equipment provided by others. The instrumentation subcontractor shall examine the mechanical, process and electrical drawings to determine actual size and locations of process connections and wiring requirements for instrumentation and controls furnished under this Contract. The instrumentation subcontractor shall inspect equipment, panels, instrumentation, controls, and appurtenances, either existing or furnished on the Project to determine requirements for interfacing with the control and information system. The Contractor shall coordinate the completion of required modifications with the associated supplier of the item furnished.

G. The instrumentation subcontractor shall review and approve the size and routing of instrumentation and control cable and conduit systems furnished by the electrical subcontractor for suitability for use with the associated cable system.

H. The Contractor shall coordinate the efforts of each supplier to aid in interfacing systems. This effort shall include, but shall not be limited to, the distribution of approved shop drawings to the electrical subcontractor and to the instrumentation subcontractor furnishing the equipment under this Division.

I. The Contractor shall be responsible for providing a signal transmission system free from electrical interference that would be detrimental to the proper functioning of the instrumentation and control system equipment.

J. The Owner shall have the right of access to the subcontractor's facility and the facilities of his equipment suppliers to observe materials and parts; witness inspections, tests and
work in progress; and examine applicable design documents, records, and certifications during all stages of design, fabrication, and tests. The instrumentation subcontractor and his equipment suppliers shall furnish office space, supplies, and services required for these observation activities.

K. The terms "Instrumentation", "Instrumentation and Control System", and "Instrumentation, Control and Information System" shall hereinafter be defined as equipment, labor, services, and documents necessary to meet the intent of the Specifications.

1.04 INSTRUMENTATION AND CONTROL SYSTEM SUBCONTRACTORS

A. Instrumentation and control system subcontractors shall be regularly engaged in the detailed design, fabrication, installation, and startup of instrumentation and control systems for water and wastewater treatment facilities. Instrumentation and control system subcontractors shall have a minimum of five years of such experience and shall have completed a minimum of three projects of similar type and size as that specified herein. Where specific manufacturers/models of major hardware or software products (PLC, HMI software, network, etc.) are specified to be used on this project, the instrumentation and control system subcontractor shall have completed at least one project using that specified hardware or software. As used herein, the term "completed" shall mean that a project has been brought to final completion and final payment has been made.

B. Acceptable instrumentation and control system subcontractors shall be Enterprise Automation; or equal.

1.05 DEFINITIONS

A. Solid State: Wherever the term solid state is used to describe circuitry or components in the Specifications, it is intended that the circuitry or components shall be of the type that convey electrons by means of solid materials such as crystals or that work on magnetic principles such as ferrite cores. Vacuum tubes, gas tubes, slide wires, mechanical relays, stepping motors or other devices will not be considered as satisfying the requirements for solid state components of circuitry.

B. Bit or Data Bit: Whenever the terms bit or data bit are used in the Specification, it is intended that one bit shall be equivalent to one binary digit of information. In specifying data transmission rate, the bit rate or data bit rate shall be the number of binary digits transmitted per second and shall not necessarily be equal to either the maximum pulse rate or average pulse rate.

C. Integrated Circuit: Integrated circuit shall mean the physical realization of a number of circuit elements inseparably associated on or within a continuous body to perform the function of a circuit.

D. Mean Time Between Failures (MTBF): The MTBF shall be calculated by taking the number of system operating hours logged during an arbitrary period of not less than six months and dividing by the number of failures experienced during this period plus one.

E. Mean Time to Repair (MTTR): The MTTR shall be calculated by taking the total system down time for repair over an arbitrary period of not less than six months coinciding with that used for calculation of MTBF and dividing by the number of failures causing down time during the period.
F. Availability: The availability of a non-redundant device or system shall be related to its MTBF and MTTR by the following formula:

\[ A = 100 \times \frac{MTBF}{MTBF + MTTR} \] \text{Percent}

The availability of a device or system provided with an automatically switched backup device or system shall be determined by the following formula:

\[ A = A_2 + 1 - ((1 - A_1) \times (1 - A_1)) \]

where:

- \( A_1 \) = availability of non-redundant device or system
- \( A_2 \) = availability of device or system provided with an automatically switched backup device or system

G. Abbreviations: Specification abbreviations include the following:

1. A - Availability
2. ADC - Analog to Digital Converter
3. AI - Analog Input
4. AO - Analog Output
5. AVAIL - Available
6. BCD - Binary Coded Decimal
7. CSMA/CD - Carrier Sense Multiple Access/Collision Detect
8. CPU - Central Processing Unit
9. CRC - Cyclic Redundancy Check
10. CS - Control Strategy
11. DAC - Digital to Analog Converter
12. DBMS - Data Base Management System
13. DI - Discrete Input
14. DMA - Direct Memory Access
15. DO - Discrete Output
16. DPDT - Double Pole, Double Throw
17. DVE - Digital to Video Electronics
18. EPROM - Erasable, Programmable Read Only Memory
19. FDM - Frequency Division Multiplexing
20. FSK - Frequency Shift Keyed
21. HMI - Human Machine Interface (Software)
22. I/O - Input/Output
23. LAN - Local Area Network
24. LCD - Liquid Crystal Display
25. LDFW - Lead Follow
26. MCC - Motor Control Center
27. MTBF - Mean Time Between Failures
28. MTTR - Mean Time To Repair
29. OS - Operating System
30. PAC - Programmable Automation Controller
31. PCB - Printed Circuit Board
32. PID - Proportional Integral and Derivative Control
33. PLC - Programmable Logic Controller or Programmable Controller
34. PROM - Programmable Read Only Memory
35. RAM - Random Access Memory
36. RDY - Ready
37. RMSS - Root Mean Square Summation
38. RNG - Running
39. ROM - Read Only Memory
40. RTU - Remote Telemetry Unit
41. SPDT - Single Pole, Double Throw
42. ST/SP - Start/Stop
43. TDM - Time Division Multiplexing
44. UPS - Uninterruptible Power Supply
45. VFD - Variable Frequency Drive
H. To minimize the number of characters in words used in textual descriptions on displays, printouts and nameplates, abbreviations may be used subject to the Engineer's approval. If a specified abbreviation does not exist for a particular word, an abbreviation may be generated using the principles of masking and or vowel deletion. Masking involves retaining the first and last letters in a word and deleting one or more characters (usually vowels) from the interior of the word.

1.06 ENVIRONMENTAL CONDITIONS

A. Instrumentation equipment and enclosures shall be suitable for ambient conditions specified. All system elements shall operate properly in the presence of telephone lines, power lines, and electrical equipment.

B. Inside control rooms and climate-controlled electrical rooms, the temperature will normally be 20 to 25 degrees C; relative humidity 40 to 80 percent without condensation and the air will be essentially free of corrosive contaminants and moisture. Appropriate air filtering shall be provided to meet environmental conditions (e.g., dust).

C. Other indoor areas may not be air conditioned/heated; temperatures may range between 0 and 40 degrees C with relative humidity between 40 and 95 percent.

D. Field equipment including instrumentation and panels may be subjected to wind, rain, lightning, and corrosives in the environment, with ambient temperatures from -20 to 40 degrees C and relative humidity from 10 to 100 percent. All supports, brackets, interconnecting hardware, and fasteners shall be aluminum, type 316 stainless steel, or metal alloy as otherwise suitable for chemical resistance within chemical feed/storage areas shown on the installation detail drawings.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

3.01 SCHEDULE OF PAYMENT

A. Refer to 01025 – Measurement of Payment

3.02 CLEANING

A. The Contractor shall thoroughly clean soiled surfaces of installed equipment and materials.

B. Upon completion of the instrumentation and control work, the Contractor shall remove surplus materials, rubbish, and debris that has accumulated during the construction work. The entire area shall be left neat, clean, and acceptable to the Owner.

3.03 FINAL ACCEPTANCE

A. Final acceptance of the Instrumentation, Control and Information System will be determined complete by the Engineer, and shall be based upon the following:
1. Receipt of acceptable start up completion and availability reports and other documentation as required by the Contract Documents.

2. Completion of the Availability Demonstration.

3. Completion of control system training requirements.

4. Completion of punch-list items that are significant in the opinion of the Engineer.

B. Final acceptance of the System shall mark the beginning of the warranty period.

- END OF SECTION -
SECTION 17060

SIGNAL COORDINATION REQUIREMENTS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall conform to the signal coordination requirements specified herein.

B. The Contractor shall be responsible for coordinating signal types and transmission requirements between the various parties providing equipment under this Contract. This shall include, but not be limited to, distribution of appropriate shop drawings among the equipment suppliers, the electrical subcontractor, and the instrumentation subcontractor.

C. Analog signals shall be signals for transmitting process variables, etc. from instruments and to and from panels, equipment PLCs and Control System PLCs.

D. Discrete signals shall consist of contact closures or powered signals for transmitting status/alarm information and control commands between starters, panels, equipment PLCs, the Control System, etc.

1.02 ANALOG SIGNAL TRANSMISSION

A. Signal transmission between electric or electronic instruments, controllers, and all equipment and control devices shall be individually isolated, linear 4-20 milliamperes and shall operate at 24 VDC.

B. Signal output from all transmitters and controllers shall be current regulated and shall not be affected by changes in load resistance within the unit's rating.

C. All cable shields shall be grounded at one end only, at the control panel, with terminals bonded to the panel ground bus.

D. Analog signal isolation and/or conversion shall be provided where necessary to interface with instrumentation, equipment controls, panels, and appurtenances.

E. Non-standard transmission systems such as pulse duration, pulse rate, and voltage regulated shall not be permitted except where specifically noted in the Contract Documents. Where transmitters with nonstandard outputs do occur, their outputs shall be converted to an isolated, linear, 4-20 milliampere signal.

F. The Contractor shall provide redundant 24 V power supplies for analog signals and instruments where applicable and as required inside panels, controls, etc.

G. Where two-wire instruments transmit directly to the Control and Information System, the instrumentation subcontractor shall provide redundant power supplies at the PLC-equipped control panels for those instruments.
H. Where four-wire instruments with on-board loop power supplies transmit directly to the Control and Information System, the instrumentation subcontractor shall provide necessary signal isolators or shall otherwise isolate the input from the Control and Information System loop power supply. Similar provisions shall be made when a third element such as a recorder, indicator, or single loop controller with integral loop power supply is included in the loop.

1.03 DISCRETE INPUTS

A. All discrete inputs to equipment and Control and Information System PLCs, from field devices, starters, panels, etc., shall be unpowered (dry) contacts in the field device or equipment, powered from the PLCs, unless specified otherwise.

B. Sensing power (wetting voltage) supplied by the PLC shall be 24 VDC.

1.04 DISCRETE OUTPUTS

A. All discrete outputs from local control panels and Control and Information System PLCs to field devices, starters, panels, etc., shall be 24 VDC powered (sourced) from PLC's.

B. PLC powered discrete outputs shall energize 24 VDC pilot relay coils in the field devices, starters, panels, etc. which in turn open or close contacts in the associated control circuit. The 24 VDC relay coil, contacts, and associated control circuitry shall be furnished integral with the field device, starter, panel, etc. by the supplier and contractor furnishing the field device, starter, or panel.

C. Where required or specified herein, discrete outputs from equipment and Control and Information System PLC's to field devices, starters, panels, motor operated valves, etc., shall be dry contact or relay outputs.

D. Outputs to solenoid valves shall be 120 VAC, powered from the PLC or control panel unless specified or shown otherwise.

1.05 OTHER DISCRETE SIGNALS

A. Discrete signals between starters, panels, etc. where no 24 VDC power supply is available may be 120 VAC, as long as such contacts are clearly identified in the starter, panel, etc. as being powered from a different power supply than other starter/panel components.

B. Where applicable, warning signs shall be affixed inside the starter, panel, etc. stating that the panel is energized from multiple sources.

C. Output contacts in the starter, panel, etc., that are powered from other locations shall be provided with special tags and/or color-coding. Disconnecting terminal strips shall be provided for such contacts.

D. The above requirements shall apply to all starters and panels, regardless of supplier.
PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

- END OF SECTION -
SECTION 17070
CONTROL AND INFORMATION SYSTEM TESTING - GENERAL

PART 1 -- GENERAL

1.01 THE REQUIREMENT
A. The Contractor shall test the Control and Information System as specified herein to demonstrate compliance with the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE
A. Section 17000 – Control and Information System Scope and General Requirements
B. Section 17072 – Field Testing

1.03 SUBMITTALS
A. For each of the specified tests, submit a test plan to the Engineer at least one month in advance of commencement of the tests. The test plan shall contain the following at a minimum:
   1. A schedule of all testing to be conducted.
   2. A brief description of the testing to be performed
   3. Test objectives.
   4. Testing criteria per the Specifications.
   5. Check lists and procedures for performing each of the specified tests.
   6. Sample test result documentation.
   7. Requirements for other parties.

1.04 GENERAL REQUIREMENTS
A. All system start-up and test activities shall follow detailed test procedures; check lists, etc., previously approved by the Engineer. The Engineer shall be notified at least 21 days in advance of any system tests and reserves the right to have his and/or the Owner's representatives in attendance.
B. The Contractor shall provide the services of experienced factory trained technicians, tools and equipment to field calibrate, test, inspect, and adjust all equipment in accordance with manufacturer's specifications and instructions.
C. The Contractor (or designee) shall maintain master logbooks for each phase of installation, startup and testing activities specified herein. Each logbook shall include
signal, loop or control strategy tag number, equipment identification, description and space for sign-off dates, Contractor signature and Engineer signature. Example test documentation specific to each phase of testing shall be approved prior to initiation of that testing, as specified hereinabove.

D. All test data shall be recorded on test forms, previously approved by the Engineer. When each test has been successfully completed, a certified copy of all test results shall be furnished to the Engineer together with a clear and unequivocal statement that all specified test requirements have been met and that the system is operating in accordance with the Contract Documents.

E. The Engineer will review test documentation in accordance with the Contract Documents and will give written notice of the acceptability of the tests within 10 days of receipt of the test results.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

- END OF SECTION -
SECTION 17072
FIELD TESTING

PART 1 -- GENERAL

1.01 THE REQUIREMENT
A. The Contractor shall perform field testing on the Control and Information System as specified herein to demonstrate compliance with the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE
A. Section 17000 – Control and Information System Scope and General Requirements
B. Section 17070 – Control and Information System Testing, General

1.03 GENERAL REQUIREMENTS
A. Control system start-up and testing shall be performed to ensure that all plant processes shall be systematically and safely placed under digital control in the following order:
   1. Primary elements such as transmitters and switch devices shall be calibrated and tested as specified in Section 17600.
   2. Each final control element shall be individually tested as specified hereinafter.
   3. Each control loop shall be tested as specified hereinafter.
   4. Each control strategy shall be tested under automatic digital control as specified hereinafter.
   5. The entire control system shall be tested for overall monitoring, control, communication, and information management functions, and demonstrated for system availability as specified hereinafter.
B. System start-up and test activities shall include the use of water, if necessary, to establish service conditions that simulate, to the greatest extent possible, normal operating conditions in terms of applied process loads, operating ranges and environmental conditions.
C. Each phase of testing shall be fully and successfully completed and all associated documentation submitted and approved prior to the next phase being started. Specific exceptions are allowed if written approval has been obtained in advance from the Engineer.
1.04 CONTRACTOR’S RESPONSIBILITIES

A. The Contractor shall ensure that all mechanical equipment, equipment control panels, local control panels, field instrumentation, control system equipment and related equipment and/or systems are tested for proper installation, adjusted and calibrated on a loop-by-loop basis prior to control system startup to verify that each is ready to function as specified. Each test shall be witnessed, dated and signed off by both the Contractor (or designee) and the Engineer upon satisfactory completion.

B. The Contractor shall be responsible for coordination of meetings with all affected trades. A meeting shall be held each morning to review the day's test schedule with all affected trades. Similarly, a meeting shall be held each evening to review the day's test results and to review or revise the next day's test schedule as appropriate.

C. The Contractor shall ensure that the electrical subcontractor conforms to the start-up, test and sign-off procedures specified herein to assure proper function and coordination of all motor control center control and interlock circuitry and the transmission of all discrete and/or analog signals between equipment furnished by the electrical subcontractor and the control system specified herein.

D. The Contractor shall ensure that the HVAC subcontractor conforms to the start-up, test and sign-off procedures specified herein to assure proper function of all HVAC system control and interlock circuitry and the transmission of all discrete and/or analog signals between HVAC equipment and controls and the control system specified herein.

1.05 FINAL CONTROL ELEMENT TESTING

A. The proper control of all final control elements shall be verified by tests conducted in accordance with the requirements specified herein.

B. All modulating final control elements shall be tested for appropriate speed or position response by applying power and input demand signals, and observing the equipment for proper direction and level of reaction. Each final control element shall be tested at 0, 25, 50, 75, and 100 percent of signal input level and the results checked against specified accuracy tolerances. Final control elements, such as VFD's, that require turndown limits shall be initially set during this test.

C. All non-modulating final control elements shall be tested for appropriate position response by applying and simulating control signals, and observing the equipment for proper reaction.

1.06 LOOP CHECKOUT

A. Prior to control system startup and testing, each monitoring and control loop shall be tested on an individual basis from the primary element to the final element, including the operator workstation or loop controller level, for continuity and for proper operation and calibration.

B. Signals from transducers, sensors, and transmitters shall be utilized to verify control responses. Simulated input data signals may be used subject to prior written approval by the Engineer. All modes of control shall be exercised and checked for proper operation.
C. The accuracy of all DAC's shall be verified by manually entering engineering unit data values at the operator workstation and then reading and recording the resulting analog output data.

D. The accuracy of all ADC's shall be verified using field inputs or by manually applying input signals at the final controller, and then reading and recording the resulting analog input data at the operator workstation.

E. Each loop tested shall be witnessed, dated and signed off by both the Contractor (or designee) and the Engineer upon satisfactory completion.

1.07 CONTROL SYSTEM STARTUP AND TESTING

A. Control system startup and testing shall be performed to demonstrate complete compliance with all specified functional and operational requirements. Testing activities shall include the simulation of both normal and abnormal operating conditions.

B. All digital hardware shall be fully inspected and tested for function, operation and continuity of circuits. All diagnostic programs shall be run to verify the proper operation of all digital equipment.

C. Final control elements and ancillary equipment shall be tested under start-up and steady-state operating conditions to verify that proper and stable control is achieved using local area control panels, motor control center circuits, and local field mounted control circuits. All hardwired control circuit interlocks and alarms shall be operational. The control to final control elements and ancillary equipment shall be tested using both manual and automatic (where provided) control circuits.

D. Signals from transducers, sensors, and transmitters shall be utilized to verify control responses for final control elements. Simulated input data signals may be used subject to prior written approval by the Engineer.

E. Each control strategy shall be tested to verify the proper operation of all required functions. The control system start-up and test activities shall include procedures for tuning all control loops incorporating PID control modules, and for adjusting and testing all control loops as required to verify specified performance.

F. The control system start-up and test activities shall include running tests to prove that the Instrumentation, Control and Information System is capable of continuously, safely and reliably regulating processes, as required by the Contract, under service conditions that simulate, to the greatest extent possible, normal plant operating ranges and environmental conditions.

G. A witnessed functional acceptance test shall be performed to demonstrate satisfactory performance of individual monitoring and control loops and control strategies. At least one test shall be performed to verify that the control and instrumentation system is capable of simultaneously implementing all specified operations.

H. Each loop and control strategy test shall be witnessed and signed off by both the Contractor (or designee) and the Engineer upon satisfactory completion.
1.08 FACILITY STARTUP COORDINATION

A. Facility start-up shall comply with requirements specified in the Contract Documents and those requirements specified herein. Facility start-up shall commence after all previously described start-up and test activities have been successfully completed and shall demonstrate that the Instrumentation, Control and Information System can meet all Contract requirements with equipment operating over full operating ranges under actual operating conditions.

B. The control system start-up period shall be coordinated with process startup activities and shall be extended as required until all plant processes are fully operational and to satisfy the Engineer that all control system Contract requirements have been fulfilled in accordance with the Contract Documents.

C. The instrumentation subcontractor's personnel shall be resident at the facility to provide both full time (eight hours/day, five days/week) and 24 hours on call (seven days/week) support of operating and maintenance activities for the duration of the start-up period.

D. At least one qualified control systems technician shall be provided for control system startup and test activities (at least two when loop checkout is being performed).

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

- END OF SECTION -
SECTION 17600
INSTRUMENTS, GENERAL

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, install, test and place in operation process instrumentation as scheduled herein, as shown on the Drawings and as specified. Mounting of associated transmitters, indicators, power supplies, brackets and appurtenances shall be provided as specified herein and shown on the Drawings.

B. It is the intent of this Specification and the Contract Documents that all process taps, isolation valves, nipples, penetrations, embedded instrumentation supports, conduit, wiring, terminations, and the installation of process instrumentation on process lines shall be provided under this Contract, except where noted otherwise.

C. Tapping and connections for primary process sensors shall be sized to suit each individual installation and the requirements of the instrument served. It is the Contractor's responsibility to ensure that the location, supports, orientation and dimensions of the connections and tapping for instrumentation furnished under this Division are such as to provide the proper bracing, the required accuracy of measurement, protection of the sensor from accidental damage, and accessibility for maintenance while the plant is in operation. Isolation valves shall be provided at all process taps.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 17000 – Control and Information System Scope and General Requirements

B. Section 17698 – Instrumentation and Control System Accessories

C. Instruments furnished with mechanical equipment shall be furnished, installed, tested and calibrated as specified elsewhere in the Contract Documents.

PART 2 -- PRODUCTS

2.01 GENERAL

A. All instrumentation supplied shall be the manufacturer's latest design. Unless otherwise specified, instruments shall be solid state, electronic, using enclosures to suit specified environmental conditions. Microprocessor-based equipment shall be supplied unless otherwise specified. All instruments shall be provided with mounting hardware and floor stands, wall brackets, or instrument racks as shown on the Drawings, or as required.

B. Equipment installed in a hazardous area shall meet Class, Group, and Division as shown on the Drawings, to comply with the National Electrical Code.

C. All field instrumentation for outdoor service shall be provided with enclosures that are suitable for outdoor service, as follows:
1. Where the manufacturer's enclosures are suitable for outdoor service, they shall be provided with instrument sunshades. Sunshades shall be Style E as manufactured by O'Brien Corporation, or equal. Where possible, these instruments shall be mounted in a north facing direction.

2. Where the manufacturer's standard enclosures are not suitable for outdoor service, instruments shall be mounted in Field Panels in accordance with Section 17520, Field Panels, or may be furnished with Vipak instrument field enclosures as manufactured by O'Brien Corporation, equivalent by Intertec, or equal. It shall not be necessary to provide the manufacturer's NEMA 4 or 4X enclosures for instruments that will be subsequently mounted in separate field panels.

D. All instruments shall return to accurate measurement without manual resetting upon restoration of power after a power failure.

E. All indicator readouts shall be linear in process units. Readouts of 0-100% shall not be acceptable (except for speed and valve position). Floating outputs shall be provided for all transmitters.

F. Unless otherwise specified, field instrument and power supply enclosures shall be 316 stainless steel, fiberglass or PVC coated copper free cast aluminum NEMA 4X construction.

G. Where separate elements and transmitters are required, they shall be fully matched, and unless otherwise noted, installed adjacent to the sensor. Special cables or equipment shall be supplied by the associated equipment manufacturer.

H. Electronic equipment shall utilize printed circuitry and shall be coated (tropicalized) to prevent contamination by dust, moisture and fungus. Solid-state components shall be conservatively rated for long-term performance and dependability over ambient atmosphere fluctuations. Ambient conditions shall be -15 to 50 degrees C and 20 to 100 percent relative humidity, unless otherwise specified. Field mounted equipment and system components shall be designed for installation in dusty, humid, and corrosive service conditions.

I. All devices furnished hereunder shall be heavy-duty type, designed for continuous industrial service. The system shall contain products of a single manufacturer, insofar as possible, and shall consist of equipment models that are currently in production. All equipment provided, where applicable, shall be of modular construction and shall be capable of field expansion.

J. All non-loop-powered instruments and equipment shall be designed to operate on a 60 Hz alternating current power source at a nominal 117 V, plus or minus 10 percent, except where specifically noted. All regulators and power supplies required for compliance with the above shall be provided. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.

K. All analog transmitter and controller outputs shall be isolated, 4-20 milliamps into a load of 0-750 ohms, unless specifically noted otherwise. All switches shall have double-pole, double-throw contacts rated at a minimum of 600 VA, unless specified otherwise.

L. Materials and equipment used shall be UL approved wherever such approved equipment and materials are available.
2.02 **ANALYTICAL INSTRUMENTS**

A. Analyzers shall be industrial grade, suitable for continuous and automatic on-line analysis of the required parameter under the conditions indicated and shall produce a 4-20 milliampere transmission signal proportional to the measured variable. Transmission signal output shall be electrically isolated. Liquid samples shall not pass through housings containing analyzer electronics. Equipment shall operate satisfactorily in an ambient temperature range of minus 20 to plus 50 degrees C and 99 percent relative humidity. Where ambient temperatures will affect accuracy by more than 1 percent of span, a suitable isothermal enclosure with thermostatically controlled space heater shall be provided.

B. All enclosures shall be suitable for wall or pipe stand mounting. Indication in process units and calibration facilities shall be provided at the analyzer. Process fluid temperature will be within a range of 5 to 30 degrees C.

C. Sample assemblies shall be suitable for submersion or flow-through as noted and shall be chemically inert to constituents of raw wastewater solids or other chemical environment as scheduled. Where the sample is drawn prior to filtration, the sample assemblies shall be capable of handling solids and grease.

D. Each analyzer requiring reagents and/or other replaceable parts shall be furnished with sufficient chemicals and replaceable parts for startup and acceptance tests and the specified warranty period.

E. The Contractor's submittals on these analyzers shall include information on monthly reagent consumption and a list of replaceable parts required for periodic maintenance and the recommended operating periods between replacements. Installation of analyzers and sample preparation shall be in accordance with the analyzer manufacturer's instructions.

F. Analysis instrumentation performance, accuracy and reproducibility shall be as prescribed in AWWA "Standard Methods for the Examination of Water and Wastewater", latest edition. For those measurements specified herein, for which performance characteristics are not listed in the above, the supplier shall state instrument performance characteristics. The "referee" method shall be as prescribed in EPA Methods for Chemical Analysis of Water and Wastes (1971).

**PART 3 -- EXECUTION**

3.01 **INSTALLATION**

A. General

1. Equipment shall be located so that it is accessible for operation and maintenance. The Contractor shall examine the Drawings and Shop Drawings for various items of equipment in order to determine the best arrangement for the work as a whole, and shall supervise the installation of process instrumentation supplied under this Division.

2. Electrical work shall be performed in compliance with all applicable local codes and practices. Where these specifications and the Drawings do not delineate precise...
installation procedures, API RP550 shall be used as a guide to installation procedures.

B. Equipment Mounting and Support

1. Field equipment shall be wall mounted or mounted on two-inch diameter aluminum pipe stands welded to a 10-inch square 1/2-inch thick aluminum base plate unless shown adjacent to a wall or otherwise noted. Instruments attached directly to concrete shall be spaced out from the mounting surface not less than 1/2-inch by use of phenolic spacers. Expansion anchors in walls shall be used for securing equipment or wall supports to concrete surfaces. Unless otherwise noted, field instruments shall be mounted between 48 and 60 inches above the floor or work platform.

2. Embedded pipe supports and sleeves shall be schedule 40, 316 stainless steel pipe, ASA B-36.19, with stainless steel blind flange for equipment mounting as shown on the Drawings.

3. Materials for miscellaneous mounting brackets and supports shall be 316 stainless steel construction.

4. Pipe stands, miscellaneous mounting brackets and supports shall comply with the requirements of Division 5 of the specifications.

5. Transmitters shall be oriented such that output indicators are readily visible.

C. Control and Signal Wiring

1. Electrical, control and signal wiring connections to transmitters and elements mounted on process piping or equipment shall be made through liquid-tight flexible conduit. Conduit seals shall be provided where conduits enter all field instrument enclosures and all cabinetry housing electrical or electronic equipment.

3.02 ADJUSTMENT AND CLEANING

A. General

1. The Contractor shall comply with the requirements of Division 1 of these Specifications and all instrumentation tests, inspection, and calibration requirements specified herein. The Engineer, or his designated representative(s), reserves the right to witness any test, inspection, calibration or start-up activity. Acceptance by the Engineer of any plan, report or documentation relating to any testing or commissioning activity specified herein shall not relieve the Contractor of his responsibility for meeting all specified requirements.

2. The Contractor shall provide the services of factory trained technicians, tools and equipment to field calibrate, test, inspect and adjust each instrument to its specified performance requirement in accordance with manufacturer's specifications and instructions. Any instrument which fails to meet any contract requirements, or any published manufacturer performance specification for functional and operational parameters, shall be repaired or replaced, at the discretion of the Engineer, at no cost to the Owner. The Contractor shall bear all costs and provide all personnel,
equipment and materials necessary to implement all installation tests and inspection activities for equipment specified herein.

B. Field Instrument Calibration Requirements

1. The Contractor shall provide the services of factory trained instrumentation technicians, tools and equipment to field calibrate each instrument supplied under this Contract to its specified accuracy in accordance with the manufacturer's specification and instructions for calibration.

2. Each instrument shall be calibrated at 0, 25, 50, 75 and 100 percent of span using test instruments to simulate inputs and read outputs. Test instruments shall be rated to an accuracy of at least five (5) times greater than the specified accuracy of the instrument being calibrated. Where applicable, such test instruments shall have accuracy's as set forth by the National Institute for Standards and Technology (NIST).

3. The Contractor shall provide a written calibration sheet to the Engineer for each instrument, certifying that it has been calibrated to its published specified accuracy. The Contractor shall submit proposed calibration sheets for various types of instruments for Engineer approval prior to the start of calibration. This sheet shall include but not be limited to date, instrument tag numbers, calibration data for the various procedures described herein, name of person performing the calibration, a listing of the published specified accuracy, permissible tolerance at each point of calibration, calibration reading as finally adjusted within tolerance, defect noted, corrective action required and corrections made.

4. If doubt exists as to the correct method for calibrating or checking the calibration of an instrument, the manufacturer's printed recommendations shall be used as an acceptable standard, subject to the approval of the Engineer.

5. Upon completion of calibration, devices calibrated hereunder shall not be subjected to sudden movements, accelerations, or shocks, and shall be installed in permanent protected positions not subject to moisture, dirt, and excessive temperature variations. Caution shall be exercised to prevent such devices from being subjected to overvoltages, incorrect voltages, overpressure or incorrect air. Damaged equipment shall be replaced and recalibrated at no cost to the Owner.

6. After completion of instrumentation installation, the Contractor shall perform a loop check where applicable. The Contractor shall submit final loop test results with all instruments listed in the loop. Loop test results shall be signed by all representatives involved for each loop test.
SECTION 17660

VANE OPERATED FLOW SWITCHES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, test, install and place in satisfactory operation all vane operated flow switches, with all spare parts, accessories, and appurtenances as herein specified and as shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 17000 - Control and Information System Scope and General Requirements

B. Section 17600 - Unpowered Instruments, General

PART 2 -- PRODUCTS

2.01 VANE OPERATED FLOW SWITCHES

A. Vane operated flow switches shall consist of a paddle or vane, a magnet that moves with the paddle or piston and a reed switch. Motion from the vane shall be passed through a sealed, magnetically coupled mechanism to actuate the switch.

B. Vane operated flow switches shall have the following specifications:

1. Temperature Limit: 275°F
2. Max. Operating Pressure: 1,000 psig
3. Switch Type: SPDT snap action micro switch
4. Switch Rating: 10 A, 125 VAC; 10⁶ cycle contact life
5. Body Type/Material: Single piece milled, bored brass
6. Enclosure Classification: Class I, Groups C, D
   Class II, Groups E, F, G
7. Vane Type/Material: Layered, 316 stainless steel

C. Manufacturer/Model: Model V4-2-U Flotect by W.E. Anderson, or equal.

PART 3 -- EXECUTION

3.01 REQUIREMENTS

A. Refer to Section 17600, Part 3 of the Specifications.

- END OF SECTION -
SECTION 17670
LEVEL SWITCHES (SUSPENDED FLOAT TYPE)

PART 1 -- GENERAL

1.01 THE REQUIREMENT
   A. The Contractor shall furnish, test, install and place in satisfactory operation the float level
      switches, with all spare parts, accessories, and appurtenances as herein specified and as
      shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE
   A. Section 17000 – Control and Information System Scope and General Requirements
   B. Section 17600 – Unpowered Instruments, General

PART 2 -- PRODUCTS

2.01 LEVEL SWITCHES (SUSPENDED FLOAT TYPE)
   A. Level switches of the direct acting float-operated design shall be comprised of a hermetically
      sealed, approximately 5 inch diameter plastic casing float, containing microswitches and
      flexibly supported by means of a heavy neoprene or PVC jacket, with three conductor cable
      a minimum of 20 feet in length. Unless otherwise specified, media specific gravity is 0.95 to
      1.05. Microswitches shall be one normally open and one normally closed, 5A-115V AC
      capacity. Float hangers and supports shall be provided as shown on the installation detail
      drawings. Float switches shall be Model ENM as manufactured by Flygt, or equal.

PART 3 -- EXECUTION

3.01 REQUIREMENTS
   A. Refer to Section 17600, Part 3 of the specifications.

- END OF SECTION -
SECTION 17743
MAGNETIC GAUGE AND TRANSMITTER LEVEL INSTRUMENTS

PART 1 -- GENERAL

1.01 THE REQUIREMENT
   A. The Contractor shall furnish, test, install and place in satisfactory operation the magnetic
      gauge and transmitter level instruments, with all spare parts, accessories, and
      appurtenances as herein specified and as shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE
   A. Section 17000 – Control and Information System Scope and General Requirements
   B. Section 17600 – Instruments, General

PART 2 -- PRODUCTS

2.01 LEVEL SIGHT GAUGE WITH TRANSMITTER
   A. General:
      1. The level sight gauge shall be comprised of a chamber, internal magnetic float,
         and external indicator. The internal float, located inside the chamber, maintains a
         constant magnetic circuit with the external indicator. As the float reacts to the
         fluctuating liquid levels within the adjoining tank, the external indicator responds to
         the rising or falling motion of the float, which provides an indirect level indication of
         the tank.
   B. Chamber Construction:
      1. Non-ferrous chamber material, 2-inch pipe with flanged connections, Schedule 40.
      2. Full ASME B31.1 and B31.3 rated.
      3. Schedule 40 branch connections.
      4. Materials to be coordinated with chemicals.
      5. Vent, drain, and process connections to be coordinated with tank.
   C. Scale:
      1. Feet and inches, ¼-inch divisions.
      2. Photoetched on stainless steel.
   D. Indicator:
      1. Yellow and black.
      2. Hermetically sealed.
E. Level Transmitter

1. Mounted externally to the level gauge chamber.
2. LCD display.
3. Two-wire, loop powered, 24 VDC nominal.
4. Signal: 4-20 mA, scaled as shown in instrument list or I/O schedule.
5. Accuracy: 0.01% total span.
6. NEMA 4X housing.

F. Manufacturers:

1. Jogler.
2. Magtech.

PART 3 -- EXECUTION

3.01 REQUIREMENTS

A. Refer to Section 17600, Part 3 of the specifications for additional requirements.

- END OF SECTION -
SECTION 17747
MULTIPLE SWITCH LEVEL PROBES

PART 1 – GENERAL

1.01 THE REQUIREMENT
A. The Contractor shall furnish, test, install and place in satisfactory operation the multiple switch level probes, with all spare parts, accessories, and appurtenances as herein specified and as shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE
A. Section 17000 – Control and Information System Scope and General Requirements
B. Section 17500 – Enclosures, General
C. Section 17700 – Powered Instruments, General

PART 2 – PRODUCTS

2.01 MULTIPLE SWITCH LEVEL PROBES
A. Multiple switch level probes shall be constructed as a slim rod from CPVC or PVC material with metal contacts at regular intervals along the probe. The metal contacts shall be high-grade stainless steel. The probe shall be sealed and potted to ensure that the unit is waterproof. The probe shall be of impact resistant construction and shall be able to withstand a drop test onto concrete from 6 feet with one end being let go before the other end.

B. Operating temperature range shall be 0 to 65 degrees C (32 to 149 degrees F).

C. Up to ten metal contacts shall be spaced along the length of the probe assembly, and each shall be individually connected to one core of cable. The cores shall be color coded for wiring into the controller (or equivalent identifier). The metal contacts shall be placed to minimize the opportunity for rags to short between contacts. For example, a small contact with minimal protrusion from the surface of the rod, offset by 120 degrees from the contact above.

D. Level monitoring range and elevations shall be per Section 17910, Instrument Schedule.

E. The flexible cable assembly shall be capable of supporting the weight of the probe and cable, without the need for additional support. The cable retained shall ensure that the probe to cable connection can support at least 100 pounds of weight. The cable shall be shielded.

F. Level probe shall be UL or FM approved for installation in Class 1, Division 2 hazardous areas without any barrier. Class I Division 1 shall be achieved with a suitable approved barrier. See Electrical Drawings for Area Classification.
G. Multiple switch level probes shall be the MultiTrode Probe as manufactured by MultiTrode, Inc.; FOGRod as manufactured by Wastewater Level, LLC; or equal.

2.02 CONTROLLER
A. The controller shall connect to the probe’s multiple sensing elements and provide relay outputs suitable for connection to a PLC or a dedicated pump controller system.
B. Controller shall be capable of accepting up to ten (10) probe inputs and shall provide ten (10) relay outputs. Controller outputs shall be programmable for the following selectable time delays: 0, 5, 10, or 15 seconds. Relay contact outputs shall be rated 5 A resistive and 2 A inductive at 250 VAC operating voltage.
C. Controller shall have a 10-LED bar graph display and one power on LED light. The unit shall be powered from 120 VAC directly or via a suitable 120 VAC to 24 VDC power supply. Operating temperature range shall be 14 degrees F to 140 degrees F. Provide an enclosure with a heater if heat calculations show that the interior of the panel will not be maintained above ambient temperature. Strip heaters attached to the enclosure shall not be acceptable.
D. Controller shall be of the same manufacturer as the probe and shall be Model MTIC as manufactured by MultiTrode, Inc.; the LIT-100 as manufactured by Wastewater Level, LLC; or equal.

2.03 INTRINSICALLY SAFE BARRIER
A. An intrinsically safe barrier (ISB) shall be provided between the level probe and the controller when the level probe is installed in classified hazardous areas. The barrier shall be compatible with the controller equipment and sensing device specified above.
B. ISB shall be Model MTISB as manufactured by Multitrode, Inc.; equivalent by Wastewater Level, LLC; or equal.

2.04 ENCLOSURE
A. A windowed front NEMA 4X Type 316 stainless steel enclosure shall be provided for housing the controller, necessary relays, the intrinsically safe barrier and other electrical components necessary for the operation of the level switch. A surge protection device shall be provided on the incoming 120 VAC power supply.
B. The enclosure shall be located in an unclassified location where the transmitter/controller is shown on the Drawings.

PART 3 – EXECUTION

3.01 REQUIREMENTS
A. The probe shall be installed as shown on the Drawings in accordance with the manufacturer’s recommendations and requirements.
B. The probe shall be suspended on its own cable and connected to a 6 mm, Type 316 stainless steel hook or mounting bracket which shall hang from a Type 316 stainless steel angle containing a polyurethane squeegee pad, so that the probe can be removed without entering the wet well. The squeegee shall have an appropriately sized hole and slot, enabling the probe to be pulled through and cleaned. Probe mounting hardware shall be MTAK 1 Mounting Bracket, as manufactured by Multitrode, Inc.; equivalent by Wastewater Level; or equal.

C. Probe cable shall be run in a separate conduit away from power cables in accordance with the requirements Section 17080, Quality Assurance and the manufacturer’s recommendations.

D. Refer to Section 17700, Powered Instruments, General for additional requirements.

- END OF SECTION -
SECTION 17910
INSTRUMENT SCHEDULE

PART 1 – GENERAL

1.01 THE REQUIREMENT
A. The Contractor shall furnish, test, install and place in satisfactory operation all instrumentation as herein specified and as shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE
A. Section 17920 – Control System Input/Output Schedule
B. Section 17950 – Functional Control Descriptions

PART 2 – PRODUCTS

2.01 NAMEPLATES
A. Items of equipment listed in the instrument schedule, control panels, and digital hardware items shall be identified with nameplates. Each nameplate shall be located so that it is readable from the normal observation position and is clearly associated with the device or devices it identifies. Nameplates shall be positioned so that removal of the device for maintenance and repair shall not disturb the nameplate. Nameplates shall include, as necessary, the equipment identification number, description, calibrated range, and set point(s). Abbreviations of the description shall be subject to the Engineer's approval.

B. Nameplates shall be made of 1/16-inch thick machine engraved laminated phenolic plastic having white numbers and letters not less than 3/16-inch high on a black background. Nameplates attached to instruments may be black laser etched 1/8-inch high text on stainless steel with sharp edges made smooth. Stamped text shall not be acceptable.

C. Nameplates shall be attached to metal equipment by NEMA rated stainless steel screws and to other surfaces by an epoxy-based adhesive that is resistant to oil and moisture. In cases where the label cannot be attached by the above methods, it shall be drilled and attached to the associated device by means of a braided stainless steel wire affixed with a permanent crimp.

D. Submit sample nameplate of each type.
## PART 3 – INSTRUMENT SCHEDULE

### Level Switches (Suspended Float) - Section 17670

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<thead>
<tr>
<th>Tag Number</th>
<th>Service Description</th>
<th>State/Span</th>
<th>Remarks</th>
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</thead>
<tbody>
<tr>
<td>4610-LSL-9101</td>
<td>CaCl2 Storage Tank 2 Sump Level Low</td>
<td>Alarm</td>
<td></td>
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<tr>
<td>4610-LSH-9101</td>
<td>CaCl2 Storage Tank 2 Sump Level High</td>
<td>Alarm</td>
<td></td>
</tr>
<tr>
<td>4610-LSHH-9101</td>
<td>CaCl2 Storage Tank 2 Sump Level Hi-Hi</td>
<td>Alarm</td>
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### Vane Flow Switches - Section 17660

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<th>Service Description</th>
<th>State/Span</th>
<th>Remarks</th>
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</thead>
<tbody>
<tr>
<td>4610FSH9101</td>
<td>CaCl2 Storage Tank 2 EEWS</td>
<td>Alarm</td>
<td></td>
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### Magnetic Gauge and Transmitter Level Instruments - Section 17743

<table>
<thead>
<tr>
<th>Tag Number</th>
<th>Service Description</th>
<th>State/Span</th>
<th>Remarks</th>
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<tr>
<td>4610LIT0111</td>
<td>CaCl2 Storage Tank 2</td>
<td>0-10 FT</td>
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### Capacitance Level Switches - Section 17747

<table>
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<tr>
<th>Tag Number</th>
<th>Service Description</th>
<th>State/Span</th>
<th>Remarks</th>
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</thead>
<tbody>
<tr>
<td>4610LSL0111</td>
<td>CaCl2 Storage Tank 2 Level Low</td>
<td>Alarm</td>
<td></td>
</tr>
<tr>
<td>4610LSH0111</td>
<td>CaCl2 Storage Tank 2 Level High</td>
<td>Alarm</td>
<td></td>
</tr>
</tbody>
</table>

- END OF SECTION -
SECTION 17920

CONTROL SYSTEM INPUT/OUTPUT SCHEDULE

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, test, install and place in satisfactory operation all control system
inputs and outputs as herein specified and as shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 17900 – Schedules and Control Descriptions
B. Section 17910 – Instrument Schedule
C. Section 17950 – Functional Control Descriptions

PART 2 -- CONTROL SYSTEM INPUT / OUTPUT SCHEDULE

<table>
<thead>
<tr>
<th>Tag Number</th>
<th>Service Description</th>
<th>State/Span</th>
<th>Type</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>QL-0117</td>
<td>CaCl2 Storage Tank 2 Outlet Valve In AUTO</td>
<td>Auto</td>
<td>DI</td>
<td>5050-PCP-0401</td>
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<tr>
<td>YOI-0117</td>
<td>CaCl2 Storage Tank 2 Outlet Valve Open status</td>
<td>Opened</td>
<td>DI</td>
<td>5050-PCP-0401</td>
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<tr>
<td>YCI-0117</td>
<td>CaCl2 Storage Tank 2 Outlet Valve Closed status</td>
<td>Closed</td>
<td>DI</td>
<td>5050-PCP-0401</td>
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<td>YA-0117</td>
<td>CaCl2 Storage Tank 2 Outlet Valve FAIL alarm</td>
<td>Fail</td>
<td>DI</td>
<td>5050-PCP-0401</td>
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<td>HSO-0117</td>
<td>CaCl2 Storage Tank 2 Outlet Valve Open command</td>
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<td>DO</td>
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<td>HSC-0117</td>
<td>CaCl2 Storage Tank 2 Outlet Valve Close command</td>
<td>Close</td>
<td>DO</td>
<td>5050-PCP-0401</td>
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<td>LAL-0111</td>
<td>CaCl2 Storage Tank 2 Level Low Alarm</td>
<td>Low</td>
<td>DI</td>
<td>5050-PCP-0401</td>
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<tr>
<td>LAH-0111</td>
<td>CaCl2 Storage Tank 2 Level High Alarm</td>
<td>High</td>
<td>DI</td>
<td>5050-PCP-0401</td>
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<td>LI-0111</td>
<td>CaCl2 Storage Tank 2 Level Indication</td>
<td>0-10 FT</td>
<td>AI</td>
<td>5050-PCP-0401</td>
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<tr>
<td>FAH-9101</td>
<td>CaCl2 Storage Tank 2 EEWS Flow Alarm</td>
<td>Alarm</td>
<td>DI</td>
<td>5050-PCP-0401</td>
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<tr>
<td>LAHH-9101</td>
<td>CaCl2 Storage Tank 2 Sump Level High Alarm</td>
<td>High</td>
<td>DI</td>
<td>5050-PCP-0401</td>
</tr>
</tbody>
</table>

Notes:
1. Input/Output types are as follows:

   DI  -  Discrete Input
   DO  -  Discrete Output
   AI  -  Analog Input
   AO  -  Analog Output
   RS485  -  Serial Communications Link

- END OF SECTION -
SECTION 17950
FUNCTIONAL CONTROL DESCRIPTIONS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, test, install and place in satisfactory operation all equipment as herein specified and as shown on the Drawings. THE CONTRACTOR SHALL BE RESPONSIBLE FOR FURNISHING COMPLETE FUNCTIONING SYSTEMS AS DESCRIBED HEREIN.

B. Together with the control system input/output schedule, the equipment specifications (including functional descriptions for local equipment control panels), and the Drawings, the functional control descriptions describe the required operation, monitoring, and control of the facilities included in this Contract.

C. THE FUNCTIONAL DESCRIPTIONS CONTAIN REQUIREMENTS FOR FURNISHING AND INSTALLING LABOR AND MATERIALS THAT MAY NOT APPEAR ELSEWHERE IN THE CONTRACT DOCUMENTS.

D. All equipment and services required in equipment local control panels provided to implement the monitoring and control functions described herein or in the process input/output schedules shall be provided by the Contractor through individual equipment suppliers.

E. Unless specifically stated otherwise, all interconnected wiring between all instruments, panels, controls, and other devices listed in the functional descriptions as required to provide all functions specified herein shall be furnished by the electrical subcontractor under Division 16. The electrical subcontractor shall provide all cable and conduit required to carry all signals listed in the process input/output schedules. Special cables that are required for interconnection between sensors or probes and transmitters or signal conditioners shall be furnished with the instrumentation devices by the equipment supplier.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01520 – Maintenance of Utility Operations During Construction

B. Section 17910 – Instrument Schedule

C. Section 17920 – Control System Input/Output Schedule
PART 2 -- FUNCTIONAL CONTROL DESCRIPTIONS, GENERAL

2.01 DEFINITIONS

A. RUNNING status signals shall be from auxiliary contacts provided with the motor control equipment (i.e., starter, VFD, SCR, etc.).

B. AUTO status signals shall be defined as HAND-OFF-AUTO switch in the AUTO position or process control system in AUTO (versus MANUAL).

C. FAIL status signals shall be defined as motor overload and/or any other shut down mode such as overtorque, overtemperature, low oil pressure, high vibration, etc.

D. READY status signal shall be defined as all conditions, including equipment control power, satisfied to permit remote control of the equipment.

2.02 CONVENTIONS

A. Operator workstation graphic display symbols and indicator lights on all MCC's, control panels, starter enclosures, etc. shall conform to the following color convention:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Running/On/Open</td>
<td>Green</td>
</tr>
<tr>
<td>Auto/Ready</td>
<td>White</td>
</tr>
<tr>
<td>Stopped/Off/Closed</td>
<td>Red</td>
</tr>
<tr>
<td>Fail/Alarm</td>
<td>Amber</td>
</tr>
<tr>
<td>Generic Status</td>
<td>Blue or White</td>
</tr>
</tbody>
</table>

2.03 PROCESS CONTROL

A. Where setpoints, operating limits, and other control settings are provided by the functional descriptions, these settings shall be initial settings only and shall be used for assistance in the initial startup of the plant. All such settings shall be fully adjustable and, based on actual operating conditions, the instrumentation subcontractor shall make all necessary adjustments to provide smooth, stable operation at no additional cost to the Owner.

B. Provision shall be made in PLC logic to suppress nuisance alarms and control actions by the following means:

1. For alarms and control actions derived from analog input signals, use adjustable time delays and deadbands.

2. For alarms and control actions derived from discrete input signals, use adjustable time delays.

3. Initial settings for time delays shall be 10 seconds (range 0-120 seconds). Initial settings for deadbands shall be 5% of span (range 0-100%).

4. Equipment that is started or stopped manually by the operator shall start or stop immediately, with no time delay.
C. All setpoint control shall be by PID control algorithms. Where only proportional control is specified, tuning constants shall be used to reduce the Integral and Derivative functions to zero. All setpoints, sequence times, sequence orders, dead bands, PID tuning parameters, PLC delay timers, variable speed operating range limits, and similar control constants shall be accessible and alterable from the operator workstations.

D. Unless otherwise specified, all equipment shall automatically restart after a power failure utilizing adjustable start delay timers in PLC control logic. Unless otherwise specified, all PLC control strategies shall be based upon automatic restart after a power failure and shall return to a normal control mode upon restoration of power.

E. The PLC shall be capable of receiving initial run-time values for existing and proposed equipment. Initial run-time shall not automatically be assumed to be zero.

F. A control discrepancy alarm shall be generated through the PLC for any drive, motor, etc. for which a command has been issued, but for which the PLC is not receiving a confirming status signal (e.g., start command with no run feedback). The failure shall be logged.

G. An instrument failure alarm shall be generated for any instrument which is generating a signal that is less than 4 mA or greater than 20 mA.

H. Unless otherwise specified in an individual control description, an instrument failure or control discrepancy alarm shall cause the control strategy to maintain last values and to generate an alarm. Manual initiation of the automatic control strategy shall be required.

I. A control program that controls multiple pieces of equipment shall not be prevented from running because not all of the equipment is in AUTO. If equipment within an equipment chain is required to be running for program operation and it is running in HAND or MANUAL, then the program shall run and control the other equipment that is in AUTO.

J. All PLC wait states (internal time delays, etc.) after an operator action shall be displayed on the operator workstation.

PART 3 -- FUNCTIONAL CONTROL DESCRIPTIONS

3.01 Calcium Chloride Storage Tank No. 2

A. Process Overview

The new 5,000-gallon bulk storage tank will have continuous level monitoring with a signal back to the SCADA system indicating tank level. The tank will also be provided with separate level switches. The tank will also have a magnetic level indicator for local level display. The PLC will include a discrepancy alarm between the new level transmitter and the level transmitter on the existing tank. When the 2 tanks are operating in tandem, if the tank level between the two instruments differs by more than 10% a discrepancy alarm will be displayed on the SCADA system. This feature shall the ability to be turned off if the tanks are operating independently.

B. Tank Control Operations
1. Control of tank filling will be performed manually through manual isolation valves and Banjo quick connection, allowing the bulk tank truck to discharge the load.

2. Control of tank discharge will be by a motorized open/close valve located on the discharge of the new tank. When the valve’s LOR switch is in LOCAL, the valve is opened and closed by the operator. When the valve’s LOR switch is in REMOTE, control of the valve will be handled by the PLC either manually at the HMI or automatically by the PLC automation.

3. The new storage tank shall be provided with a level transmitter that will have the signal transmitted to the SCADA system for indication, control, and archiving. A tank high level switch and a tank low level switch shall, upon activation, be alarmed at the SCADA system.

4. The new tank containment area will collect into a new sump. The new sump will be provided with a new sump pump and control panel. The LCP shall include START/STOP pushbuttons for the sump pump. When the START pushbutton is pressed, the sump runs until the STOP pushbutton is pressed or the low level switch is activated. The pump will stop when it is RUNNING and the STOP pushbutton is pressed. A High-High level alarm will be sent to the SCADA system.

5. A new emergency eye wash and shower (EEWS) will be provided near the new storage tank. The EEWS shall be provided with a flow switch that will be sent to the SCADA system for alarming.

- END OF SECTION -
WATER REPLENISHMENT DISTRICT OF SOUTHERN CALIFORNIA

LEO J. VANDER LANES WATER TREATMENT FACILITY CALCIUM CHLORIDE BULK STORAGE EXPANSION

OVERALL SITE PLAN

- CONSTRUCTION NOTE
  1. DRAWING SCALE IS DEPICTED FOR 1/2" = 1'-0" AND CONSTRUCTION SCALE
  2. DRAWING IS NOT CONSTRUCTION SCALE
  3. ACCEPTABLE IN ACCORDANCE WITH INSTRUCTIONS AND REQUIREMENTS OF ENGINEER TO DETERMINE SCALE OF PLAN AND ACCURACY OF DRAWING
  4. REMAIN IN PLACE STEEL GIRDERS AND CONCRETE BLOCKER TILES AND AS SHOWN IN DRAWING
  5. PIPE CONNECTIONS TO WATER MAIN SHALL BE OF WELDED ANDMADE FROM PIPE AS SHOWN
  6. FOUNDATION AND WALLS TO BE SITE BORROWEDCALCULATED TO PROVIDE SOIL SIDE WALL

Hazen and Sawyer
1149 S. Hill Street, Suite 450
Los Angeles, California 90015

Issued for Construction

Issue Date: 03/2019

Packet Page 760 of 814
GENERAL STRUCTURAL NOTES

G-15 NO BACKFILL SHALL BE PLACED AGAINST ANY SUBSTRUCTURE WALLS UNLESS ALL ADJACENT SUPPORTING ELEMENTS HAVE ACHIEVED GENERAL STRUCTURAL NOTES

G-13 STRUCTURES HAVE BEEN DESIGNED FOR OPERATIONAL LOADS ON THE COMPLETED STRUCTURE. DURING CONSTRUCTION, THE STRUCTURAL DRAWINGS SHALL BE USED IN COORDINATION WITH THE DRAWINGS OF ALL OTHER DISCIPLINES AND ALL DIMENSIONS INDICATED (*) SHALL BE VERIFIED EITHER BY FIELD MEASUREMENTS FOR EXISTING STRUCTURES OR BY SHOP DRAWINGS FOR EQUIPMENT FURNISHED. STRUCTURAL DIMENSIONS NOT SHOWN BUT CONTROLLED BY OR RELATED TO CONCRETE DEMOLITION WITHIN STRUCTURES BEING MODIFIED SHALL BE SELECTIVE DEMOLITION BY CORE DRILLING OR DOWELS SET IN EPOXY IN DRILLED HOLES AS SPECIFIED. DOWELS LOCATED CLOSER THAN 3" FROM ANY EDGE OF CONCRETE SHALL NOT BE PERMITTED. CONTRACTOR SHALL CORE DRILL CORNERS OF OPENING PRIOR TO SAWCUTTING. EXPLOSIVES AND VIBRATORY HAMMERS SHALL NOT BE USED FOR DEMOLITION WORK.

D-6 PRIOR TO DEMOLITION OF SMALL OPENINGS (LESS THAN 6 INCHES IN SIZE) FOR PENETRATIONS, ETC., CONTRACTOR SHALL USE NON-DESTRUCTIVE MEANS TO FIELD LOCATE REINFORCEMENT. OPENINGS SHALL BE LOCATED TO AVOID CUTTING THROUGH EXISTING BACK ANCHORS AND REINFORCEMENT STEEL 1/2" MIN BELOW SURFACE AND VOIDS CREATED SHALL BE FILLED WITH EPOXY RESIN.

D-8 DETAILED CONSTRUCTION AND DEMOLITION PLAN SHALL BE SUBMITTED TO THE ENGINEER AND APPROVED BY THE ENGINEER PRIOR TO SHUTDOWN.

D-10 A. SAWCUT THE FLOOR AROUND THE EQUIPMENT PAD PERIMETER TO A DEPTH OF 1/4".

D-11 CONCRETE DEMOLITION WITHIN STRUCTURES BEING MODIFIED SHALL BE SELECTIVE DEMOLITION BY CORE DRILLING OR DOWELS SET IN EPOXY IN DRILLED HOLES AS SPECIFIED. DOWELS LOCATED CLOSER THAN 3" FROM ANY EDGE OF CONCRETE SHALL NOT BE PERMITTED. CONTRACTOR SHALL CORE DRILL CORNERS OF OPENING PRIOR TO SAWCUTTING. EXPLOSIVES AND VIBRATORY HAMMERS SHALL NOT BE USED FOR DEMOLITION WORK.

D-12 EQUIPMENT SUPPORTS, ANCHORAGE, OPENINGS AND REBAR SHAL NOT BE MADE TO THE STRUCTURE, DRAWN BUT NOT REQUIRED OR SPECIFIED IN THE CONTRACT DOCUMENTS.

D-15 PRIOR TO DEMOLITION OF SMALL OPENINGS (LESS THAN 6 INCHES IN SIZE) FOR PENETRATIONS, ETC., CONTRACTOR SHALL USE NON-DESTRUCTIVE MEANS TO FIELD LOCATE REINFORCEMENT. OPENINGS SHALL BE LOCATED TO AVOID CUTTING THROUGH EXISTING BACK ANCHORS AND REINFORCEMENT STEEL 1/2" MIN BELOW SURFACE AND VOIDS CREATED SHALL BE FILLED WITH EPOXY RESIN.

D-17 CONSULTS AND OTHER SIMILAR ITEMS IMPOSED THROUGH CONSTRUCTION WILL BE SPACED ON CENTER NOT LESS THAN THREE TIMES THEIR DIAMETER OR SIZE, AND CONTRACTOR SHALL NOT PERMIT EXISTING EQUIPMENT PAD CONCRETE TO BE REPAIRED, REPLACED OR MODIFIED WITHOUT CONSENT OF THE ENGINEER.

D-19 CLEARance FROM EXISTING ANCHORS TO ANY CONCRETE ISLANDS SHOULD BE AT LEAST THREE TIMES THE DIAMETER OF THE ANCHORS.

D-20 CONCRETE CONSTRUCTION STRENGTH TESTS WILL BE AVAILABLE ON THE JOB SITE FOR REVIEW BY THE ENGINEER.

NONSTRUCTURAL COMPONENT ARCHITECTURE

A-1 ALL ARCHITECTURAL, MECHANICAL, AND ELECTRICAL COMPONENTS SHALL BE DESIGNED AND INSTALLED TO RESIST THE CONTINUING OPERATIONAL LOADS ON THE STRUCTURE IN ACCORDANCE WITH THE ASME, ACI, ASCE, AWS, UL, NFPA, ANSI AND OTHER CODES AND STANDARDS APPLICABLE TO THE ELEMENTS AS DESIGNED.

A-2 COMPONENT REACTION FORCES AT THE POINT OF ATTACHMENT TO THE STRUCTURE SHALL BE SUBMITTED TO AND COORDINATED WITH THE ENGINEER prior to construction.

A-3 CONTRACTOR SHALL PROVIDE SPECIAL SEISMIC CERTIFICATION (SSC) FROM MANUFACTURER OF EQUIPMENT FOR ALL SYSTEMS AND COMPONENTS. SPECIAL SEISMIC CERTIFICATION SHALL INCLUDE THE FOLLOWING:

1. A PHASE 1 REPORT THAT DESCRIBES THE GENERAL DESIGN PHILOSOPHY OF THE VENDOR'S EQUIPMENT.

2. A PHASE 2 REPORT THAT DESCRIBES THE DETAILS OF THE VENDOR'S EQUIPMENT.

A-4 ALL RESULTS OF ARCHITECTURAL, MECHANICAL, AND ELECTRICAL COMPONENTS SHAL Be SUBMITTED TO THE ENGINEER prior to construction.

A-5 ALL CONNECTIC DESIGN CHECKS AND CONFIRMATION DRAWINGS SHALL BE SUBMITTED TO AND APPROVED BY THE ENGINEER prior to construction.

A-6 ALL CONCRETE REINFORCEMENT SHALL CONFORM TO AASHTO (A483) AND ASTM (A615). MINIMUM REINFORCEMENT SPACING SHALL BE 2" FOR 1/2" BARS AND 3" FOR 5/8" BARS.

A-7 ALL CONCRETE STEEL REINFORCEMENT SHALL BE HEAT TREATED.

A-8 ALL CONCRETE STEEL REINFORCEMENT SHALL BE HEAT TREATED.

A-9 ALL CONCRETE STEEL REINFORCEMENT SHALL BE HEAT TREATED.
SPECIAL INSPECTIONS

1. CONTINUOUS SPECIAL INSPECTION OF SPECIAL STRUCTURAL STEEL CONNECTIONS SHALL BE PERFORMED IN ACCORDANCE WITH THE REQUIREMENTS OF THE CBC.

2. SPECIAL INSPECTIONS ARE REQUIRED DURING CONSTRUCTION ON THE TYPES OF WORK LISTED IN THE TABLE BELOW. THE CONTRACTOR SHALL NOTIFY THE INSPECTION OFFICIAL OF THE INTENT TO PERFORM SPECIAL INSPECTIONS ADEQUATELY PRIOR TO COMMENCING WORK.

3. THE REQUIRED SPECIAL INSPECTION TASK TABLES ARE IN CONFORMANCE WITH THE APPROPRIATE STANDARD REQUIREMENTS AS LISTED IN THE FOLLOWING.

4. WHERE APPLICABLE, SEE SECTION 1705.11 OF THE CBC. REGARDING SPECIAL INSPECTION REQUIREMENTS.

5. SPECIAL INSPECTION FOR STRUCTURAL STEEL SHALL BE PERFORMED IN ACCORDANCE WITH THE QUALITY ASSURANCE PLAN REQUIREMENTS OF ACI 318.

6. CONTINUOUS INSPECTION REFERS TO THE FULL-TIME OBSERVATION OF WORK COMMENCED ON THE SITE WHERE THE WORK IS BEING PERFORMED.

7. PREVIOUS INSPECTION REFERS TO THE PREVIOUS INTERRUPTION OF SPECIAL INSPECTION BY AN APPROVED SPECIAL INSPECTOR WHO IS PRESENT IN THE AREA WHERE THE WORK HAS BEEN OR IS BEING PERFORMED PRIOR TO THE COMPLETION OF THE WORK.

8. OWNER OR OWNER'S REPRESENTATIVE SHALL BE NOTIFIED OF SPECIAL INSPECTION PRIOR TO CONCRETE PLACEMENT IF THE PROJECT IS NOT UNDER THE JURISDICTION OF A BUILDING DEPARTMENT.

INSTRUCTION TASK LEGEND

1. DOCUMENT ACCEPTANCE OR REJECTION

2. PRE-INSTALLATION VERIFICATION TESTING

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8. OWNER OR OWNER'S REPRESENTATIVE SHALL BE NOTIFIED OF SPECIAL INSPECTION PRIOR TO CONCRETE PLACEMENT IF THE PROJECT IS NOT UNDER THE JURISDICTION OF A BUILDING DEPARTMENT.
1. Vertical joints shall be formed by an approved keyway (hatch or grooved joint). Horizontal joints shall be formed by an approved keyway (hatch or grooved joint). Joints shall be covered for protection.

2. Depth shall be 1/10th of the concrete thickness, and shall be top concrete thickness (minimum 1/4") from the edge of the slab.

3. Vertical bars shall be covered for protection.

4. Vertical bars shall be lengthened for protection.

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100. Vertical bars shall be lengthened for protection.
STAIR NOISING

TERMINATES ABRASIVE NOISING 2' INFRONT OF STAIR.

PAINT UNDERSIDE OF NOSING PER
PAINTING SPECS

REINFORCING AS
REQUIRED, SEE
CONTRACT DWGS

ALUMINUM HANDRAILS

3 1/2" 3/4" 3/4"

EDGE OF CONCRETE

CAST AL BASE PLATE

3'-6"

8"

2'-10"

17"

4" MAX

SURFACE MOUNTED TO CONCRETE

ALUMINUM HANDRAILS

TYPE 1

DETAIL

NOTE:

 ELEMENTS PIPE OR CONDUIT EMBEDDED IN SLAB

STAIR FITTING

1 1/2" SCH, 40 ALUMINUM PIPE (TYP FOR RAILS)

1 1/2" SCH, 80 ALUMINUM PIPE (TYP FOR POSTS)

1 1/2" AL PIPE

RAILING

TOEBOARD, TYPICAL

ALL HANDRAILS

9/16"Ø Holes

SURFACE MOUNTED TO CONCRETE

FRP OR CONDL. EMBEDDED IN SLAB

FRP L3x3x3/8, CONT

FRP EMBEDDED ANGLE

PROVIDE 1/2" FRP STIFFENER @ 18" OC

FRP EMBEDDED ANGLE

1/2"Øx5 1/2" @ 18" SPAN, S

3'-6"< S ≤ 5'-0" 5/8"Øx6" @ 18" SPAN, S

0'-0" < S ≤ 3'-6" 1/2"Øx5 1/2" @ 18" SPAN, S

04/26/19

structStdDetails.png
1. Apply protective coating on interior surface of walls, including tops of walls, and floor slab of chemical storage areas, in conformance with specification section 09900.

2. Contractor shall coordinate placement of equipment pad with mechanical drawings. Concrete equipment pads shown on drawing are approximate. Contractor shall coordinate with equipment manufacturer to verify equipment pad sizes and thicknesses.

3. Steel framed canopy shall be per specification section 13121. Canopy design calculations and detailed drawings shall be signed and sealed by a professional engineer currently registered in the state of California.

4. Canopy system shall be designed per the California Building Code, loads, and code parameters shown on drawing S-01. In addition to these loads, the roof shall be designed for a dead load of 5 PSF plus the building selfweight. For wind uplift, this dead load shall be reduced to zero.

5. The contractor shall coordinate anchor rod requirements with the canopy manufacturer. A minimum of four anchor rods with 12 inch minimum embedment shall be provided for all columns per detail P/S-06. All canopy column connections to foundations shall be designed as "PINNED" connections. No moment transfer is permitted. The contractor shall provide the column reaction loads to the engineer for verification of anchor rod embedment requirements and foundation capacity.

6. All appurtenances attached to or supporting the canopy structure shall be designed by and provided by the canopy manufacturer as part of the canopy structure package. The canopy manufacturer and supplier shall be totally responsible for coordinating attachment of all appurtenances to canopy frame.

7. Contractor shall coordinate lighting, piping, or other utility supports to be attached to beams, with the canopy manufacturer.

8. Canopy frame shall be designed to accommodate 1/2" of differential settlement between lines X&Y and lines 1&3.

9. Roof metal decking shall be 24 gauge minimum thickness per specification section 13121. Fasteners shall be designed for applicable design wind pressures and seismic forces. Fastener size and spacing shall be submitted in shop drawings.

10. Provide 2" layer of clean sand over 10 mil vapor barrier, over 4" crushed gravel, 3/4" in size or smaller. Excavated soil beneath base course shall be moisture conditioned to slightly above the laboratory optimum and compacted to 90% maximum dry density per ASTM D1557.

**3'-0" dimension is a fixed dimension and controls the location of the calcium chloride structure. It is from the outside edge of the existing citric acid storage wall to the outside edge of the proposed calcium chloride structure.**
I. WATERS
H. BENAVIDES

ELECTRICAL
ONE LINE DIAGRAMS, RISER
DIAGRAMS, AND SCHEDULES

G. FRON
ISSUED FOR
CONSTRUCTION

LEO J. VANDER LANS WATER TREATMENT
FACILITY CALCIUM CHLORIDE BULK
STORAGE EXPANSION
WATER REPLENISHMENT DISTRICT OF
SOUTHERN CALIFORNIA

20125-003
APRIL 2019

IF THIS BAR DOES NOT
MEASURE 1" THEN DRAWING IS
NOT TO FULL SCALE

CHECKED BY:

DRAWN BY:

DESIGNED BY:

PROJECT ENGINEER:

CONTRACT NO.:

HAZEN NO.:

DATE:

DRAWING NUMBER:

HAZEN AND SAWYER
1149 S. HILL STREET, SUITE 450
LOS ANGELES, CALIFORNIA 90015

WATER REPLENISHMENT DISTRICT OF
SOUTHERN CALIFORNIA

LEO J. VANDER LANS WATER TREATMENT
FACILITY CALCIUM CHLORIDE BULK
STORAGE EXPANSION

ELECTRICAL
ONE LINE DIAGRAMS, RISER
DIAGRAMS, AND SCHEDULES

REV ISSUED FOR DATE BY

Meeting Date: 7/18/2019   Item No. 9
Packet Page 741 of 760
MEMORANDUM

ITEM NO. 10

DATE: JULY 18, 2019
TO: BOARD OF DIRECTORS
FROM: ROBB WHITAKER, GENERAL MANAGER
SUBJECT: RESERVE FUND POLICY

SUMMARY

The level of reserves maintained by a utility is an important component of short and long-term financial management, is a key consideration in the rate-setting process. Further, the level of reserves is one of the key financial metrics used by credit rating agencies when evaluating the financial strength of an organization. Prudent reserves are an important financial tool that benefits both WRD and the pumpers. A prudent level of reserves helps mitigate financial risks due to changes in pumping levels, unexpected cost increases, and emergencies.

Given recent changes in legislation (SB 963), it is important that WRD establish a reserve policy and adopt formal practices to ensure that reserves meet WRD’s financial and operational objectives. Among other things, the Reserve Policy articulates:

- How these balances are established
- How funds are used
- How the adequacy of each respective reserve fund balance is determined
- How reserves are replenished when used

Once reserve targets are established, they should be reviewed annually during the budgeting process to monitor current levels and evaluate conformance with the policy. Decisions can then be made to maintain, increase, or spend down reserve balances, as appropriate, with an understanding of the impact of such decisions to the upcoming budget period and WRD’s long-term financial plan.

Staff has reviewed reserve fund guidelines from the Government Finance Officers Association (GFOA), American Water Works Association (AWWA), California Special Districts Association (CSDA) and the National Advisory Council on State and Local Budgeting (NACSLB) in developing the District’s Reserve Fund Policy.

With SB 963 removing any limit on District reserve funds, this annual analysis of funds is an important part of responsible financial planning, particularly as WRD transitions from an agency that produces water to one that produces water and operates and maintains three capital facilities.
The recommended policy reflects comments from the Budget Advisory Committee (BAC) and the Finance/Audit Committee. The policy does not include restricted reserves held in trust by US Bank (e.g. bond proceeds, CalTrans Trust, etc.) The policy identifies six reserve funds:

1. **Operating Reserve.** The operating reserve is an unrestricted reserve used to stabilize finances in the event of lower than expected sales, un budgeted expenses and other unforeseen events.

2. **Debt Service Reserve.** This restricted fund is established pursuant to the covenants in WRD’s State Revolving Fund Loan.

3. **Equipment Replacement Reserve Fund.** The Equipment Replacement Fund is used to fund periodic replacement of assets with expected useful lives of three to twenty years. Effective use of a replacement reserve helps to stabilize annual budgets, reducing the need for large expenditures as equipment is replaced.

4. **Safe Drinking Water Program Fund.** The Safe Drinking Water Fund is used to account for, and fund, loans and grants to help clean up the groundwater basin. This fund will be a “revolving” fund, to be replenished by repayment of outstanding loans as well as any needed funding from WRD.

5. **Well Construction and Rehabilitation Program Fund.** This fund would be used provide zero loans to pay for well construction and rehabilitation. Qualifying projects would assist groundwater producers’ ability to utilize their full groundwater extraction rights, reducing demands for imported water. As with the Safe Drinking Water Program Fund, this would be a revolving fund, replenished by repayment of loans as well as any additional contributions by WRD.

6. **Water Purchase Carryover Fund.** The Water Purchase Carryover Fund is funded with revenues that would have been used to purchase water to replenish the basin when imported water is unavailable for purchase. This reserve is funded with remaining revenues that had been budgeted for purchasing imported water or other supplies but were not expended for this purpose due to the lack of availability of water.

The Budget Advisory Committee reviewed the attached reserve policy and, has agreed with the targets shown in Table 1 for each of the funds. These targets are consistent with the following specific BAC recommendations:

1. **Operating Reserve.** The BAC suggested increasing the Operating Reserve to include 3 months of operations.

2. **Debt Service Reserve.** The District’s bond covenants required the District to keep one year of debt service payments for the 2004, 2008 and 2011 debt. When the District refinanced those funds through the 2015 revenue bond, the covenants no longer required a reserve of one year of debt service payments. The SRF loan is the only debt that requires one year of debt service held in reserve. Therefore, the BAC suggested decreasing this reserve fund to include only the SRF required amount of $3.2M.
3. Emergency Capital Repair Reserve – This is related to any emergency repairs needed by the District. The original staff proposal included establishing a reserve for emergency capital repairs. The BAC and the Finance/Audit Committee suggested eliminating that reserve in favor of a larger Operating Reserve. This would provide more financial flexibility to fund both capital and operating expenditures.

4. Water Purchase Carryover Fund – The BAC recommended that there be no target or maximum for the Water Purchase Carryover Fund, and these funds would be driven by the resource goals of the District.

The BAC also requested that WRD review the Equipment Replacement Fund to see if it could be reduced. As a result, the target level has been reduced to $5.0 million from the original staff proposal of $15.0 million.

Table 1 reflects these comments and suggestions. These targets and the amount of money in each fund will be reviewed each year as part of the annual budget process.

<table>
<thead>
<tr>
<th>Reserve Fund</th>
<th>Description</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Reserve</td>
<td>Three months operating expenses</td>
<td>$20.4 Million</td>
</tr>
<tr>
<td>Debt Service Reserve</td>
<td>One year of principal and interest on the State Revolving Fund Loan</td>
<td>$3.2 Million</td>
</tr>
<tr>
<td>Equipment Replacement Reserve Fund</td>
<td>Estimate of equipment replacement needs based on WRD’s depreciation schedules</td>
<td>$5.0 Million</td>
</tr>
<tr>
<td>Safe Drinking Water Program Fund</td>
<td>Estimated need to sustain funding for eligible projects.</td>
<td>$5.0 Million</td>
</tr>
<tr>
<td>Well Construction and Rehabilitation Loan Program</td>
<td>Estimated need to sustain funding for eligible projects.</td>
<td>$7.5 Million</td>
</tr>
<tr>
<td>Water Purchase Carryover Fund</td>
<td>There would be no set target. This Fund would be equal to amounts remaining after funding water purchases and other activities needed to replenish the basin.</td>
<td>NA</td>
</tr>
</tbody>
</table>

Table 1. Target Amounts for Reserve Funds

Table 2 shows projected balances at June 30, 2019, given current reserve levels and how reserves would be reallocated to be consistent with the proposed reserve policy. The projected balances are based on financial results through March 31, 2019. As such, final year-end results will likely be different than shown in Table 2 – and will be reflected in the balance in the Water Purchase Carryover Fund.
<table>
<thead>
<tr>
<th>Reserve Fund</th>
<th>Estimated Balance at June 30, 2019 (1)</th>
<th>Balances Consistent with Proposed Reserve Fund</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Reserve</td>
<td>$8.0 Million</td>
<td>$20.4 Million</td>
</tr>
<tr>
<td>Debt Service Reserve</td>
<td>$14.8 Million</td>
<td>$3.2 Million</td>
</tr>
<tr>
<td>Equipment Replacement Reserve Fund</td>
<td>$4.8 Million</td>
<td>$5.0 Million</td>
</tr>
<tr>
<td>Safe Drinking Water Program Fund</td>
<td>$3.7 Million</td>
<td>$5.0 Million</td>
</tr>
<tr>
<td>Well Construction and Rehabilitation Loan Program</td>
<td>$1.5 Million</td>
<td>$7.5 Million</td>
</tr>
<tr>
<td>Water Purchase Carryover Fund</td>
<td>$18.7 Million</td>
<td>$10.4 Million</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>$51.5 Million</strong></td>
<td><strong>$51.5 Million</strong></td>
</tr>
</tbody>
</table>

(1) Based on March 31, 2019 financial activity. Actual results will vary.

**Table 2. Projected Reserve Fund Balances vs. Proposed Targets**

Table 2 assumes that all reserves will be funded at their recommended targets beginning in fiscal year 2019/20. Monies from the Debt Service Reserve Fund and Water Purchase Carryover Fund are reallocated to meet the targets, leaving an estimated $10.4 million in the Water Purchase Carryover Fund for future needs.

**FISCAL IMPACT**
Adopting the Reserve Policy, proposed targets and funding levels will improve financial planning, improve transparency and strengthen WRD’s financial profile.

**BUDGET ADVISORY COMMITTEE (BAC) RECOMMENDATION**
For discussion and possible action.
RESERVE FUND POLICY

The purpose of this Reserve Fund Policy for the Water Replenishment District of Southern California (WRD or District) is to describe the District’s need and use of reserves to support the organization’s financial needs. Reserves are an important tool to ensure financial sustainability and to mitigate impacts on WRD and the groundwater producers.

This Reserve Fund Policy will be implemented in conjunction with the other financial policies of the organization and is intended to support the goals and strategies contained in those related policies and in strategic and operational plans.

As part of the District’s effort to increase transparency, the Board of Directors approved adding the Budget Advisory Committee (BAC) to the District’s Administrative Code so the BAC can continue to be used to review the annual budget, as well as the District’s reserve fund policy.

The following list explains several considerations for setting appropriate levels of operating reserves:

1. Bond/Loan Covenants – bond/loan covenants often define required minimum operating reserve levels in addition to restricted debt service reserves. In the case of WRD, the 2016 State Revolving Fund (SRF) loan of $80 million, which has an interest rate of 1.0%, requires the District to maintain have 120% debt service coverage without the use of reserves. In addition, the loan covenants require WRD to maintain a debt service reserve fund equal to or greater than one year’s debt service.

2. Credit rating objectives – unrestricted reserves are a key consideration in establishing a bond rating. Each of the major rating agencies includes available reserves (unrestricted reserves) as a metric used in judging the credit strength of the agency. Reserves are a measure of liquidity and the utility to meet unforeseen events such as earthquakes, droughts, and other weather-related events (e.g., greater rain and cooler weather leading to lower pumping). Rating agencies look at the number of days cash the utility holds to assess how much financial flexibility the utility maintains. Days cash is equal to the amount of available reserves divided by annual operating expenses times 365. The District is rated AA+ by both Standard & Poor’s and Fitch Ratings. The level of reserves is an important reason for these strong credit ratings.

3. Rate structure – major impacts to the District’s rate structure include annual pumping in the Central and West Coast Basins, regional conservation efforts, water quality issues and legislation (such as the previous Water Code §60290).

The District’s reserves will be segregated into separate categories as follows:

1 Source: Cash Reserve Policy Guidelines from the American Water Works Association
1. Operating Reserve  
2. Debt Service Reserve  
3. Equipment Replacement Reserve  
4. Safe Drinking Water Fund  
5. Well Replacement and Rehabilitation Fund  
6. Water Purchase Carryover Reserve

Cash, investments and reserve balances will be reported to the Finance/Audit Committee and Board of Directors and included in the regular financial reports.

**OPERATING RESERVE**

*Purpose of Fund* - An operating reserve is an unrestricted fund balance set aside to stabilize finances by providing a cushion against unexpected events, losses of income, and unbudgeted expenses. Operating reserves are not used to cover a long-term shortfall or structural deficit. The Operating Reserve can allow WRD to weather serious bumps in the road by providing a source of funds while the District implements actions and strategies to address these one-time or temporary events. It is also a benefit to the groundwater producers as the Operating Reserve can be used to offset the need to have large and varying increases in the Replenishment Assessment due to a one-year event. Ideally, WRD would never draw upon its Operating Reserve, and if it does, it would only be used to solve temporary problems, not structural financial problems.

*Reserve Target* - The District’s Operating Reserve is defined as the designated fund set aside by action of the Board of Directors. The minimum amount to be designated as operating reserve will be established in an amount sufficient to maintain ongoing operations and programs for a set period of time, measured in months. The operating reserve serves a dynamic role and will be reviewed and adjusted in response to internal and external changes.

The Government Finance Officers Association (GFOA), recommends a minimum Operating Reserve Fund equal to two months of average recurring operating costs or revenues².

Additionally, the American Water Works Association (AWWA) states that the most common metric used in evaluating operating reserve levels is time; number of days or months of operating expenses. While they do not provide an actual recommendation, they provide recommended reserve levels from Water Environment Federation (one to three months of operating costs) and International City/County Management Association (1-2 months of expenses).³ The AWWA recommendation levels are similar to those of the GFOA. The rating agencies also provide guidance for the AA rating category, ranging from 90 days cash to 180 days cash.

**The reserve target for operating reserves will be three months (90 days) cash.**

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³ Source: Cash Reserve Policy Guidelines for 2018 from the American Water Works Association
In addition to calculating the actual operating reserve at the fiscal year-end, the operating reserve fund target will be calculated each year during the annual budget process. As stated in Water Code §60233(a), the Budget Advisory Committee (BAC) will review the annual budget, as well as the reserve funds maintained by the District.

**Intended Use of Reserve** - The operating fund should be used for non-recurring operating expenses at the discretion of the Board of Directors.

**DEBT SERVICE RESERVE FUND**

*Purpose of Fund* – The debt service reserve fund is necessary to meet bond and/or loan covenants. These covenants often require the borrower to hold an amount equal to one year’s worth of principal and interest payments or an amount equal to the highest year of principal and interest (maximum annual debt service.) Such reserves provide additional comfort to investors regarding the District’s ability to meet its annual principal and interest payments.

*Reserve Target* – The Debt Service Reserve Fund is used to set aside funds for future use to meet the District’s debt service obligations. Currently, the District has three major debt instruments:

- **State Revolving Fund (SRF) – Prop 1 Funding**
  The District entered into a loan agreement with the State Water Resources Control Board that requires the District to “establish a restricted Reserve Fund, held in the District Fund, equal to one year’s debt service…" This fund must be maintained for the full term of the Agreement. One year of principal and interest for the SRF loan is **$3.2 million** (rounded up to the nearest hundred thousand). In a fiscal emergency, this reserve fund is intended to provide security to the bondholders while allowing the District time to address any financial issues causing non-payment.

- **2015 Revenue Bonds**
  In 2015, the District issued $148,345,000 of debt for the refunding of the outstanding 2004, 2008 and 2011 Certificates of Participation (COPs) and $69,500,000 of new money for the District’s capital improvement plan. The District does not have a bond covenant requiring it to maintain a debt service reserve.

- **2018 Revenue Bonds**
  In 2018, the District issued $65,785,000 in December 2018. As with the 2015 Revenue Bonds, the District has not covenanted to maintain a debt service reserve.

The reserve target for the debt service reserve fund is equal to one year of principal and interest on the 2016 SRF Loan.

*Intended Use of Reserve* – This fund shall be maintained for the term of the debt instrument and can be used to pay principal and interest payments if the District is unable to do so or to pay the last year of principal and interest on the loan.

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4 Source: California Clean Water Loan Agreement, Appendix D
EQUIPMENT REPLACEMENT RESERVE FUND

*Purpose of Fund* – An equipment replacement fund is established to fund the periodic replacement of assets with relatively short useful lives. Assets defined as equipment include vehicles, pumps, computer equipment, office equipment, mechanical equipment, laboratory equipment, and other similar equipment with an expected life typically in the range of as few as three to as many as twenty years. The use of an equipment replacement reserve helps to smooth out budget impacts over years as equipment reaches the end of its useful life.

*Reserve Target* – There are two general methods of determining equipment replacement funds:

Method 1 – Annual deposits based on depreciation of existing equipment and maintenance of a minimum balance based on a percentage of the value of equipment. Annual deposits are determined based on an itemized schedule of equipment, listing the type of equipment, the original cost, the expected service life, and the annual deposit to the equipment replacement fund. The total annual deposit is the sum of the annual deposits for each asset. When an asset on the equipment replacement fund list is replaced, the amount is drawn from the fund, and the schedule of annual deposits is adjusted accordingly to reflect the value and service life of the new asset(s).

Method 2 – A minimum balance in the equipment reserve fund is often determined based on a percentage of the value of equipment assets. The more equipment maintained by a utility, the lower the recommended percentage of value of the equipment assets that are maintained in reserve. In determining the recommended percentage, the utility should consider the value of the costliest piece of equipment on the replacement schedule as it represents the maximum cost to replace an unplanned equipment item.

With the District’s Computerized Maintenance Management System (CMMS), the District will obtain all funding requirements through the system to set the target reserve level, using Method 1 of the AWWA’s Cash Reserve Policy Guidelines.

This target will be updated annually to reflect actual equipment needs.

*Intended Use of Reserve* – This fund shall be used for equipment replacement.

SAFE DRINKING WATER FUND

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5 Source: Cash Reserve Policy Guidelines for 2018 from the American Water Works Association
**Purpose of Fund** – The Safe Drinking Water program is intended to promote the cleanup of groundwater resources at specific well locations through the installation of wellhead treatment facilities at existing production wells. Focused on VOCs, the District provides grant funding for affected wells and no interest, 10-year loans for other constituents of concern.

**Reserve Target** – Wellhead treatment varies in cost depending upon various criteria. Capital costs for wellhead facilities range from $800,000 to $2,500,000. The target for the Safe Drinking Water Fund will be set based on the expected need of $5 million in 2019/20.

**Intended Use of Reserve** – This fund shall be used in accordance with the guidelines set forth by the Board of Directors for the District’s Safe Drinking Water Program. This fund is a revolving fund, replenished by loan repayments as well as funds from WRD.

**WELL CONSTRUCTION AND REHABILITATION FUND**

**Purpose of Fund** – The District has developed a Well Construction and Rehabilitation Loan Program to assist groundwater producers improve their ability to utilize their full groundwater extraction rights and reduce their need for imported water. The Program provides no interest, 10-year loans for groundwater production well construction and/or rehabilitation.

**Reserve Target** – Well construction and/or rehabilitation expenditures vary in cost depending upon various criteria. The target for the Well Construction and Rehabilitation Fund will be set based on the expected need of $7.5 million in 2019/20.

**Intended Use of Reserve** – This fund shall be used in accordance with the guidelines set forth by the Board of Directors for the District’s Well Construction and Rehabilitation Loan Program. This fund is a revolving fund, replenished by loan repayments as well as funds from WRD.

**WATER PURCHASE CARRYOVER FUND**

**Purpose of Fund** - The District’s primary responsibility is to replenish the groundwater basin. During each fiscal year, the WRD purchases imported and recycled water for replenishment either through the Montebello Forebay and San Gabriel River spreading grounds or through the seawater intrusion barrier systems. If water is unavailable for purchase, budgeted revenues will not be used. Instead, these funds will be carried over to future years to ensure WRD’s ability to acquire or develop water supplies to ensure the Central and West Coast groundwater basins are replenished. In the years when water is unavailable for purchase, the District will track budgeted expenses to actual
expenses with unexpended monies placed in the Water Purchase Carryover Account for use in the future.

*Reserve Target* – The account will be funded through budget surpluses made available due to lack of available water. The balance of the Water Purchase Carryover Fund will be reviewed each year during the budget process. **There is not a target for the Water Purchase Carryover Fund, with no minimum or maximum limiting the Water Purchase Carryover Fund.**

*Intended Use of Reserve* – This fund shall be used for the purchase of recycled or imported water or for developing water supplies.

**ACCOUNTING FOR RESERVES**

Reserve Funds will be recorded in the accounting system and financial statements. The Operating Reserve Fund will be funded and available in cash or cash equivalents. Operating reserves will be maintained separately for accounting purposes but will be commingled with the general cash and investment accounts of the organization.

Reserves are presented to the Finance/Audit Committee for review and forwarded to the Board of Directors for approval on a monthly basis. In addition, the Budget Advisory Committee will review the reserve levels and the use of reserves each year during the budget process.

**FUNDING OF RESERVES**

The Operating Reserve Fund will be funded with unrestricted operating funds. The Board of Directors may, from time to time, direct that a specific source of revenue be set aside for operating reserves.

As part of the budget process, the District will determine appropriate reserve levels consistent with this Policy.

**AUTHORITY TO USE OPERATING RESERVES**

The General Manager will identify the need for access to reserve funds and confirm that the use is consistent with the purpose of the reserves as described in this Policy. Determination of need requires analysis of the sufficiency of the current level of reserve funds, the availability of any other sources of funds before using reserves, and evaluation of the time period for which the funds will be required and replenished.

The General Manager will submit a request to use reserve funds through the District’s Committee structure with final approval by the Board of Directors. The request will include the analysis and determination of the use of funds and plans for replenishment. WRD’s goal is to replenish the funds used within 24 months to restore the Reserve Fund to the target amount.
REPORTING AND MONITORING

The General Manager and/or Chief Financial Officer is responsible for ensuring that all reserve funds are maintained and used as described in this Policy.

The Chief Financial Officer will maintain records of the use of funds and plan for replenishment of any reserves as necessary. If any Reserve Fund falls below its target, the Finance/Audit Committee and Board of Directors will receive periodic reports of progress to restore the fund to the target level. Further – reserve balances and targets will be discussed and approved during the annual budget process. This will include review and recommendations by the BAC.

RELATIONSHIP TO OTHER POLICIES

The District shall maintain the following board-approved policies, which may contain provisions that affect the creation, sufficiency, and management of the Reserve Fund:

- Investment Policy, including risk tolerance
- Debt Service Policy
- Policies related to Operating and Capital Budgeting

REVIEW OF POLICY

This Policy will be reviewed by the Finance/Audit Committee, the Budget Advisory Committee (BAC) and the Board of Directors, at least annually during the budget process or sooner if warranted by internal or external events or changes. Changes to the Policy will be recommended by the Finance/Audit Committee to the Board of Directors, after the Finance/Audit Committee has received recommendations from the BAC.
MEMORANDUM
ITEM NO. 11

DATE: JULY 18, 2019
TO: BOARD OF DIRECTORS
FROM: ROBB WHITAKER, GENERAL MANAGER
SUBJECT: 5-YEAR STRATEGIC PLAN

SUMMARY
The Water Replenishment District (WRD) has developed a strategic planning process to guide the District in near-term and long-term planning efforts. These efforts begin at the highest level, looking 20 years into the future and setting visionary goals for increased regional sustainability, and continue into a refined near-term focused 5-year Strategic Plan and Capital Improvement Projects Program, as well as a more detailed 1-Year Work Plan.

With construction of the Albert Robles Center Advanced Water Treatment Facility, the District has now successfully completed the Water Independence Now (WIN) program and realized a long-term goal of eliminating imported water use for groundwater replenishment. With this milestone behind us, the District is now poised to focus on new efforts to increase regional water sustainability and resiliency. Building upon the District’s successful WIN program, the 20-year long-term planning effort has been re-envisioned as WIN 4 ALL: The 2040 Plan for Regional Water Independence. WIN 4 ALL will aim to further offset the region’s imported water use by securing locally sustainable groundwater supplies. Key components of WIN 4 ALL include expanded recycled water sources and increased stormwater capture, reflecting the goals and accomplishments of the WIN program and prioritizing local supply and environmental resiliency.

The 5-Year Strategic Plan, which outlines the District’s Strategic Goals established to achieve WIN 4 ALL and other WRD goals, has been discussed during the Capital Improvement Projects (CIP) Committee meetings held on March 13, 2019 and May 9, 2019. During these discussions, the CIP Committee re-examined the format of the plan and provided direction to staff to develop a document that could serve not only as an internal guide for District efforts, but also as a resource for public outreach and engagement with stakeholders and elected officials.

Staff will provide an overview presentation on the updated 2019 Strategic Action Plan, seeking approval from the Board of Directors to adopt the document as an official guide.
for near and long-term planning efforts and as an outreach tool for District communications.

**FISCAL IMPACT**
None

**CAPITAL IMPROVEMENT PROJECTS (CIP) COMMITTEE RECOMMENDATION**
The Capital Improvement Projects (CIP) recommends that the Board of Directors approve the 5-Year Strategic Plan.