



St. Johns River Water Management District

Michael A. Register, P.E., Executive Director

4049 Reid Street • P.O. Box 1429 • Palatka, FL 32178-1429 • 386-329-4500 • www.sjrwmd.com

DATE: June 3, 2022
TO: Interested Firms
FROM: Kendall Matott, Sr. Procurement Specialist
SUBJECT: Invitation for Bid 37744, Addendum 2
Black Creek Water Resource Development Pump Station Project Construction

Please be advised of the following changes to the subject Invitation for Bid:

1. The time and date for the submittal of responses is extended to: **2:00 p.m., June 23, 2022.**
2. On Page 5, delete Paragraph 8. Minimum Qualifications in its entirety and replace it with the following:

“8. Minimum Qualifications

Respondent must use the “Qualification” forms (General, Similar Projects, and Client References) provided in these documents to document the minimum qualifications listed below. If Respondent fails to include these forms and the Respondent-provided documentation requested below with the Bid, Respondent’s Bid may be considered non-responsive.

- a. Respondent must have **successfully completed** at least two projects of a similar nature within the ten years immediately preceding the date for receipt of Bids.
 1. Similar nature is defined as follows [items (a) and (b) below must both be a part of the same Similar Project cited]:
 - (a) Construction of a pump station facility (minimum 5,000,000 gallons/day), including pumps, sitework, piping system, instrumentation and electrical components.
 - (b) Dewatering, excavation, and construction of a concrete and/or steel structure inside a temporary cofferdam installed in an active navigable waterway or other surface waterbody.
 2. Each Similar Project cited must have had a project value of at least \$5,000,000.
 3. At least one of the two Similar Projects cited must include vertical turbine can pumps (minimum 20-foot can depth) – use the Similar Projects Form on Page 18 to document.
 4. Respondent must have performed approximately 50% of the work with its employees on each Similar Project.
 5. For each Similar Project cited, Respondent is responsible to provide all the information requested. Respondent is cautioned to ensure that the contact information (names, email addresses, and phone numbers) is correct, and that the proposed contact is amenable to speak with District representatives and/or respond to a written inquiry. The District will contact the individuals named to verify the similar project information as it relates to this solicitation. If the information provided by Respondent is not of a similar nature, cannot be verified by the District, or the proposed contact person fails to respond to the District’s inquiry, Respondent’s bid may be considered non-responsive.

(Complete the District-provided forms)

- b. Respondent shall currently employ a Florida Licensed General Contractor who shall serve as Respondent's qualifying agent and who shall have at least three years of experience within the last ten years on projects of the nature specified under **Subparagraph 8.a.** above.
(Respondent-provided documentation – license), and
(Respondent-provided documentation to substantiate experience)
- c. Respondent must provide three client references. Up to two of the client references may be from the similar projects listed in response to **Subparagraph 8.a.** above. For each client reference cited, Respondent is responsible to provide all the information requested. Respondent is cautioned to ensure that the contact information (names, email addresses, and phone numbers) is correct, and that the proposed contact is amenable to speak with District representatives and/or respond to a written inquiry. The District will contact the references to verify the information as it relates to this solicitation. If the information provided by Respondent cannot be verified by the District, or the proposed contact person fails to respond to the District's inquiry, Respondent's bid may be considered non-responsive.
(Complete the District-provided forms)

Irrespective of the minimum qualifications stated above, the District may make such investigations as it deems necessary to determine the ability of the Respondent to perform the Work. The District reserves the right to reject any Bid if the evidence submitted by such Respondent and/or the District's independent investigation of such Respondent fails to satisfy the District that such Respondent is properly qualified to carry out the obligations of the Agreement and complete the Work in a manner acceptable to the District within the time period specified.”

3. On page 27, Paragraph 1. **TERM**, delete this paragraph and replace it with the following revised paragraph:

“1. TERM

- (a) The term of this Agreement shall be from the Effective Date to the Completion Date. Time is of the essence for each and every aspect of this Agreement. Where additional time is allowed to complete the Work, the new time limit shall also be of the essence. All provisions of this Agreement that by their nature extend beyond the Completion Date survive termination or expiration hereof.
- (b) **Effective Date.** The Effective Date is the date upon which the last party to this Agreement has dated and executed the same.
- (c) **Commencement of Work.** Contractor shall commence the Work within 15 days of the Effective Date. Contractor shall prosecute the Work regularly, diligently, and uninterruptedly so as to complete the Work ready for use in accordance with the Statement of Work and the time for completion stated therein. Contractor shall not commence the Work until any required submittals are received and approved.
- (d) **Completion Date.** The Completion Date of this Agreement is the later of 761 days from the Effective Date of the Agreement or August 31, 2024, unless extended by mutual written agreement of the parties. All Work shall be completed by the Completion Date. Refer to paragraph entitled SUBSTANTIAL COMPLETION; PUNCH LIST, for additional information regarding Substantial Completion.

4. On Page 30, delete subparagraph 6(h) in its entirety and replace it with the following revised subparagraph 6(h) as follows:

“(h) **Retainage.** The District shall pay Contractor 95% of each approved invoice and retain five percent as retainage. Upon completion and District acceptance of the Work associated with the Interim Completion Date, the District will reduce the retainage from 5% of the contract amount to 5% of the value of the pumps, Pumps Field Testing, instrumentation, Instrumentation Final Functional Demonstration Testing, and Site Acceptance Test, which will to be paid upon completion of the Work, which occurs at the completion of the final Punch List. Contractor may present the District with a payment request for part or all of the retainage as provided by §218.735(7)(e), Fla. Stat
5. On Page 46, delete Paragraph 46. **SUBSTANTIAL COMPLETION; PUNCH LIST**, and replace it with the following revised Paragraph 46. **SUBSTANTIAL COMPLETION; PUNCH LIST**:

“**46. SUBSTANTIAL COMPLETION; PUNCH LIST.** Contractor shall notify the District in writing when it considers the Work to be substantially complete. “Substantially complete” is the point when the District can beneficially occupy its property and use the Work for its intended purpose, with only minor items remaining in order for the Work to be fully complete. Within 30 days of receipt of such notice, the District shall review the Work and determine whether the Work is substantially complete. If the District agrees that the Work is substantially complete, the District shall, within said 30-day period, develop a list of items (“Punch List”) required to render the Work complete, satisfactory, and acceptable in all respects. The Punch List shall be delivered to Contractor not later than five days after it is developed. Contractor shall complete the Punch List items by the Completion Date; provided, however, that if the Completion Date is less than 60 days after the date of delivery of the Punch List, the District may authorize an extension to the Completion Date of up to 60 days. Failure to include any corrective work or pending items not yet completed on the Punch List does not alter Contractor’s responsibility to complete all construction services required by the Agreement. Upon completion of all Punch List items, Contractor may request payment of any remaining retainage. If the District disputes the completion of any items on the Punch List, it may withhold up to 150% of the estimated cost of completing any such items, and shall return the remainder of the retainage to Contractor. Any disputed matters shall be resolved pursuant to the dispute resolution procedure of this Agreement. Refer to the Technical Specifications for additional information and requirements regarding Substantial Completion. In the event of a discrepancy regarding substantial completion between this Agreement and the Technical Specifications, the language in this Agreement shall govern.”
6. On Page 50, delete Insurance paragraph (b) General Liability in its entirety and replace it with the following paragraph (b):

“(b) **General Liability.** Commercial General Liability Insurance on an “Occurrence Basis,” with limits of liability for each occurrence of not less than \$1,000,000 for personal injury, bodily injury, and property damage, with an aggregate of \$2,000,000. Coverage shall include: (1) contractual liability, (2) perils generally known as XCU (explosion, collapse, and underground property damage), subsidence, absolute earth movement (excepts as it pertains to earthquake peril only) or any equivalent peril, (3) products and completed operations, (4) independent contractors, and (5) property in the care, control, or custody of the Contractor. Extensions shall be added or exclusions deleted to provide the necessary coverage.”
7. Delete Page 13, COST SCHEDULE in its entirety and replace it with the attached REVISED COST SCHEDULE.

8. Delete Page 51, ATTACHMENT A — STATEMENT OF WORK in its entirety and replace it with the following ATTACHMENT A — REVISED STATEMENT OF WORK.
9. Delete the following sections in CDM Smith’s Technical Specifications in their entirety and replace them with the attached sections (additions and revisions in each section are denoted in “**red**”).
Section 01465 — Equipment Testing and Startup
Section 01740 — Warranties and Bonds
Section 11214 — Vertical Turbine Pumps
Section 13302 — Testing
10. On Sheet CD-1 of the Drawings, Detail A, Note 2, delete the second sentence in its entirety – no replacement.
11. In Section 02325 — Microtunneling of CDM Smith’s Technical Specifications, make the following revisions:
 - a. In Paragraph 3.06.B.1, after “maximum of” delete “0.5-inch” and replace with “0.75-inch”.
 - b. In Paragraph 3.12.M, in the second sentence delete “50-feet” and replace with “150-feet”.
12. **Question:** How is the Cavity Drainage Material supposed to get installed, full-height per the Specifications or just at the flashing level per the Drawings?

Answer:

Comply with Technical Specification Section 04200 — Unit Masonry, 2.08-D.1.a. and install cavity drainage material full height of cavity.

On Sheet AD-2 of the Drawings, in Details A/AD-1 and D/AD-1, delete “1” AIR SPACE” call out. Revise “1” MORTAR NET” call-out text to read “**1” MORTAR MAT, FULL HEIGHT TYP.**”

On Sheet AD-2 of the Drawings, in Detail F/AD-1, Revise “1” AIR SPACE” call-out text to read “**1” MORTAR MAT, FULL HEIGHT TYP.**”

On Sheet AD-2 of the Drawings, in Details A/AD-2, B/AD-2, C/AD-2, D/AD-2 and F/AD-2, replace Keynote 116 with Keynote 134. Revise Keynote 134 text to read “**1” MORTAR MAT, FULL HEIGHT TYP.**”

NOTE: Please acknowledge receipt of this Addendum in your submittal.

If you have any questions regarding this addendum, contact Kendall Matott at (386) 312-2324 or via email at kmatott@sjrwmd.com.

REVISED COST SCHEDULE

Include this form in the response

Bid to be opened at 2:00 P.M., June 23, 2022

To: ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

In accordance with the advertisement requesting bids for the Black Creek Water Resource Development Pump Station Construction, subject to the terms and conditions of the Agreement, the undersigned proposes to perform the Work for the price contained in the following schedule (fill in all blanks).

If said bid exceeds the estimated range previously provided, the District expressly reserves the right to increase, decrease, or delete any class, item, or part of the Work, as may be determined by the District.

Respondents are reminded to refer to "PREPARATION AND ORGANIZATION OF BID DOCUMENTS" for information to be included with the bid package.

The bid will be awarded to the lowest responsive and responsible Respondent for the Total Bid Cost (Total Base Bid Cost AND Supplemental Work Allowance).

Total Base Bid Cost..... \$ _____

Supplemental Work Allowance (SWA) \$ 300,000.00

Total Bid Cost (Total Base Bid AND SWA)..... \$ _____

Total Bid Cost (Total Base Bid and SWA) in words: _____

NOTE: The District has included the above SWA in the Cost Schedule to cover Contractor activities not included in the construction drawings, technical specifications, or Scope/Statement of Work (i.e., changes to the quantities, unforeseen site conditions, or changes to the work). SWA Funds can only be released to Contractor through issuance of a written and fully executed change order to the Contract. Escalation costs are not considered a compensable cost under this allowance. All escalation costs, if any, will be borne by Contractor.

I HEREBY ACKNOWLEDGE, as Respondent's authorized representative, that I have fully read and understand all terms and conditions as set forth in this bid and upon award of such bid, shall fully comply with such terms and conditions.

Respondent (firm name) Date

Address

E-mail address

Signature Telephone number

Typed name and title Fax number

ATTACHMENT A — REVISED STATEMENT OF WORK

**BLACK CREEK WATER RESOURCE DEVELOPMENT
PUMP STATION PROJECT CONSTRUCTION**

Technical specifications and drawings for this project are provided separately from this document.

The technical specifications and drawings were prepared by the District's engineer, CDM Smith.

Project Objectives:

1. The District has established an Interim Milestone of 580 days from the Effective Date of the Agreement to complete all Work, with the exception of (1) Pumps Field Testing (2) Instrumentation Final Functional Demonstration Test and the (3) Site Acceptance Test. Contractor will be responsible for the project site and all Work through the Completion Date defined in Paragraph 1. **TERM** of the Agreement. Provided all Work, except that specifically stated above is Substantially Complete, the District will inspect the Work and provide a punch list for Contractor's use and completion.
 - Refer to paragraph entitled SUBSTANTIAL COMPLETION; PUNCH LIST, for additional information regarding Substantial Completion requirements
 - Refer to Section 01465, Equipment Testing and Startup of the Technical Specifications for additional information and requirements regarding the above tests.
2. Note that the (1) Pumps Field Testing (2) Instrumentation Final Functional Demonstration Test and (3) Site Acceptance Test required by the Technical Specifications cannot be performed until the pipeline work under District Contract 37843 is completed (estimated for August 2024). The Contractor is responsible to coordinate the performance and completion of these tests with both the District and its pipeline contractor.

SECTION 01465
EQUIPMENT TESTING AND STARTUP

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Provide a competent field services technician of the manufacturers of all equipment furnished under Divisions 11, 13, 15 and 16 to supervise installation, adjustment, initial operation and testing, performance testing, final acceptance testing and startup of the equipment.
- B. Perform specified equipment field performance tests, final acceptance tests and startup services.

1.02 RELATED WORK

- A. Operation and Maintenance Data is included in Section 01730.
- B. Performance and acceptance testing and startup requirements are included in the respective sections of Divisions 11, 13, 15 and 16.

1.03 SUBMITTALS

- A. Submit name, address and resume of proposed field services technicians at least 30 days in advance of the need for such services.
- B. Submit, in accordance with Section 01300, detailed testing procedures for shop tests, field performance tests and final acceptance tests as specified in the various equipment sections. Submittals shall include the following:
 - 1. Test procedures shall be submitted at least 30 days in advance of the proposed test dates and shall include at least the following information:
 - a. Name, classification, model and serial number of equipment to be tested, including reference to specifications section number and title.
 - b. Testing schedule of proposed dates and times for testing.
 - c. Summary of power, lighting, water, etc., needs and identification of who will provide them.
 - d. Outline specific assignment of the responsibilities of the Contractor and manufacturers' factory representatives or field service personnel.
 - e. Detailed description of step-by-step testing requirements, with reference to appropriate standardized testing procedures and laboratory analyses by established technical organizations (e.g., ASTM, WPCF Standard Methods, etc.).
 - f. Samples of forms to be used to collect and record test data and to present tabulated test results.
 - 2. Copies of test reports upon completion of specified shop, performance and acceptance tests. Test reports shall incorporate the information provided in the test procedures submittals and modified to reflect actual conduct of the tests and the following additional information:
 - a. Copy of all test data sheets and results of lab analyses.
 - b. Summary comparison of specified test and performance requirements vs actual test results.

C. See the Agreement for Interim Milestone and Delayed Startup/Testing requirements of Substantial Completion

- c. Should actual test results fail to meet specified test and performance requirements, describe action to be taken prior to re-testing the equipment.
 3. Copies of the manufacturer's field service technician's report summarizing the results of their initial inspection, operation, adjustment and pre-tests. The report shall include detailed descriptions and tabulations of the points inspected, tests and adjustments made, quantitative results obtained, suggestions for precautions to be taken to ensure proper maintenance, and the equipment supplier's Certificate of Installation in the format specified herein.

1.04 REFERENCE STANDARDS

- A. American Water Works Association (AWWA)
- B. ASTM International
- C. Water Environment Federation (WEF)
- D. Standard Methods for the Examination of Water and Wastewater (Latest Revision)
- E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

- A. Field service technicians shall be competent and experienced in the proper installation, adjustment, operation, testing and startup of the equipment and systems being installed.
- B. Manufacturers' sales and marketing personnel will not be accepted as field service technicians unless they can prove their qualifications.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PRELIMINARY REQUIREMENTS

- A. After installation of the equipment has been completed and the equipment is presumably ready for operation, before it is operated by others, the manufacturer's field service technician shall inspect, operate, test and adjust the equipment. The inspection shall include at least the following points where applicable:
 1. Soundness (without crack or otherwise damaged parts).
 2. Completeness in all details, as specified and required.
 3. Correctness of setting, alignment and relative arrangement of various parts.
 4. Adequacy and correctness of packing, sealing and lubricants.
- B. The operation, testing and adjustment shall be as required to prove that the equipment has been left in proper condition for satisfactory operation under the conditions specified.

- C. Upon completion of this work, the manufacturer's field service technician shall submit a signed report of the results of their inspection, operation, adjustments and tests.

3.02 WITNESS REQUIREMENTS

- A. Shop tests or factory tests may be witnessed by the District and/or District's representatives, as required by the various equipment specifications.
- B. Field performance and acceptance tests shall be performed in the presence of the District, the District's designed personnel and/or District's representatives.

3.03 STARTUP AND ACCEPTANCE OF THE TREATMENT PLANT AND RELATED SYSTEMS

A. General Requirements

1. Successfully execute the step-by-step procedure of startup, normal operation, shutdown, and performance demonstration specified herein.
2. The startup and performance demonstration shall be successfully executed prior to Substantial Completion and acceptance by the District of the facility and its related systems.
3. All performance tests and inspections shall be scheduled at least 10 working days in advance or as otherwise specified with the District and the Engineer. All performance tests and inspections shall be conducted during the work week of Monday through Friday, unless otherwise specified.

B. Preparation for Startup

1. All mechanical and electrical equipment shall be checked to ensure that it is in good working order and properly connected. Preliminary run-ins of the pumps, and other remaining equipment shall be made. All systems shall be cleaned and purged as required. All pipes and equipment which are hydraulically checked shall be drained and returned to their original condition once the water testing is complete.
2. All instruments and controls shall be calibrated through their full range. All other adjustments required for proper operation of all instrumentation and control equipment shall be made.
3. Perform all other tasks needed for preparing and conditioning the facility for proper operation.
4. No testing or equipment operation shall take place until it has been verified by the Engineer that all specified safety equipment has been installed and is in good working order.
5. No testing or equipment operation shall take place until it has been verified by the Engineer that all lubricants, tools, maintenance equipment, spare parts and approved equipment operation and maintenance manuals have been furnished as specified.

C. Facilities Startup

1. Startup period shall not begin until all new treatment facilities and equipment have been tested as specified and are ready for operation. The District shall receive spare parts, safety equipment, tools and maintenance equipment, lubricants, approved operation and maintenance data and the specified operation and maintenance instruction prior to the startup with raw wastewater. All valve tagging shall also be complete prior to this startup.
2. Demonstrate a seven consecutive 24-hour day period of successful operation of the facility as a prerequisite of Substantial Completion and Acceptance. This testing will be the responsibility of the Contractor.
3. In the event of failure to demonstrate satisfactory performance of the facility on the first or any subsequent attempt, all necessary alterations, adjustments, repairs and replacements shall be made. When the facility is again ready for operation, it shall be brought on line and a new test shall be started. This procedure shall be repeated as often as necessary until the facility has operated continuously to the satisfaction of the District and Engineer, for the specified duration.
4. The District will furnish all operating personnel (other than manufacturer's or subcontractor's service personnel) needed to operate equipment during the final test period after substantial completion; however, said personnel will perform their duties under Contractor's direct supervision. Until performance tests are completed and units and systems are accepted by the District as substantially complete, the Contractor shall be fully responsible for the operation and maintenance of all new facilities.
5. The District will provide all necessary electricity for startup. However, the Contractor shall provide all necessary personnel of the various construction trades, i.e., electricians, plumbers, etc, and field service personnel of the major equipment suppliers on an 8 hour per day basis at the facilities and on a 24 hour per day basis locally during the startup period. Major equipment suppliers shall include, but not be limited to, the following:
 - a. Instrumentation and Control Equipment: unwitnessed and witnessed factory testing
 - b. All Pumping Equipment
 - c. Electrical Control Systems
 - d. Generator Equipment
 - e. HVAC and Plumbing
6. Do not, at any time, allow the facility to be operated in a manner which subjects equipment to conditions that are more severe than the maximum allowable operating conditions for which the equipment was designed.

EQUIPMENT SUPPLIER'S CERTIFICATE OF INSTALLATION

District _____

Project _____

Contract No. _____

EQUIPMENT SPECIFICATION SECTION _____

EQUIPMENT DESCRIPTION _____

I _____, Authorized representative of
(Print Name)

(Print Manufacturer's Name)

hereby CERTIFY that _____
(Print equipment name and model with serial no.)

installed for the subject project has (have) been installed in a satisfactory manner, has (have) been tested and adjusted, and is (are) ready for final acceptance testing and operation on :

Date _____

Time _____

CERTIFIED BY: _____
(Signature of Manufacturer's Representative)

Date: _____

END OF SECTION

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SECTION 01740
WARRANTIES AND BONDS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturer Equipment Supplier/Manufacturer's standard warranties on products and special warranties.

1.02 RELATED WORK

- A. General closeout requirements are included in Section 01700 Project Closeout.
- B. Specific requirements for warranties for the work and products and installations that are specified to be warranted are included in the individual Sections.

1.03 SUBMITTALS

- A. The individual Equipment Supplier/Manufacturer shall submit written warranties to the District prior to the date fixed by the Equipment for Substantial Completion. If the Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the work, or a designated portion of the work, submit written warranties upon request of the District.
- B. When a designated portion of the work is completed and occupied or used by the District, by separate agreement with the Equipment Supplier/Manufacturer (as applicable) during the construction period, submit properly executed warranties to the District via the Equipment within 15 days of completion of that designated portion of the Work.
- C. When a special warranty is required to be executed by the Equipment Supplier/Manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the District via the Equipment for approval prior to final execution.
- D. Forms for special warranties are included at the end of this Section. Prepare a written document utilizing the appropriate form, ready for execution by the Contractor, or the Contractor and subcontractor, or Equipment Supplier/Manufacturer. Submit a draft to the District for approval prior to final execution.
- E. Refer to individual Sections for specific content requirements, and particular requirements for submittal of special warranties.
- F. At Final Completion the Contractor shall compile two copies of each required warranty and bond properly executed by the Equipment Supplier/Manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- G. Bind warranties and bonds in heavy-duty, commercial quality, durable three-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents and sized to receive 8-1/2-inch by 11-inch paper.

See the Agreement for Interim Milestone and Delayed Startup/Testing requirements of Substantial Completion.

- H. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the Section in which specified and the name of the product or work item.
- I. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address and telephone number of the installer or Equipment Supplier/Manufacturer.
- J. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS", the project title or name and the name, address and telephone number of the Equipment Supplier/Manufacturer.
- K. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

1.04 WARRANTY REQUIREMENT

- A. Related Damages and Losses: When correcting warranted work that has failed, remove and replace other work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted work.
- B. Reinstatement of Warranty: When work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement Cost: Upon determination that work covered by a warranty has failed, replace or rebuild the work to an acceptable condition complying with requirements of Contract Documents. The Equipment Supplier/Manufacturer is responsible for the cost of replacing or rebuilding defective work regardless of whether the District has benefited from use of the work through a portion of its anticipated useful service life.
- D. District's Recourse: Written warranties made to the District are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the District can enforce such other duties, obligations, rights, or remedies.
- E. Rejection of Warranties: The District reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- F. The District reserves the right to refuse to accept work for the Project where a special warranty, certification, or similar commitment is required on such work or part of the work, until evidence is presented that entities required to countersign such commitments are willing to do so.
- G. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Equipment Supplier/Manufacturer (as applicable) of the warranty on the work that incorporates the products, nor does it relieve Equipment Supplier/Manufacturer and subcontractors required to countersign special warranties with the Contractor.

1.05 MANUFACTURERS CERTIFICATIONS

- A. Where required, the Contractor shall supply evidence, satisfactory to the Equipment, that the Equipment Supplier/Manufacturer can obtain manufacturers' certifications as to the Contractor's installation of equipment.

1.06 DEFINITIONS

- A. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the District.
- B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the District.

1.07 EQUIPMENT WARRANTIES

- A. All equipment supplied under this Contract shall be guaranteed to be free from defects in workmanship, design, and/or materials for a period of two years unless otherwise specified. The period of such warranties shall start on the date the particular equipment is placed in use by the District and provided that the equipment demonstrates satisfactory performance during the 30-day operational period after equipment startup. If the equipment does not perform satisfactorily during the 30-day startup operational period, the start of the warranty period shall be delayed until the equipment demonstrates proper operation. Warranties and guarantees shall be indicated on the Warranty for Equipment Item form appended to this Section. The Equipment Supplier/Manufacturer shall repair or replace without charge to the District any part of equipment which is defective or showing undue wear within the warranty 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 level.
- B. The equipment shall be warranted to be free from defects in workmanship, design and materials. If any part of the equipment should fail during the warranty period, it shall be replaced in the equipment(s) and the equipment and/or unit(s) restored to service at no expense to the District.
- C. Obtain equipment warranties in accordance with Section 01740 from each of the respective Equipment Supplier/Manufacturer for all the equipment specified under Divisions 11, 13, 15 and 16 of these Specifications. The form of warranty is included at the end of this Section.
- D. The Equipment Supplier/Manufacturer's warranty period shall run concurrently with the Contractor's warranty or guarantee period. ~~No exception to this provision shall be allowed. In the event that the Equipment Supplier/Manufacturer is unwilling to provide a two year warranty commencing at the time of District acceptance, obtain from the Equipment Supplier/Manufacturer a three-year warranty starting at the time of equipment delivery to the job site. This three-year warranty shall not relieve the Contractor of the two-year warranty starting at the time of District acceptance of the equipment.~~

1.08 FINAL GUARANTEE

- A. All work shall be guaranteed by the Contractor for a period of ~~two years~~ from and after the date of acceptance of the work by the District.

one year

- B. If, within the guarantee period, repairs or changes are required in connection with guaranteed work, which, in the opinion of the Equipment, is rendered necessary as the result of the use of materials, equipment or workmanship which are inferior, defective, or not in accordance with the terms of the Contract, promptly upon receipt of notice from the District and without expense to the District, replace any part of equipment which is defective or showing undue wear within the warranty period, or replace the equipment with new equipment if the mechanical performance is unsatisfactory.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

WARRANTY FOR EQUIPMENT ITEM

LOCATION OF PROJECT: _____

DISTRICT: _____

PROJECT NUMBER: _____

EQUIPMENT ITEM: _____

SECTION NO. / ITEM NO.: _____

SUPPLIER/MANUFACTURER: _____

SUPPLIER/MANUFACTURER'S ADDRESS: _____

SUPPLIER/MANUFACTURER'S REFERENCE NO.: _____

The undersigned guarantees that the above equipment is of good merchantable quality, free from defects in material or workmanship, fully meets the type, quality, design and performance requirements defined in the Contract Documents of the above project, and that the equipment will in actual operation satisfactorily perform the functions for which installed.

The undersigned agrees to repair, replace, or otherwise make good, any defect in workmanship or materials in the above described equipment which may develop within a period of two years from the date of final acceptance by the District of the above-named project.

COMPANY _____

COMPANY ADDRESS _____

BY _____

TITLE _____

SIGNED _____

DATE _____

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SECTION 11214
VERTICAL TURBINE PUMPS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required, install, complete and ready for operation and field test, four vertical turbine can pumps, including their respective motors and variable frequency drives as shown on the Drawings and as specified herein.
- B. These Specifications are intended to give a general description of what is required, but do not cover all details which will vary in accordance with the requirements of the equipment as offered. It is, however, intended to cover the furnishing, factory testing, delivery and complete installation and field testing of all materials, equipment and appurtenances for the complete pumping units as herein specified, whether specifically mentioned in these Specifications or not.
- C. The work under this Section shall include supervisory services during installation and field testing of each unit and instructing the regular operating personnel in the proper care, operation and maintenance of the equipment.

1.02 RELATED WORK

- A. Concrete work and the installation of anchor bolts are included in Division 3; however, anchor bolts for these units as recommended by the pump manufacturer (Manufacturer) shall be furnished by the Contractor under this Section.
- B. Instrumentation and control work, except as specified herein, is included in Division 13. Instrumentation and controls provided in this section shall adhere to Instrumentation and Control Specifications Sections in Division 13.
- C. Valves, mechanical piping and appurtenances and pipe hangers and supports are included in Division 15.
- D. Electrical work except as hereinafter specified is included in Division 16.

1.03 REFERENCE STANDARDS

- A. Design, manufacturing and assembly of elements of the equipment specified herein shall be in accordance with the following, where applicable:
 - 1. American Concrete Institute (ACI).
 - 2. American Gear Manufacturers Association (AGMA).
 - 3. American Institute of Steel Construction (AISC).
 - 4. American Iron and Steel Institute (AISI).
 - 5. American Society of Mechanical Engineers (ASME).
 - 6. American National Standards Institute (ANSI).

7. American Petroleum Institute (API).
8. American Society for Testing Materials (ASTM).
9. American Water Works Association (AWWA).
10. American Welding Society (AWS).
11. American Bearing Manufacturers Association (ABMA).
12. Hydraulic Institute (HI) Standards.
13. Institute of Electrical and Electronics Engineers (IEEE).
14. International Organization for Standardization (ISO).
15. National Electrical Code (NEC).
16. National Electrical Manufacturers Association (NEMA).
17. National Sanitation Foundation (NSF).
18. Occupational Safety and Health Administration (OSHA).
19. The Society for Protective Coatings (SSPC).
20. Underwriters Laboratories (UL).

- B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.04 SYSTEM DESCRIPTION

- A. The vertical turbine can pumps will pump water from the South Fork of Black Creek, at the crossing of Black Creek and SR 16 to Keystone Heights area between Lake Magnolia and Lake Brooklyn. The on/off pump operation of the four pump system will be controlled by the corresponding on/off water surface levels within Black Creek and the flow will be limited using the VFD to a maximum of 1,750 gpm per pump in operation. The equipment to be furnished under this section shall include four vertical turbine raw water can pumps, motors, variable frequency drives, and accessories all as specified herein and as shown on the Drawings. Refer to Section 13305 for system description and control narratives. Contractor shall coordinate and be fully responsible for proper operation and compatibility between items in this scope of work and items in Division 13 scope.

1.05 QUALIFICATIONS

- A. To assure unity of responsibility, the pumps, the motors, pump cans, and variable frequency drives shall be furnished and coordinated by the Pump Manufacturer. The Contractor and Pump Manufacturer shall assume responsibility for the satisfactory installation and operation of the entire pumping system including pumps, motors, variable frequency drives, and pump cans as specified.

- B. The equipment covered by this Section is intended to be standard pumping equipment of proven ability as manufactured by companies having extensive experience in the production of such equipment similar to the applications stated in Articles 1.04 and 2.02. Units specified herein shall be furnished by a single manufacturer. The equipment provided shall be designed, constructed and installed to operate satisfactorily when installed as shown on the Drawings or as approved by the Engineer.
- C. Pumps and pump cans shall be manufactured in accordance with the Hydraulic Institute Standards, except where otherwise specified.
- D. The Pump Manufacturer shall be fully responsible for the design, arrangement, and operation of all connected rotating components of the assembled pumping unit mounted on a fabricated steel baseplate and pump can to ensure that neither harmful nor damaging vibrations occur at any speed within the specified operating range.
- E. The Pump Manufacturer or its representative shall have an authorized warranty center within a 300-mile radius of the job site, fully staffed with factory trained mechanics.
- F. All equipment furnished under this Specification shall be new and unused, shall be the standard product of manufacturers having a successful record of manufacturing and servicing similar equipment and systems to that specified herein for a minimum of five years.
- G. The pumping equipment shall be furnished complete with accessories required and shall meet the detailed requirements of the Specifications.
- H. The Pump Manufacturer shall be certified to the ISO 9001 standard for design and manufacture of vertical turbine pumps.
- I. Welding of pressure-containing fabrications shall be by welders qualified to ASME Code Section 9 or AWS D1.1 Structural Welding Code – Steel.
- J. Prior to manufacture, a submittal must be forwarded to the Engineer indicating that the required vibration analyses outlined herein have been performed and that the specified limitations will be met. For the dynamic vibration analysis described, minimum and maximum operating speeds will be in accordance with the operating speeds required to satisfy the conditions of operation specified in Article 2.02. The dynamic vibration analysis required by the following paragraphs shall be performed by Mechanical Solutions Inc. (MSI) of Whippany, NJ, or Engineering Dynamics Inc. (EDI) of San Antonio, TX or alternatively by the Pump Manufacturer if Pump Manufacturer's demonstrated, successful, vibration analysis experience, in at least 20 projects similar in scope, with proposed personnel involved, may be acceptable to the Engineer with analyses in accordance with the specified requirements.
 - 1. Structural dynamic analysis of the combined pump/motor system including the nearby foundation and the piping out to the first pipe restraint or expansion joint. Analysis shall not simply assume the foundation is rigid rather it shall incorporate foundation design shown on the Drawings. The structural dynamic analysis shall predict that no first or second bending mode frequencies will exist within a pump speed range from 20 percent below minimum operating speed of 70 percent to 20 percent above maximum operating speed of 100 percent.

2. A lateral rotordynamic analysis of the pump rotating system (i.e., motor rotor, line shafting, couplings, bowl shafting and impellers, etc.) shall identify and predict that the first lateral critical speed shall have a separation margin of at least 20 percent above the maximum pump speed or 20 percent below the minimum pump speed. If a design modification (i.e., such as changing the bearing span or shaft diameter) cannot resolve a separation margin deficiency or is not practical, a forced damped response analysis shall be performed to demonstrate that the pump will function properly over the speed range.
3. A torsional rotordynamic analysis of the complete rotating system (pump, motor, intermediate shafting, and coupling) shall identify and predict that no torsional natural frequencies occur within a separation margin extending from 20 percent below to 20 percent above the specified pump operating speed range. Additionally, no natural frequencies shall be +/- 10% of 2x times running speed, line frequency, 2x line frequency, vane pass frequency, and VFD control frequencies (if applicable). If a design modification (i.e., such as a shaft diameter change or different coupling arrangement) cannot resolve a separation margin deficiency or is not practical, a forced damped response analysis shall be performed to show that infinite life will be achieved with a safety factor of at least two.
4. Campbell diagrams shall be submitted, documenting the structural lateral, rotating component lateral, and torsional analysis results, graphically demonstrating the separation margins specified above.
5. Maximum vibration velocity in inches per second RMS, measured in the field, shall conform to the requirements of ANSI/HI 9.6.4. In addition, for operating motor speeds less than or equal to 600 rpm, field vibration displacement in mils peak-to-peak shall conform to the requirements of ANSI/HI 9.6.4.

1.06 SUBMITTALS

- A. Submit, in accordance with Section 01300, copies of all materials required to establish compliance with the specifications. In the event that it is not practical to conform to certain details of the specifications because of different manufacturing techniques, describe completely all nonconforming aspects. Submittals shall include the following:
 1. Certified dimensional drawings showing all important details of pump construction and auxiliary apparatus.
 2. Baseplate and pump support design details showing anchor bolt locations and sizing information.
 3. Literature and drawings describing the equipment in sufficient detail, including materials of construction, to indicate full conformance with the detail specifications.
 4. Schematic electrical wiring diagram and other data as required for complete pump installation.
 5. The total weight of the equipment including the weight of the single largest item.
 6. A complete materials table for all equipment establishing compliance with these specifications.

7. A list of the Pump Manufacturer's recommended spare parts with the Pump Manufacturer's current price for each item. Include gaskets, packing, etc. on the list. List all bearings by the bearing manufacturer's numbers only.
8. All information required by Division 1.
9. A statement and supporting data indicating motor bearing life meets or exceeds specified value.
10. Complete data on motors in accordance with Section 16150.
11. Compliance with noise levels as specified in this Section.
12. Complete description of surface preparation and shop painting for pumps and motors.
13. Critical speed analyses report submittal including backup documentation and a statement of guarantee that the critical speed analyses as required in Paragraph 1.05 J of this Section have been completed and that the specified limitations will be met.

B. Design Data:

1. Data on the characteristics and performance of each pump. Data shall include guaranteed performance curves to ANSI/HI 14.6 acceptance grade 1U for all specified points, based on actual factory tests of similar units, which show that they meet the specified requirements for head, flow rate, efficiency, guaranteed maximum net positive suction head required (NPSH3), submergence and horsepower. Curves shall be submitted on 8-1/2-inch by 11-inch sheets, at as large a scale as is practical. Curves shall be plotted from zero flow at shut off head to pump flow rate at minimum specified total head (TH). The POR and AOR (refer to ANSI/HI 9.6.3) shall be clearly shown on the curves. This information shall be prepared specifically for the pump proposed. Catalog sheets showing a family of curves will not be acceptable.

C. Test Reports:

1. Certified motor test data as described in Section 16150.
2. Tabulated data for the drive motors including rated horsepower, full load rpm, power factor and efficiency curves at 1/2, 3/4 and full load, service factor and kW input, including when the pump is at its design point. Submit a certified statement from the motor manufacturer that the motors are capable of continuous operation on the power supply from the variable frequency drives to be furnished without affecting their design life for bearings or windings.
3. Description of proposed pump factory test procedures and equipment.
4. Factory and field performance test data as specified in PART 2 and PART 3.
5. A schedule of the date of factory testing and delivery of the equipment to the job site.

D. Instructions, Certifications, and Reports:

1. Manufacturer's Installation Instructions.

2. Manufacturer's certification of installation meeting Manufacturer's installation, operation and maintenance manuals and as specified in PART 3.
3. Manufacturer's field report as specified in PART 3.
4. Submit warranty information to demonstrate conformance to Article 1.10.
5. Identify the entity and experienced individual who will inspect the installation in accordance with Article 1.07.
6. Welder certifications.

E. Pump Can Plumbness Monitoring Program:

1. At least three weeks prior to beginning installation of any pump can unit, Contractor shall submit to the Engineer a plan for monitoring the plumbness of each installed pump can during and throughout its installation and the installation of surrounding facilities, including concrete placement and earth backfilling, that could affect the unit. The plan should be developed in accordance with the Pump Manufacturer's guidelines for pump can and pump unit to be provided. At a minimum, the plan shall address the following:
 - a. The type and construction of monitoring points to be used including their design and procedures for installation.
 - b. The number and location of monitoring points on each pump can installation.
 - c. Equipment and procedures to be used to perform the monitoring.
 - d. Personnel responsible for conducting the monitoring program and their qualifications. Should the proposed program incorporate surveying techniques, they shall be performed by a professional surveyor with at least three years of experience in surveying with similar instruments.
 - e. The location of control points to which the monitoring measurements will be referenced. The control points shall be at stable locations beyond the influence of planned construction operations and public interference.
 - f. The accuracy of measurements to be acquired and reported.
 - g. Procedures for establishing baseline values to which all subsequent measurements will be compared. Baseline values shall be developed from at least three independent measurements.
 - h. The frequency at which measurements will be made. At a minimum the frequency shall be daily during installation of the pump cans and when excavation, construction or backfilling operations are occurring within 50 feet of the monitored location. If previous readings indicate a trend of possible movement, daily readings shall continue for a period of one week after any apparent movement has ceased. Readings shall be made at least once every two weeks until the pump installation is complete.
 - i. Replacement and/or repair of damaged monitoring instruments including reestablishment of baseline values.
 - j. Provide threshold values that indicate corrective action may be needed to prevent the installation from exceeding the tolerances established by the Pump Manufacturer. The threshold values should be developed so as to provide sufficient warning such that corrective actions can be implemented before limit values are exceeded. Limit values shall be: top plate level within 0.002 in/ft or tolerance provided by the Pump Manufacturer in all directions and plumb to allow centering of suction bell within three percent of bell diameter.

- k. Provisions for developing a plan for corrective action if the threshold value is reached such that the limit value will not be exceeded.
 - l. Provide limit values based on the Pump Manufacturer's tolerances that if exceeded will require corrective action.
 - m. Provisions for developing a plan for corrective action to achieve Pump Manufacturer's requirements.
2. Within one week following establishment of the monitoring network on each installation, Contractor shall submit to the Engineer drawings and reports showing the actual locations of the monitoring points and baseline monitoring records. The monitoring report shall include but not be limited to:
 - a. Project name and number.
 - b. Identification of the monitored installation.
 - c. Monitoring point identification number.
 - d. Date and time of measurement.
 - e. Person making the measurement.
 - f. Measurement results.
 - g. Notes concerning, equipment malfunctions, damage to monitoring components, interferences to measurement or any other unusual occurrence that could have an effect on the measurement.
 3. Contractor shall submit measurement data to the Engineer and Pump Manufacturer within 24 hours of each measurement. Include all previous measurements and utilize graphs or other means to illustrate trends and relationships to threshold and limit values.

F. Project Record Documents.

1.07 MANUFACTURER SERVICES INCLUDING OPERATING INSTRUCTIONS

A. Operating and Maintenance Manual:

1. Operating and maintenance manual shall be furnished by the Manufacturer to the Engineer as provided for in Section 01730. The manuals shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, description, etc. that are required to instruct operating and maintenance personnel unfamiliar with such equipment. The maintenance instructions shall include trouble shooting data, full preventative maintenance schedules, and complete spare parts lists with ordering information.

B. Installation Inspection and Startup:

1. The Contractor shall include in his bid price the services of a Manufacturer's factory representative who has complete knowledge of proper operation and maintenance shall be provided to instruct representatives of the District and the Engineer on proper operation and maintenance. This work may be conducted in conjunction with the inspection of the installation and start-up. If there are difficulties in operation of the equipment because of the Manufacturer's design or fabrication, additional service shall be provided at no additional cost to the District. The listed service requirements are exclusive of travel time, and shall not limit or relieve the Contractor of the obligation to provide sufficient service

necessary to place the equipment in satisfactory and functioning condition. VFD training shall be as specified in Division 16. Also refer to requirements in PART 3 of this Section.

2. Installation inspection: Complete review of installation in accordance with Section 01465. Provide written certification that the installation is complete and operable in all respects, and that no conditions exist which may affect the warranty. Qualified supervisory services, including Manufacturers' Factory representatives, shall be provided to ensure that the installation is done in a manner fully approved by the Manufacturer. The Manufacturer's factory representative shall specifically approve the installation and alignment of the pump with the motor, the grouting, and the alignment of the connecting piping and the installation of the field installed packing or mechanical seal. If there are difficulties in the start-up or operation of the equipment due to the Manufacturer's design or fabrication, additional service shall be provided at no additional cost to the District. Services of the Manufacturer's factory representative and training shall be provided when the first pump is started, with follow-up visits upon start-up of each subsequent pump.
 - a. Minimum time on-site shall be three eight-hour days per pump station.
3. Start-Up: Provide written report, summarizing test procedures, tested and measured variables (flow rates, total heads, shaft-speed, vibration measurements, alignment check, etc.):
 - a. Minimum time on-site shall be one eight-hour day per pump station.

C. Training:

1. Field and classroom instruction on operation and maintenance of the equipment, including start-up, shut-down troubleshooting, lubrication, maintenance and safety.
2. The Manufacturer shall provide detailed manuals to supplement the training courses. The manuals shall include specific details of equipment supplied and operations specific to the project.
3. The Manufacturer shall make use of teaching aids, manuals, slide/video presentations, etc. After the training services, such materials shall be delivered to District.
 - a. Minimum time on-site shall be one eight-hour day per pump station.

- D. The Contractor alone shall be responsible for requesting these services, and shall coordinate these requests with all other relevant trades, to ensure the effectiveness of the Manufacturers' service. In the event that the lack of coordination by the Contractor results in the need to recall the Manufacturer's factory representative, the lost time shall not be counted against the above days.

1.08 TOOLS AND SPARE PARTS

- A. Furnish all special tools and test equipment required for the proper servicing of all equipment as specified in Section 01030. All such tools and test equipment shall be furnished in a suitable steel tool chest complete with lock and duplicate keys.
- B. All spare parts shall be properly protected for long periods of storage and packed in containers that are clearly identified with indelible markings as to contents.

- C. Furnish the following spare parts for each size pump.
 - 1. One mechanical seal.
- D. Provide to the District a list of all spare and replacement parts with individual prices and location where they are available. Prices shall remain in effect for a period of not less than one year after start-up and final acceptance.
- E. Special tools and spare parts shall be furnished in accordance with Section 01030.

1.09 PRODUCT HANDLING

- A. Delivery, storage and handling of equipment shall be in accordance with Section 01600 and as specified herein.
- B. All equipment and parts must be properly protected against any damage during shipment. Store the equipment in accordance with Manufacturer's recommendations.
- C. All completely assembled units shall be off loaded by the use of a primary and "tail" crane system. Additionally, when lifting the units from a horizontal position to a vertical position, the use of a primary and "tail" crane system shall be used.
- D. Long Term Storage:
 - 1. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of fabrication, including storage in accordance with Manufacturer's requirements, until the unit and equipment are ready for operation.
 - 2. If long-term storage is required on-site, Contractor shall follow Manufacturer's detailed recommendations for long term storage.
 - 3. If the pumps are delivered and stored on-site in a horizontal position and left for an extended period of time, the rubber line-shaft bearings may become deformed and the shafts may take on a permanent "sag". The Contractor shall be responsible for rotating the shafting so that damage does not occur.
- E. Factory assembled parts and components less than 25 feet in length shall not be dismantled for shipment unless permission is received in writing from the Engineer.
- F. For units greater than 25 feet in length that are shipped unassembled, all connecting parts shall be "match-marked" by the Manufacturer to ensure correct assembly on-site by the Contractor.
- G. The finished surfaces of all exposed flanges shall be protected by wooden or equivalent blank flanges, strongly built and securely bolted thereto.
- H. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.
- I. No shipment shall be made until approved by the Engineer in writing.

- J. For protection of bearings during shipment and installation, the bearing shall be properly processed. Anti-friction bearings, if pre-lubricated, shall be protected in accordance with the bearing manufacturer's recommendations against formation of rust during a long period of storage while awaiting completion of installation and start-up of the machine in which they are used. Anti-friction bearings which are not pre-lubricated shall be properly treated in accordance with the bearing manufacturer's recommendation against formation of rust during a long period of storage while waiting completion of installation and start-up by the application of an appropriate rust preventative treatment.

1.10 WARRANTY

- A. All equipment supplied under this Section of the Specifications shall be warranted for a period of one year from Substantial Completion by the Contractor and the Pump Manufacturer. Warranty period shall commence on the date of District acceptance, as outlined in Division 1 and in Division 0. ← and completely satisfying the requirements of paragraph 3.02, E. Field Testing.
- B. The equipment shall be warranted to be free from defects in workmanship, design and materials. If any part of the equipment should fail during the warranty period, it shall be replaced in the machine(s) and the unit(s) restored to service at no expense to the District.
- C. The Pump Manufacturer's warranty period shall run concurrently with the Contractor's warranty period. No exception to this provision shall be allowed.
- D. Refer to Section 01740 for additional warranty requirements.

PART 2 PRODUCTS

2.01 GENERAL

- A. The pumping units shall all be supplied by one manufacturer and shall be complete including pumps, cans, motors, variable frequency drives, and appurtenances such as, but not limited to, couplings, guards and gauges. The pump shall conform to AWWA E-103, Horizontal and Vertical Line-Shaft Pumps Standard where not in conflict with the requirements specified herein. Ample room shall be provided for inspection, repairs and adjustments.
- B. Discharge head lifting lugs or eye bolts shall be provided by the Pump Manufacturer.
- C. The pumps, motors, variable frequency drives, shall be designed and built for 24-hour continuous service at any and all points within the required range of operation, without overheating, excessive vibration or strain.
- D. Pump can top flange and baseplate shall be rigidly and accurately anchored into position, precisely leveled and aligned, so that the completed installation is free from stress or distortion. The baseplate shall be proportioned to support each entire pump/motor assembly and the loads (including the results of the dynamic vibration analysis) to which it may be subjected during operation. All necessary anchor bolts, plates, nuts and washers shall be furnished as specified herein and installed by the Contractor and conform to the recommendations and instructions of the Pump Manufacturer.

- E. The pump can top flange shall be bolted to the concrete foundation with Type 316 stainless steel sleeve type cast-in anchor bolts and washers. Nuts on stainless steel anchor bolts shall be monel. Anchor bolt configuration and installation shall be in accordance with API RP 686 and ACI 318-08 where not in conflict with the specific requirements contained herein. An anti-seize compound of molybdenum disulfide base such as Moly coat G or approved equal, shall be used on the anchor bolt threads.
- F. The pump support/anchors and associated accessories shall conform to the following:
1. Pump shall be properly supported on can top flange and anchored with Type 316 stainless steel bolts and monel nuts, where nuts used and located as shown on the Drawings. Special slings, strongbacks, or other devices necessary to handle the pump during loading, unloading, erection, installation, and subsequent disassembly and assembly shall be furnished by the Contractor.
 2. Can top flange shall be provided under pump discharge head. The can top flange shall be installed, leveled and grouted in accordance with API RP 686, Chapter 5 – Mounting Plate Grouting. Jacking bolts and Five Star non-shrink epoxy grout as specified below shall be provided for leveling pump baseplate assembly.
 3. An anchor bolt layout shall be provided to aid in placement of anchor bolts. All leveling jacking bolts shall be backed off after grouting so that they do not support any of the load. The use of shims or leveling nuts on anchor bolts is specifically prohibited.
 4. The grout for use in grouting under the can top flange supported by jack bolts shall be Five Star DP Epoxy Grout which is an expansive, non-shrink, low exothermic epoxy system, or approved equal, mixed and applied according to the manufacturer's directions to a thickness as noted in Article 2.03.
 5. The presence of the Pump Manufacturer's representative during the pouring of the epoxy grout as well as the use of rigid non-absorbing formwork and a head box are mandatory. The surface of the formwork in contact with the epoxy grout shall be covered with a layer of paste wax to facilitate removal. Clearance between the concrete surface and the bottom surfaces of the can top flange shall be per Pump Manufacturer's recommendation.
 6. The concrete surface to be in contact with the epoxy grout shall be chipped to present a slightly rough surface and remove the laitance. The surface shall then be cleaned of all dust, moisture and oil. A one-inch minimum diameter by 1/4 inch thick stainless steel disk, with full radiused edges shall be placed under each jack bolt. A thin layer of leveling grout shall be placed under metal discs on which the jack bolts shall bear. All metal edges in contact with the epoxy grout shall be radiused to a minimum 1/2 inch radius in order to prevent stress risers in the epoxy grout. Plastic vent tubes, sized and spaced per Pump Manufacturer's recommendation, shall be placed under the can top flange to vent air during grouting and prevent voids in the epoxy grout.
 7. The annular space between the anchor bolts and the anchor bolt sleeve shall be filled with expanding urethane foam. The threads of both the anchor bolts and jack bolts in contact with the grout shall be covered with paste wax and a layer of duct tape. After all alignment tolerances are met, the anchor bolts shall be tightened snug to prevent movement during the pour. The epoxy grout shall not be allowed to extend above the top edge of the can top flange. After the epoxy grout has fully cured, within 24 to 48 hours after pouring, the jack

bolts shall be removed and the anchor bolts tightened to the torque levels as recommended by the Pump Manufacturer.

8. The threaded jack bolt holes shall be coated with grease and the jack bolts cleaned of the paste wax and duct tape then reinserted and secured in position with a lock nut to within 1/4 inch of the bottom of the hole. After grouting, edges shall be chipped and patched to present a smooth finish.
- G. Each major piece of equipment shall be furnished with a stainless steel nameplate (with embossed data) securely mounted to the body of the equipment. At a minimum, the nameplate for the pumps shall include the manufacturer's name and model number, serial number, rated flow rate, head, and speed. At a minimum, nameplates for motors shall include the manufacturer's name and model number, serial number, horsepower, speed, input voltage, amps, number of cycles and power and service factors. Nameplate information for the variable frequency drives shall include the manufacturer's name and serial number, input speed, voltage, current and frequency and horsepower at full load.
- H. The pump and its driving equipment shall be designed and constructed to prevent reverse rotation using a non-reverse ratchet installed in the electric motor. As an alternate, the pump and motor shall be designed and constructed to successfully withstand a maximum turbining speed of the unit resulting from backflow through the pump. Manufacturer shall determine maximum potential reverse rotational speed for design.
- I. The maximum sound pressure level from one pump/motor when operating on utility power measured three feet from the equipment and five feet above the floor shall be 90 dBA.
- J. The nameplate ratings of the motor shall not be exceeded, nor shall the design service factor be reduced when the pump is operating at any point on its performance curve within the specified operating range at maximum speed.
- K. Mechanical equipment, including electric motors shall be supplied and installed in accordance with applicable OSHA regulations. The Contractor's attention is drawn to the requirement for guards on all rotation assemblies.

2.02 CONDITIONS OF OPERATION

- A. The pumps shall be Model 14EMM by Flowserve; or equal; Model M14HC by National; Model 14KDM by Trillium Flow Technologies (Floway). Any "or equal" substitution must be submitted to the design engineer at least two weeks before the bid date for pre-approval. The pumps shall be identical in every respect with all parts interchangeable.
- B. Each pump shall be designed for the conditions of service tabulated as follows and shall operate within the system head curve envelope as appended. All pumps shall have a continuously rising (from runout toward shutoff) head-flow rate performance curve for stable pump operation within the AOR.
- C. The pumps shall operate throughout the specified operating range, within the vibration limitations specified in Paragraph 1.05 J.5 above.

TABLE 11214-1
PUMPING UNIT DESIGN REQUIREMENTS

Item Description	Design Conditions
Service	Raw Water
Number of Pumps (operating/standby)	4 (3/1)
Maximum Motor Full Load Speed (FLS) (rpm)	1775
Minimum Motor Speed (rpm as % of FLS)	65
Maximum Allowable Motor Horsepower (non-overloading throughout operating range) (HP)	250
Motor Design Voltage/Phase/Frequency	460/3/60
Maximum Anticipated Pumped Fluid Temperature (degrees F.)	85
Minimum Pump Discharge Nozzle Size (inches)	10
Minimum Pump Column Diameter (inches)	10
Minimum Can Diameter (inches)	24
Minimum Can Suction Diameter (inches)	18
Pump Shut-Off Head at Motor FLS Acceptable Range (minimum/maximum) (feet)	470/610
Flow Rate at Secondary Operation Point (gpm)	750
Minimum TH at Secondary Operation Point (feet)	430
Minimum Bowl Efficiency at Secondary Operation Point (%)	58
Maximum NPSH3 at Secondary Operation Point (feet)	11
Intermediate (Design) Point Flow Rate (gpm)	1,750
Minimum TH at Intermediate (Design) Point (feet)	360
Minimum Bowl Efficiency at Intermediate (Design) Point (%)	80
Maximum NPSH3 at Intermediate (Design) Point (feet)	14
Best Efficiency Point (BEP) Flow Rate Acceptable Range (minimum/maximum) (gpm)	1,580/1,760
Minimum Bowl Efficiency at BEP (%)	80
BEP Location Relative to Intermediate Design Point	Left
Primary Operating Point TH (feet)	260
Minimum Flow Rate at Primary Operating Point (gpm)	2,100
Minimum Bowl Efficiency at Primary Operating Point (%)	70
Maximum NPSH3 at Primary Operating Point (feet)	32
Minimum Submergence Above Pump Suction Bell (feet)	6.86
Minimum Can Water Level (feet)	7.69
Can Suction Configuration	below ground suction

See attached pump and system curve envelope in Figure 11214-1.

2.03 PUMP CONSTRUCTION

- A. Vertical turbine line-shaft pumps shall be product lubricated with open line-shaft bearings as specified below, completely equipped with motor support and discharge head and shall conform to AWWA E-103, Horizontal and Vertical Line-Shaft Pumps, and ANSI/NSF 61 and ANSI/NSF 61 Annex G and ANSI/NSF 372 where not in conflict with the specific requirements contained herein. All pump assemblies shall be evaluated by the manufacturer for galvanic corrosion potential and zinc anode protection systems provided where required.

- B. Pump bowls, including suction bell, shall be ASTM A48 Class 30 cast iron, flanged and bolted construction with bearings as specified below. All bowl hardware shall be Type 316 stainless steel with monel nuts, where nuts used.
- C. Impeller shall be enclosed type of 316L stainless steel ASTM A582 Grade CF-3M two-plane dynamic balance in accordance with ISO 1940-1 quality grade G6.3. Enclosed type impeller design shall include adequate material so as to provide for the future addition of wear ring to restore impeller efficiency.
- D. Impeller shafts and couplings shall be 416 stainless steel. Collets and locknuts shall be steel ASTM A519 grade 1020 or approved equal.
- E. Line-shafts and couplings shall be provided in accordance with AWWA E-103 and shall be 416 stainless steel and shall be field replaceable. Maximum shaft lengths shall be 10-ft and shall be verified with vibration analysis as specified in Paragraph 1.05J above and clearance limitations. Design of the column couplings, for flange system shall provide for bearing retainers and shall be constructed of Type 316 stainless steel if of bolted or threaded construction.
- F. Open line-shaft and bowl bearings above impeller shall be removable self-flushing product lubricated combination bismuth tin bronze (ASTM B505 Alloy C89835) and cutlass rubber, or synthetic materials as manufactured by Greene Tweed and Co. (model AR[®] HT) or Thordon (model SXL) mounted in bronze, fabricated steel, or stainless steel bearing supports as specified above.
- G. Discharge columns shall be carbon steel, flanged and bolted construction in lengths not exceeding 10-ft. All flange hardware shall be Type 316 stainless steel with monel nuts. The minimum wall thickness on all columns with nominal diameters 12-in and above shall be 0.375-in. The minimum wall thickness on columns below 12-in nominal size shall be in accordance with Table E-1 of AWWA E-103.
- H. Discharge Head for Can Mounted Pumps:
 - 1. The discharge head shall be fabricated carbon steel with 150 lb ASME B16.5 or B16.47 flanged connections. The discharge head shall be an L-type design. The base of the discharge head shall be machined to match the drilling of the can top flange or adaptor flange if can is oversized as selected by the Pump Manufacturer or as shown on the Drawings complete with all Type 316 stainless steel bolts and washers and monel nuts. The pump shall be equipped with a one-inch tapped vent in the pump baseplate with a one-inch 316 stainless steel nipple, and Type 316 stainless steel J-tube for the removal of air from the can. A can top flange shall be welded to the suction can at the location shown on the Drawings and as specified below.
 - 2. Motor mounting flange for the vertical driving motor shall be of standard NEMA dimensions for commercially available motors.
 - 3. The top of the discharge head shall have a registered fit for mounting the driving motor.
 - 4. The discharge head shall include a stuffing box and have large openings for pump adjustment and seal maintenance. Provide suitably sized drain connection, a design that ensures continuous positive stuffing box bushing lubrication and a 1/4-in tap for the suction and discharge pressure gauges, each complete with 1/4-in brass pipe nipples and

stainless steel ball valves. Stuffing box must be located and accessible above pump baseplate.

- I. Stuffing box/seal box sealed with single-piece mechanical seal: The discharge head shall be fitted with a mechanically sealed type stuffing box arranged for fresh water flush of stuffing box. Stuffing box shall be equipped complete with a cartridge mechanical seal manufactured by A.W. Chesterton, John Crane, Flowserve or equal. The mechanical seal shall have self-aligning faces and be of a stationary cartridge design specific for high pressure, high torque applications and capable of sealing 25" Hg vacuum to 300 psig. The seal shall have a flushing/venting port. The seal faces shall be sleeve mounted to insure the faces remain both concentric and perpendicular to the shaft and minimize oscillation and wiping limiting the opportunity for face contamination. The springs shall be isolated from the pumpage. All dynamic O-rings shall be on the O.D. and seal to a micro polished surface to eliminate hang up and hysteresis. The seal materials of construction shall be 316 stainless steel for all wetted parts and Hastelloy C springs. The Pump Manufacturer shall be responsible for ensuring that shaft movement and seal chamber pressures at all specified operating conditions are fully compatible with the mechanical seal system provided. Any small diameter drain piping shall be secured to the pump column and be armored to prevent damage during installation and removal.
1. O-rings shall be Viton® or compatible with the fluid being pumped. The gland shall be of a universal design to fit varied bolt sizes and circles. The gland shall have a minimum of one tapped flush/by-pass port that can be rotated 360 degrees to accommodate flush piping.
 2. Seal faces shall be of carbon rotating face and 99.5% minimum alumina ceramic stationary face.
 3. The Pump Manufacturer shall install a SpiralTrac version D installation type I, as manufactured by EnviroSeal Engineering Products Ltd., active throat bushing in the bottom of each stuffing box to convert the radial flow created inside the seal area into axial flow to remove any solids away from the seal. The SpiralTrac devices shall be made of Type 316 stainless steel. The Pump Manufacturer shall install a throat bushing in the bottom of stuffing box to throttle flow into seal area. The throat bushing shall be bismuth tin bronze.
 4. System shall be configured in accordance with flushing system, API Plan 13.
 5. Shaft sleeve: The section of line-shaft that extends through or into the stuffing box shall be fitted with a replaceable 316 stainless steel sleeve that extends beyond the face of the stuffing box far enough to accommodate the total length of the mechanical seal. The sleeve shall be held to the shaft with set screws to prevent rotation and shall be sealed to prevent leakage between the shaft and the sleeve. Minimum shaft sleeve thickness shall be 1/4 inch.
- J. Vortex suppressor: A pump suction bell mounted "basket" style vaned type vortex suppressor, or other approved device shall be furnished and installed to reduce the possibility of vortices entering the pump. The dimensions of the device shall be as recommended by the Pump Manufacturer. Configuration of the device shall be equivalent to the configuration provided at the end of this Specification.

K. Pump Suction Can:

1. The pump suction can shall be designed and supplied by the Pump Manufacturer and shall be constructed of carbon steel with a minimum wall thickness of 0.375-in and shall be suitable for 50 psig working pressure. The diameter and length of the can shall be selected by the Pump Manufacturer to ensure proper delivery of flow into the first stage impeller and shall meet the requirements of the Hydraulic Institute Standard for Pump Intake Design – ANSI/HI 9.8.
 2. Can lengths that require the can to be transported in sections shall be connected in the field as directed by the Pump Manufacturer to the tolerances required by the Pump Manufacturer. See Paragraph 1.06.E for Pump Can Plumbness Monitoring Program.
 3. The suction can and both flange connections (suction and can top flanges) shall be designed to ASME standards. Suction flange and nozzle shall be sized and furnished for non-“T” head design and located in accordance with ANSI/HI 9.8 requirements.
 4. The can top flange, constructed of materials specified for the can, shall be welded to the suction can, drilled and tapped ASME B16.5 or B16.47 standard flanged dimensions to mate to the pump discharge head. An O-ring gasket shall be used to seal the pump discharge head to the can top flange. The suction can top flange shall extend beyond the can diameter to serve as a rectangular supporting plate to support the weight of the entire assembled pumping unit and shall have a minimum thickness of 1.5-in. The flange shall be secured to the structural concrete support with anchor bolts and a one to two-in. grout layer between the suction can top flange and the concrete as specified in Paragraph 2.01F.
 5. Internally mounted vertical flow vanes, shall be furnished and installed within the pump suction can to prevent the possibility of fluid circulation around the pump bowl assembly for pump flow rates above 1,000 gpm. The dimensions of the vanes shall be as recommended by the Pump Manufacturer. Special design considerations shall be taken for vertical flow vanes in order to avoid flow induced excitation of vane sheets, which can result in vibration and loosening of the flow straightener. Below 3,000 gpm the pump manufacturer may propose an alternate vane design. Dimensional allowances shall be made for the vortex suppressor specified in Paragraph 2.03 J above.
- L. The construction of the pumps, position and number of column pipe flanges shall be such that the pumps can be readily installed and removed for repairs within the head room limitations of the building and crane vertical lift limitations using normal methods of operation and handling without undue difficulties.
- M. Furnish one pump can blind flange at each site that is normally uninstalled but, when a pump has been removed for maintenance, the pump can blind flange can be bolted to the open pump can to protect against accidents and for general safety. The pump can blind flange designed for maximum internal can pressure, with holes drilled to match the top can flange bolts and be fitted with a large lifting eye(s) in the middle to allow lifting by a crane. All surfaces shall be painted per Paragraph 2.08.

2.04 MOTOR TO PUMP COUPLING

- A. Pump shafting shall be directly connected to the motor by means of a flanged adjustable spacer coupling, suitably sized to transmit the required driving torque, axial thrust and be easily accessible for impeller adjustment, packing or mechanical seal replacement.

2.05 MOTORS

- A. Each pump shall be driven by a vertical solid shaft, inverter duty rated squirrel cage induction electric motor with a maximum horsepower and speed as specified under Article 2.02 above and with Weather Protected (WP) Type I enclosure and shall meet all the requirements of Section 16150 and include a thrust bearing capable of handling both the mechanical and hydraulic thrust of the pump.
- B. A non-reverse ratchet shall be installed in the motor to prevent reverse rotation.
- C. Non-reverse ratchet:
 - 1. The non-reverse ratchet shall provide immediate protection against reversing due to phase reversals or from backspin at shutdown.
 - 2. The non-reverse ratchet shall be a shaft mounted mechanical device configured with an outer rotating component equipped with a series of holes bored at angles. The holes shall house hardened steel balls. The inner stationary component shall consist of a series of flutes to receive the balls, with one of which shall engage in the locked position the instant the motor stops running. The number of flutes shall differ from the number of balls to increase the number of possible locking positions.
 - 3. In cases of conflict with the motor specification this Section shall control.
 - 4. The non-reverse ratchet shall be robust enough to withstand the motor torque developed during accidental reverse rotation.
 - 5. The non-reverse ratchet shall disengage due to normal rotation speed of no more than 20% of full speed.
- D. All lubrication fittings shall be brought to the outside of all equipment so that they are readily accessible from the outside without the necessity of removing covers, plates, housings, or guards, or without creating falling hazards. Fittings shall be buttonhead type. Lubrication fittings shall be mounted together wherever possible. Pressure grease-lubricated fittings shall be the "Zerk Hydraulic" type or the "Alemite" type. Housings of grease-lubricated bearings shall be automatically exhausted to the atmosphere to prevent excessive greasing.
- E. Motors shall be mounted to the top of the pump discharge head motor stand with Heavy Hex Grade 8 bolts, nuts and washers torqued to the Pump Manufacturer's recommended value.

2.06 VARIABLE FREQUENCY DRIVES

- A. The speed control for variable speed pumps shall be Variable Frequency Drives, as specified in Section 16370, suitable for installation as shown on the Drawings.

- B. The Variable Frequency Drives shall be supplied by the Pump Manufacturer and shall be completely coordinated with the pumps and pump driving motors and shall include all internal auxiliaries required to meet the functional specifications.
- C. The Variable Frequency Drives shall conform to all requirements stipulated in this section and Division 16, Electrical, and shall be designed for a speed range of 70% to 100% of full load motor speed. The VFD design shall incorporate the necessary components to accommodate receiving vibration and temperature data from the pump motor.
- D. The Variable Frequency Drives shall be compatible with the motors provided by the Pump Manufacturer.

2.07 PRESSURE GAUGES

- A. Each pump shall be equipped with a discharge pressure gauge. Pressure gauges shall be bronze bourdon tube Ametek U.S. Gauge, SOLFRUNT Duragauge Series 1980 Black Phenol Turret type with 316 stainless steel rack and pinion movement or equal. The gauges shall be glycerin filled. Gauges shall be calibrated from 0 to 300 psig for discharge service. Gauges shall be 4-1/2-in diameter furnished with 1/4-in inlet. All fittings and cocks shall be Type 316 stainless steel. Pressure gauges shall be furnished with isolating pulsation dampers. Diaphragm seals shall be Teflon coated, oil filled, Type 316 stainless steel suitable for use with pressure gauges. All gauges and diaphragms shall be furnished by the Contractor.

2.08 SHOP PAINTING

- A. Each piece of equipment in the pumping system including pump, support system, motor and associated equipment shall be prepared, shop-primed and finished-coated in accordance with the Pump Manufacturer's standard practice prior to shipment. Colors shall be Pump Manufacturer's standard. Coating for Variable Frequency Drives shall be as specified in Section 16370. Adequate supply of touch-up paints shall be supplied by the Pump Manufacturer.
- B. All interior and exterior surfaces of pump columns ,cans and discharge heads and the exterior of the bowl assemblies shall be cleaned of all rust and mill scale, grease, dirt, other foreign matter and supplied with Pump Manufacturer's standard epoxy coatings.
- C. All coatings on wetted surfaces shall be epoxy type and shall comply with AWWA E-103 and ANSI/NSF 61 and ANSI/NSF 61 Annex G and ANSI/NSF 372 for use with drinking water systems. Surface preparation shall conform to the coating manufacturer's recommendations.
- D. All nameplates shall be properly protected during painting.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Take all necessary measurements in the field to determine the exact dimensions for all work and the required sizes of all equipment under this Contract. All pertinent data and dimensions shall be verified.

- B. Installation shall be in strict accordance with the Pump Manufacturer's instructions and recommendations in the locations shown on the Contract Documents and pump shop drawings. Refer to Article 1.07 for additional requirements. The Contractor shall furnish all required oil and grease for initial operation, if required, in accordance with the Pump Manufacturer's recommendations. Anchor bolts shall be set in accordance with the Pump Manufacturer's recommendations and setting plans.
- C. If the Contractor does not provide qualified installation staff on the job during the pump installation, the Engineer may direct the Contractor to provide the services of a Pump Manufacturer's factory representative to give the necessary instructions to ensure a proper installation.
- D. Refer to Article 2.01 for additional installation (sole plate temporary support, grouting, etc.) requirements. Connection of piping to pumps and cans shall be done in the presence of the Engineer. All piping connections to the pump and can shall be done without bending and/or twisting the piping to mate with the pump and can flange connections.
- E. A certificate from the Pump Manufacturer shall be submitted stating that the installation of their equipment is satisfactory, that the equipment is ready for operation, and that the District's operating personnel have been suitably instructed in the operation, lubrication and care of each unit.

3.02 INSPECTION AND TESTING

A. General:

- 1. The Engineer shall have the right to inspect any equipment to be furnished under this Section prior to their shipment from place of manufacture and shall witness the factory pump performance test.
- 2. The Engineer shall be notified in writing no fewer than 10 working days prior to the factory performance test, so that arrangements can be made for inspection by the Engineer.
- 3. Field tests shall not be conducted until such time that the pumping system, including controls, is complete and ready for testing.

B. Factory Pump Testing:

- 1. Each pump shall be factory tested as described in ANSI/HI 14.6, American National Standard for Rotodynamic Pumps for Hydraulic Performance Acceptance Tests, as specified herein.
- 2. The Pump Manufacturer shall perform hydrostatic test on the pressure-containing parts in accordance with ANSI/HI 14.6. Test shall be conducted on each pump prior to shipment.
- 3. Cast surfaces of all components shall be examined by visual inspection per MSS SP-55.
- 4. Each pump shall be factory tested as described in ANSI/HI 14.6, American National Standard for Rotodynamic Pumps for Hydraulic Performance Acceptance Tests, as specified herein.

5. The Pump Manufacturer shall perform hydrostatic test on the pressure-containing parts in accordance with ANSI/HI 14.6. Test shall be conducted on each pump prior to shipment.
 6. Cast surfaces of all components shall be examined by visual inspection per MSS SP-55.
 7. Factory pump tests shall be the basis of acceptance of the hydraulic performance of the pumps. The Pump Manufacturer shall factory test all pumps prior to shipment in accordance with the Hydraulic Institute standards. Flow rate, total head, efficiency and input KW shall be tested and recorded for at least five points on the pump performance curve. Test shall be performed to demonstrate that the pumps meet ANSI/HI 14.6, acceptance grade 1U for all specified points. The five points shall include the points specified in Article 2.02. If any pump tested fails to meet any specification requirement it will be modified until it meets all specification requirements. If any pump tested fails to meet the flow rate, head or efficiency requirements for any of the conditions listed in Article 2.02 of this specification and all reasonable attempts to correct the inefficiency are unsuccessful, the pump(s) shall be replaced with a unit(s) that meets the specified requirements.
 8. Certified pump performance curves shall be submitted, including total head, flow rate, bowl efficiency and total brake horsepower for each pump supplied. Test data shall be submitted for approval by the Engineer prior to shipment.
 9. If the Pump Manufacturer does not have historical test records for NPSH3 at the specified design pump speed, one pump shall be tested to demonstrate NPSH3 versus flow rate.
 10. All meters, gauges, and other test instruments shall be calibrated within the manufacturer's established time period prior to the scheduled test and certified calibration data shall be provided. If the Pump Manufacturer has no ISO standard calibration period, Hydraulic Institute Standards shall govern.
 11. In lieu of testing with all job equipment, job pump bowls may be tested with a laboratory motor, laboratory column pipe and discharge head similar in size to that furnished for final installation. If possible, the length of column pipe will be the same as will be required to set the bowl in the field.
 12. The pumps shall be tested at 100 percent of the design speed. Reduced speed curves will be determined using affinity laws.
 13. Each pump shall be tested through the specified range of flow, and head/flow rate/efficiency curves plotted at maximum output speed. During each test, the pump shall be run at each head condition for sufficient time to accurately determine flow rate, head, power input, and efficiency. In addition, during the tests, the overall efficiency shall be determined at each test point. The pump under test shall be modified until the specified conditions are met or replaced with a pump that will meet the specified conditions.
 14. All pumps shall receive a non-witness factory test.
- C. Pump motor tests, including physical testing after manufacture and before shipment to determine actual motor reed critical frequency of each motor, in two perpendicular planes denoted relative to the conduit box, at the motor manufacturer's facility, as specified in Section

16150 and variable frequency drive tests as specified in Section 16370 shall be submitted for approval by the Engineer prior to shipment.

E. ~~D.~~

Field Testing:

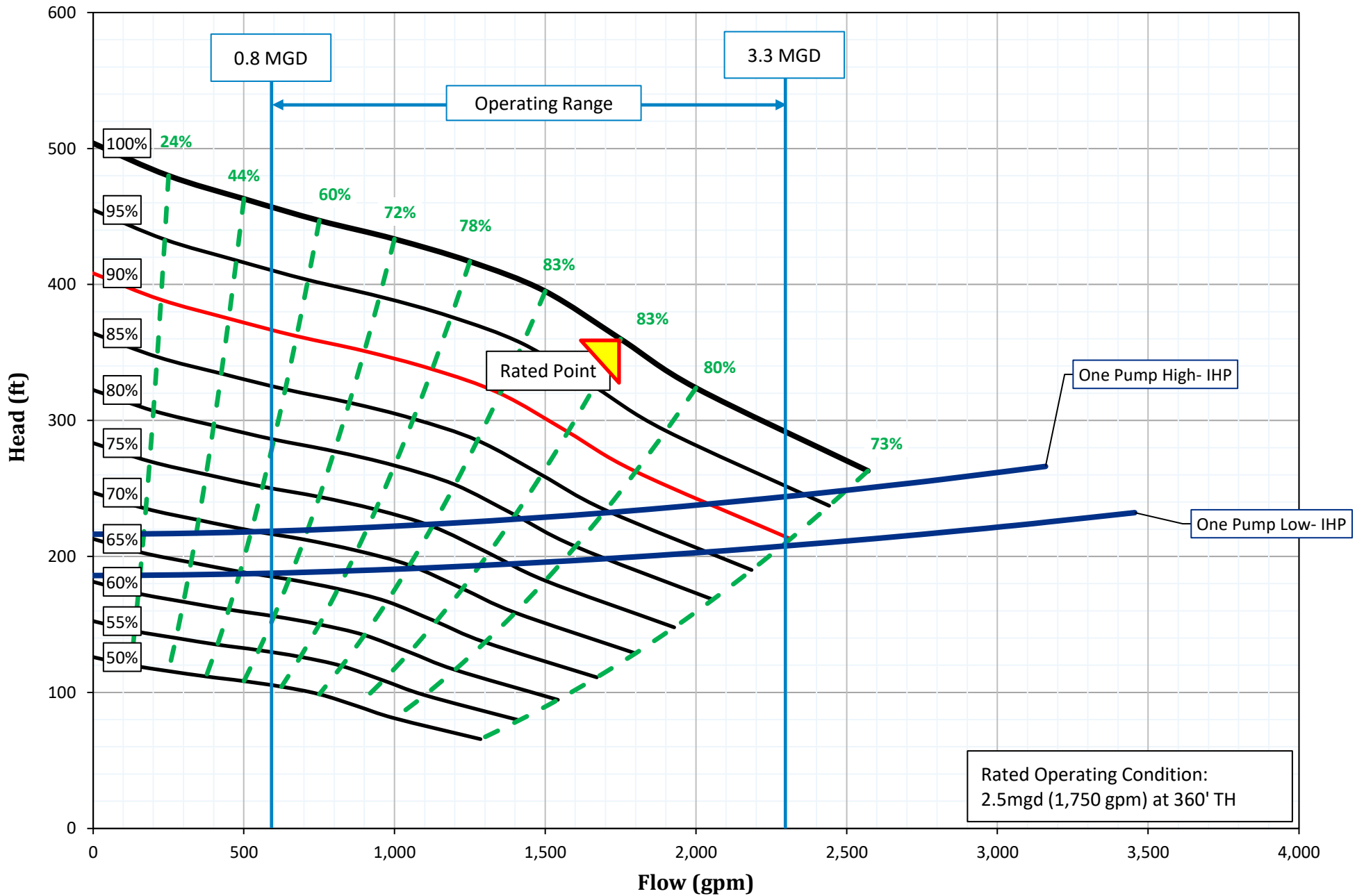
Field Testing cannot be completed until the raw water transmission main (by others) is Substantially Complete.

1. In the presence of the Engineer, necessary tests shall be performed to indicate that the pumps, variable frequency drives and motors generally conform to the operating conditions specified. The factory testing specified above will be the basis of performance acceptance. A seven-day operating period of the pumps will be required before acceptance. If a pump performance does not generally agree with the factory test results, corrective measures shall be taken or the pump shall be removed and replaced with a pump that satisfies the conditions specified. Provide, calibrate and install all temporary gauges and meters, make necessary tapped holes in the pipes, and install all temporary piping and wiring required for the field acceptance tests. Written test procedures shall be submitted to the Engineer for approval no fewer than 30 days prior to testing.
 2. After installation and as soon as conditions permit full speed operation, and in the presence of the Engineer, have the vibration tests performed in accordance with ANSI/HI 9.6.4 on each unit by a minimum level III qualified vibration technician as defined by Vibration Institute or equivalent to (a) prove compliance with specified limitations, and (b) prove that there are no field installed resonant conditions due to misalignment, the foundation, or the connecting piping and its supports, when operating at any speed within the specified operating range.
 - a. At a minimum, if pump system is furnished with vibration and temperature monitoring system, the motor lower vibration sensors may be used for acceptance testing. Alternatively, temporary surface mounted sensors mounted in the vicinity of the installed sensors are preferred to additionally establish the accuracy of the permanently installed system.
 - b. If required, take corrective action and the units shall be retested to ensure full compliance with this Section. All costs associated with the field tests or any required corrective action shall be borne by the Contractor.
 3. Motor tests:
 - a. Prior to any pump mechanical test, the Contractor shall megger each motor winding before energizing the motor, and, if insulation resistance is found to be low, shall notify the Engineer and shall not energize the motor.
 - b. Prior to any pump mechanical test, the Contractor shall check all motors for correct clearances and alignment and for correct lubrication in accordance with the motor manufacturer's instructions. The Contractor shall check direction of rotation of all motors prior to any pump mechanical test and reverse connections, if necessary.
 4. The Contractor shall meet all the testing requirements of Section 16150.
- E. If required, take corrective action and have the units retested to ensure full compliance with the specified requirements. All costs associated with the field tests or any required corrective action shall be borne by the Contractor.

END OF SECTION

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One Pump Operation



SECTION 13302 TESTING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required to complete the testing of all devices and systems furnished and installed as detailed on Drawings, and as specified herein.
- B. Refer to Section 13300 for other general requirements.

1.02 RELATED WORK

- A. Refer to Section 13300.

1.03 SUBMITTALS

- A. Refer to Section 13300.
- B. Testing Submittals - Submit, in one submittal, the following testing related documents:
 - 1. Status signoff forms:
 - a. Develop and submit project specific I/O Status and Automatic Control Strategy signoff forms to be used during factory and field testing to organize and track each loop's inspection, adjustment, calibration, configuration, and testing status and sign off. Include sign-off forms for each testing phase showing all loops.
 - 1) Example forms are shown in the Appendices.
 - 2) Separate forms for factory and field testing can be used, or they can be combined, at the discretion of the PCSS.
 - 3) Submit testing forms prior to start of testing.
 - 2. Testing Procedures:
 - a. Submit detailed procedures proposed to be followed for each of the tests specified herein. The test procedures shall serve as the basis for the execution of the required tests to demonstrate that the system meets and functions as specified.
 - b. Documents shall be structured in an orderly and easy to follow manner to facilitate an efficient and comprehensive test.
 - c. Test procedures shall indicate all pre-testing setup requirements, all required test equipment, and simulation techniques to be used.
 - d. Test procedures shall be structured in a cause and effect manner where the inputs are indicated, and the outputs are recorded.
 - e. Test procedures shall include the demonstration and validation under normal operating conditions and under various failure scenarios as specified in Contract Documents.
 - f. Testing may not start until all Testing Submittals have been approved.

C. Test Documentation:

1. Upon completion of each required test, document the test by submitting a copy of the signed off Testing Status forms. Testing shall not be considered complete until the signed-off forms have been submitted and approved. Submittal of other test documentation, including "highlighted" wiring diagrams with field technician notes, are not acceptable substitutes for the formal test documentation.

1.04 MAINTENANCE

- A. Refer to Section 13300.

1.05 COST OF TRAVEL

- A. Scheduled tests will only be attended once by Engineer /District. If test is not successful, all subsequent tests will be performed at Contractor's expense. Reimburse District for all costs, including labor and expenses, invoiced by Engineer and incurred by District for subsequent retests.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 TESTING - GENERAL

- A. Refer to Section 13300.
- B. Results of all testing shall be tracked on a project specific status sign off form or similar document. PCSS shall be responsible for maintaining the sheet. Appendix of this Section has an example template for this sheet.
- C. Tests the PCSS is required to perform are as follows:
 1. Factory Testing:
 - a. Unwitnessed Factory Test (UFT).
 - b. Witnessed Factory Test (WFT).
 2. Field Testing:
 - a. Operational Readiness Test (ORT).
 - b. Functional Demonstration Test (FDT). (required separately for both Interim Milestone and Final FDT)
 - c. Site Acceptance Test (SAT). (required separately for both Interim Milestone and Final FDT)
- D. Wherever possible, perform tests using actual process variables, equipment, and data. Where it is not practical to test with real process variables, equipment, and data, provide all special testing materials and equipment required for a suitable means of simulation.
- E. PCSS shall coordinate all required testing with Contractor, affected Subcontractors, Engineer, and District.

- F. No equipment shall be shipped to jobsite until Engineer or District has received all Factory Testing results and approved the system as ready for shipment.
- G. Engineer reserves the right to test or re-test any functions.
- H. Correction of Deficiencies:
 - 1. Deficiencies in workmanship and/or items not meeting specified testing requirements shall be corrected to meet specification requirements at no additional cost to District.
 - 2. Testing, as specified herein, shall be repeated after correction of deficiencies is made until specified requirements are met. This work shall be performed at no additional cost to District.

3.02 FACTORY TESTING - UNWITNESSED FACTORY TEST (UFT)

- A. Purpose of UFT is for PCSS to check system prior to Engineer and/or District attending factory testing. This type of testing shall be part of any quality firm's internal QA/QC procedures.
- B. Temporary network connections will be required to confirm the network configuration. Temporary wiring of primary elements, final control elements, and field-mounted transmitters is not required.
- C. Hardware to be tested shall include all control system devices shown on System Architecture drawings and provided by PCSS.
- D. Tests to be performed shall include, but not be limited to, the following. Each of these tests shall be specifically addressed in Test Procedure submittal.
 - 1. All panels and enclosures being provided shall undergo a thorough inspection to verify integrity of cabinet enclosures, frame structures, paint work and finish, etc. Review panel drawings to ensure they accurately reflect panel layout and wiring.
 - 2. Perform a system audit to verify all components have been staged for test and have been documented properly with correct model numbers, serial numbers, etc. Following documentation of audit shall be provided at factory test and submitted as part of O&M Manual Documentation:
 - a. For each OIT , list of all software installed (including the operating system), with software revision number, software improvement modules or patches installed, license number and District registration information, warranty period, vendor and local distributor names and contacts.
 - b. For each microprocessor-based component connected to control communication backbone in system (PLCs, managed switches, protocol converters, communication cards on final field devices, radios, etc.), list firmware revision, vendor and local distributor information, and system, warranty information, configuration parameters (e.g., communication settings, fail position settings, etc.)
 - 3. Panel wire pull tests shall be performed to ensure all wiring has been connected with appropriate torque to prevent wires from coming loose.

4. UPS shall be tested to verify UPS switch power correctly while keeping all UPS powered loads online. Testing of UPS to determine if they have been sized correctly to maintain specified run time shall be performed during field testing.
 5. A 100 percent I/O point checkout shall be performed to verify proper operation of input/output points from panel terminations OIT nodes. At a minimum, I/O checkout shall consist of four steps.
 - a. Discrete input signals shall be jumpered at field terminal blocks in control panels to verify proper status in OIT nodes.
 - b. Analog input signals shall be connected to a signal generator at field terminal blocks in control panels to verify proper status in OIT nodes and signals shall be verified at zero percent, 50 percent, and 100 percent of full scale.
 - c. Discrete output signals shall be tested by switching equipment to manual control at OIT nodes and turning the output on or other means to turn the output on. Then verify the output is on by connecting a digital multimeter to measure continuity at terminations, thus verifying command from PLC has properly executed contact closure.
 - d. Analog output signals shall be tested by switching the equipment to manual control at OIT nodes and turning output on or other means to turn the output on. Then verify output by utilizing a digital multimeter to measure current or voltage generated at termination points.
 - e. All the records transferred and calculated to the Datalogger and Loggernet must be include as part of the I/O test.
 6. All control strategies shall be verified using simulation or other means to verify logic performs as expected. Verify faults and logical failure conditions for control strategies such instrument failures, equipment failures, loss of communication between HMI and PLC, loss of peer-to-peer communication, out of range testing (over and under scale) for analog inputs, and all other strategies specified in control strategy document.
 7. For each hardware enclosure, inspection shall include, but not be limited to, cabinet enclosures, frame structure, paint work and finish, dimensions, and hardware operability (i.e., fans, door hinges, keylocks, etc.).
 8. For each subpanel, inspection shall include, but not be limited to, I/O subsystem physical layout, power supply sizing and mounting, cable routing, wire runs across hinges properly installed, fans and blowers unobstructed and mounted to maximize air flow, power conditioning correctly installed, and overall layout and installation of components meets manufacturer's recommendations and standard industry accepted practices.
 9. All other control panel circuitry.
 10. Following systems tests shall be performed:
 - a. Demonstrate ability to share data between PLC and Datalogger and Loggernet.
 - b. Demonstrate ability of each workstation to reproduce data provided by Datalogger.
 - c. Demonstrate communication failure and recovering self-healing ring testing.
- E. Upon successful completion of UFT, PCSS shall submit a record copy of test results as specified in PART 1. As part of this test results submittal, notify Engineer and District in

writing that system is ready for WFT. No other notice of Factory test will be accepted. Engineer and/or District shall schedule a test date within 30 days of receipt of this submittal.

3.03 FACTORY TESTING - WITNESSED FACTORY TEST (WFT)

- A. Purpose of WFT is to allow Engineer or District representatives to witness functionality, performance, and stability of entire hardware and software system as a complete integrated system. WFT shall be run by PCSS and conducted at PCSS's facility.
- B. Required Documents for Test:
 - 1. Clean set of approved panel drawings and wiring diagrams.
 - 2. Set of Contract Documents - all drawings and specifications.
 - 3. All design change related documentation.
 - 4. Master copy of the PCSS developed factory testing signoff forms.
 - 5. Testing procedures.
- C. System shall operate continuously throughout WFT without failure, except where initiated per established test procedures. Unanticipated failures may, at District or Engineer's option, result in overall WFT being deemed unsuccessful. All deficiencies identified during these tests shall be corrected and re-tested prior to completing WFT or shipment of panels to jobsite as determined by District/Engineer.
- D. Tests to be performed during the WFT shall include, but not be limited to, the following:
 - 1. A repeat of all tests specified in the UFT.
- E. Daily schedule during these tests shall be as follows:
 - 1. Morning meeting to review the day's test schedule.
 - 2. Scheduled tests and sign-offs.
 - 3. End of day meeting to review day's test results and to review or revise next day's test schedule.
 - 4. Unstructured testing period by witnesses.
- F. Upon successful completion of WFT, PCSS shall submit a record copy of test results as specified in PART 1.

3.04 FIELD TESTING - OPERATIONAL READINESS TEST (ORT)

- A. Purpose of ORT is to check with Engineer or District representatives that process equipment, instrument installation, instrument calibration, instrument configuration, field wiring, control panels, and all other related system components are ready to monitor and control the processes. This test will determine if equipment is ready for operation.

- B. This test shall take place prior to FDT and startup. Prior to starting this test, relevant process equipment shall be installed and mechanically tested, instruments installed, control panels installed, and field wiring complete.
- C. Required Documents for Test:
 - 1. Master copy of the PCSS developed field testing signoff forms.
 - 2. Testing procedures.
 - 3. Calibration forms.
- D. These inspections, calibrations, and tests do not require witnessing. However, Engineer may review and spot-check testing process periodically. All deficiencies found shall be corrected by PCSS prior to commencement of Functional Demonstration Test.
- E. PCSS shall maintain Sign-off forms and Calibration forms at job site and make them available to Engineer/District at any time.
- F. Following tests shall be performed as part of ORT:
 - 1. Instrument calibration, configuration, and set-up.
 - 2. Input/Output (I/O) Testing to OITs.
 - 3. Testing of control strategies.
- G. Instrument calibration, configuration, and set-up:
 - 1. Calibrate, configure, and set-up all components and instruments to perform specified functions.
 - 2. Calibration form:
 - a. For any component or instrument requiring dip switch settings, calibration, or custom configuration, maintain a calibration form in field documenting this information. These forms shall provide a summary of the actual settings used in the field to allow an Instrument technician to replace the device entirely and configure it to function as it did before.
 - b. This information shall be added to Instrument data sheet, shall be added to a copy of manufacturer's standard "Configuration Sheet", or a separate form shall be created.
 - 1) If a separate form, the form shall list Project Name, Loop Number, ISA Tag Number, I/O Module Address, Manufacturer, Model Number/Serial Number, Output Range and Calibrated Value.
 - c. Some examples of required information are:
 - 1) For Discrete Devices: Actual trip points and reset points.
 - 2) For Instruments: Any configuration or calibration settings entered into instrument
 - 3) For Controllers: Mode settings (PID).
 - 4) For I/O Modules: Dip switch settings, module configuration (if not documented in native programming documentation).

- d. Maintain a copy of these forms in field during testing, and make them available for inspection at any time.
- e. For any device that allows a software back-up of configuration files to a laptop, make configuration files available to Engineer/District for inspection. Submit as part of Final System Documentation as specified in Section 13300.

H. I/O Testing:

1. Purpose of I/O testing is to check that process equipment, instrument installation, calibration, configuration, field wiring, and control panels are set-up correctly to monitor and control the processes. This test is commonly referred to as a "loop test" or an I/O checkout.
2. PCSS in conjunction with Contractor shall test signals under process conditions. Preferred test method will always be to execute test wherever possible to end elements. For example, preferred test will prove valve open/close limit switches by operating valve, not by installing a jumper on limit switch contacts. However if equipment or process is not available to test a signal over its entire calibrated range, PCSS may test using a simulation methods and make a note on sign-off form.
3. The following I/O tests shall be performed:
 - a. Discrete Input: At device or instrument, change signal condition from inactive to active state. Observe results on all indicators within loop such as, OIT screens, pilot lights, horns, beacons, etc.
 - b. Analog Input: Test analog signal over entire engineering range at various intervals including 0, 50%, and 100% as well as on increasing and decreasing range. Observe results on all indicators within loop such as, OIT screens, recorders, digital indicators, etc.
 - c. Discrete output signals shall be tested by switching equipment to manual control at the OIT nodes and turning output on or using other means to turn output on. Then verify equipment responds accordingly.
 - d. Analog output signals shall be tested by switching equipment to manual control at OIT nodes and turning output on or other means to turn output on. Then verify equipment responds accordingly.

I. Testing of Automatic Control Strategies:

1. All automatic control strategies shall be verified using actual process equipment and instruments, or other means, to verify logic performs as expected. Verify faults and logical failure scenarios for control strategies such as instrument failures, equipment failures, loss of communication between HMI and PLC, loss of peer-to-peer communication, out of range testing for analog inputs, loss of power, and all other strategies specified in control strategy document.

J. Repeat all systems tests specified under factory testing.

- K. UPS shall be tested to verify UPS switch power correctly while keeping all UPS powered loads online. Also, test sizing of UPS by switching off line power to UPS and verify if they maintain specified run time.

- L. For all panels with enclosures modified by this Contract, internal control panel temperature shall be tested under full running conditions to ensure proper cooling/ventilation is being provided.
- M. Upon successful completion of ORT, PCSS shall submit a record copy of test results as specified in PART 1 and request scheduling of FDT.

3.05 FIELD TESTING - FUNCTIONAL DEMONSTRATION TEST (FDT)

- A. After facility is started-up and running treatment process in automatic control to extent possible, a Functional Demonstration Test shall be performed. Purpose of FDT is to allow Engineer or District representatives to witness actual functionality, performance, and stability of system while connected to process equipment.
- B. Required Documents for Test:
 - 1. Set of panel drawings and wiring diagrams from ORT with corrections noted
 - 2. Set of Contract Documents - all drawings and specifications.
 - 3. All design change related documentation.
 - 4. Signed-off master copy of the PCSS developed field testing signoff forms.
 - 5. Testing procedures.
 - 6. Copy of completed calibration forms.
 - 7. One copy of all O & M Manuals for PCSS supplied equipment.
- C. A witnessed FDT shall be performed on each process area. To extent possible, repeat testing performed during ORT.
- D. Daily schedule specified to be followed during factory tests shall also be followed during FDT.
- E. After coordinating with Operations, a "Black Start" of the plant shall be performed to confirm plant operation recovers as specified in Contract Documents. Black start means shutting off power to the plant and turning it back on. Separate tests shall be performed by recovering the plant while on generator (if a generator is specified) and while on utility power.
- F. Punch list items and resolutions noted during test shall be documented on Punch list/Resolution form. In event of rejection of any part or function test procedure, PCSS shall perform repairs, replacement, and/or retest within 10 days.
- G. Upon successful completion of the FDT, PCSS shall submit a record copy of test results as specified in "Part 1 - General".

3.06 FIELD TESTING - SITE ACCEPTANCE TEST (SAT)

- A. After completion of FDT, and system is started-up and running treatment process in automatic control to extent possible, system shall undergo a test as defined in Division 01 "Equipment Testing and Start-up" Section.

- B. While this test is proceeding, Engineer and District shall have full use of system. Only plant operating personnel shall be allowed to operate equipment associated with live plant processes. Plant operations shall remain responsibility of District and decision of plant operators regarding plant operations shall be final.
- C. During this test, PCSS personnel shall be present as required to address any potential issues that would impact system operation. PCSS is expected to provide personnel for this test who have an intimate knowledge of hardware and software of system. When PCSS personnel are not on-site, PCSS shall provide cell phone/pager numbers that District personnel can use to ensure that support staff is available by phone and/or on-site within four hours of a request by operations staff.
- D. Any malfunction during test shall be analyzed and corrections made by PCSS. In event of rejection of any part or function, PCSS shall perform repairs or replacement within 5 days.
- E. Throughout duration of SAT, no software or hardware modifications shall be made to system without prior approval from District or Engineer.

3.07 CERTIFICATE OF INSTALLATION

- A. Following successful completion of SAT test, PCSS shall submit a Certification of Installation for system as required in Division 01 "Equipment Testing and Start-up" Section.

END OF SECTION

APPENDIX 13302-A: EXAMPLE INPUT/OUTPUT (I/O) STATUS SIGN OFF FORM

An example template for I/O Status signoff form to be used for documenting testing results to District is attached. PCSS is required, prior to testing, to create a project specific I/O Status signoff form based on attached template or approved equal. PCSS may obtain an electronic copy of template from Engineer or develop it on their own.

APPENDIX 13302-B: EXAMPLE AUTOMATIC CONTROL STRATEGIES SIGN OFF FORM

An example template for Automatic Control Strategies signoff form to be used for documenting testing results to District is attached. PCSS is required, prior to testing, to create a project specific Automatic Control Strategies signoff form based on attached template or approved equal. PCSS may obtain an electronic copy of template from Engineer or develop it on their own.

[Project Name] Appendix A - Input/Output (I/O) Status Sign-Off Form

4-Jun-14

All Sections below are required to be filled out by PCSS as part of Field Testing.

PLC	Signal Tag	Description	Range or Active State when closed	P&ID	Signal	Chan	Instru- ment Alarm Setpoint	Calibrate, Alarm and Wiring complete	PCSS I/O testing Date	I/O Testin g to the HMI Date	Notes
PLC-SC	LI-4000-1	Secondary Clarifier No. 1 Sludge Level	0-10" H	8	AI	2	1				
PLC-SC	LI-4000-3	Secondary Clarifier No. 3 Sludge Level	0-10" H	8	AI	2	1				
PLC-SC	SI-4100-1	RAAS Pump No. 1 Speed Feedback	0-100%	14	AO	2	7				
PLC-SC	SI-4100-2	RAAS Pump No. 2 Speed Feedback	0-100%	15	AO	2	7				
PLC-SC	SI-4100-3	RAAS Pump No. 3 Speed Feedback	0-100%	14	AO	2	7				
PLC-SC	SI-4100-4	RAAS Pump No. 4 Speed Feedback	0-100%	14	AO	2	7				
PLC-SC	SI-4100-5	WAS Pump No. 1 Speed Feedback	0-100%	14	AO	2	7				
PLC-SC	SC-4100-1	Spare Slot	N/A	N/A	Spare	2	5				
PLC-SC	SC-4100-2	RAAS Pump No. 1 Speed Setpoint	0-100%	14	AO	2	7				
PLC-SC	SC-4100-3	RAAS Pump No. 2 Speed Setpoint	0-100%	14	AO	2	7				
PLC-SC	SC-4100-4	RAAS Pump No. 3 Speed Setpoint	0-100%	14	AO	2	7				
PLC-SC	SC-4110-1	WAS Pump No. 1 Speed Setpoint	0-100%	14	AO	2	7				
PLC-SC	Spare	Spare	N/A	N/A	AO	2	7				
PLC-SC	Spare	Spare	N/A	N/A	AO	2	7				
PLC-SC	TSH-4000-1	Secondary Clarifier No. 1 High Torque	Normal	8	DI	3	1				
PLC-SC	YA-4000-1	Secondary Clarifier No. 1 Motor On/Off	Normal	8	DI	3	1				
PLC-SC	WAH-4000-1	Secondary Clarifier No. 1 High Torque	Normal	8	DI	3	1				
PLC-SC	YRH-4000-1	Secondary Clarifier No. 1 High Torque	Normal	8	DI	3	1				
PLC-SC	YRI-4000-1	Secondary Clarifier No. 1 On/Off	On	8	DI	3	1				
PLC-SC	YCI-4000-1	Secondary Clarifier No. 1 In Remote	In Remote	8	DI	3	1				
PLC-SC	YFI-4100-1	RAAS Pump No. 1 VFD Fault	Normal	14	DI	3	1		12/22/2011	12/29/2011	Example completed line
PLC-SC	FAL-4100-1	RAAS Pump No. 1 Low Flow	Normal	14	DI	3	1		JAS		
PLC-SC	Spare	Spare	Normal	14	DI	3	1		RJM		
PLC-SC	YRI-4100-1	RAAS Pump No. 1 Running	Running	14	DI	3	1				
PLC-SC	YCI-4100-1	RAAS Pump No. 1 In Remote	In Remote	14	DI	3	1				
PLC-SC	FAL-4110-1	WAS Pump No. 1 VFD Fault	Normal	14	DI	3	1				
PLC-SC	FAL-4110-1	WAS Pump No. 1 Low Flow	Normal	14	DI	3	1				
PLC-SC	Spare	Spare	Normal	14	DI	3	1				
PLC-SC	YRI-4110-1	WAS Pump No. 1 Running	Running	14	DI	3	1				
PLC-SC	YRI-4110-1	WAS Pump No. 1 In Remote	In Remote	14	DI	3	1				
PLC-SC	YCI-4110-1	WAS Pump No. 1 In Remote	In Remote	14	DI	3	1				
PLC-SC	HSS-4000-2	Secondary Clarifier No. 2 Start Command	Start	8	DO	4	6				
PLC-SC	Spare	Spare	N/A	N/A	DO	4	6				
PLC-SC	HSS-4100-2	RAAS Pump No. 2 Start Command	Start	14	DO	4	6				
PLC-SC	HSS-7000-2	Sludge Holding Tank Blewer No. 2 Start Command	Start	17	DO	4	6				
PLC-SC	HSS-4100-5	RAAS Pump No. 5 Start Command	Start	15	DO	4	6				
PLC-SC	Spare	Spare	N/A	N/A	DO	4	6				
PLC-SC	HSS-4105-1	Secondary Sludge Pump No. 2 Start/Stop	Start	15	DO	4	6				
PLC-SC	HSS-4110-2	WAS Pump No. 2 Start/Stop Command	Start	15	DO	4	6				
PLC-SC	7160FQH-1	Sludge Lostout LCP Pumping Indicator	Pumping	17	DO	4	6				
PLC-SC	Spare	Spare	N/A	N/A	DO	4	6				
PLC-SC	HSS-7115-2	Sludge Holding Tank Mixval No. 2 Start	Start	17	DO	4	6				
PLC-SC	Spare	Spare	N/A	N/A	DO	4	6				
PLC-SC	HSS-7117-2	Sludge Holding Tank Discharge Valve No. 2 Open CMD	Open	17	DO	4	6				
PLC-SC	HSS-7117-2	Sludge Holding Tank Discharge Valve No. 2 Close CMD	Close	17	DO	4	6				
PLC-SC	HSS-7120-2	Transfer Pump No. 2 Start Command	Start	17	DO	4	6				
PLC-SC	Spare	Spare	N/A	N/A	DO	4	6				

[Project Name] Appendix B - Automatic Control Strategies Sign-Off Form
All Sections below are required to be filled out by PCSS as part of Testing

Auto. Control Strategies. - Loop operational in Automatic as defined in Control Strategies

Control Strategies Loop #	Control Strategy Description	P&ID	Auto. Control Strategy	Date	Notes
LOOP 281 - 284	LOW FLOW PUMPS	8			
LOOP 290	LOW EQ CHANNEL FLOW NO. 4	8			
LOOP 300	MICROFILTRATION AIR SUPPLY LOW PRESSURE	10			
LOOP 351, 352	SITE LIFT STATION PUMP NO.1 AND NO. 2	12			
LOOP 355	SITE LIFT STATION HIGH AND LOW LEVEL CONTROL	12			
LOOP 371, 372	SLUDGE HOLDING TANK NO.1 AND NO. 2 LEVEL	14			
LOOP 381, 382	SLUDGE TRANSFER PUMPS	14			
LOOP 385	SLUDGE TRANSFER PUMPS REMOTE START/STOP COMMAND	14			
LOOP 700	EFFLUENT PUMPING STATION LEVEL	14			
LOOP 701, 702, 703	EFFLUENT PUMP NO.1	14			
LOOP 840	POST AERATION CHANNEL AIR FLOW CONTROL	15			
LOOP 900	SLUDGE TRANSFER PUMPS DISCHARGE FLOW	8			
LOOP 971	CENTRIFUGE SLUDGE FEED PUMP NO.1	8			
LOOP 1001	CENTRIFUGE NO.1 SLUDGE FEED FLOW CONTROL	8			
LOOP 1411, 1412	SODIUM HYPOCHLORITE STORAGE TANKS LEVEL	8			
LOOP 1421, 1422	SODIUM HYPOCHLORITE PUMPS	8			
LOOP 1430	SODIUM HYPOCHLORITE STORAGE TANKS CONTAINMENT AREA HIGH LEVEL DETECTION	14			
LOOP 2051, 2052, 2053	DIESEL ENGINE GENERATOR STATUS	14			
LOOP 2055	TRANSFER SWITCH STATUS	14			
LOOP 2060	GENERATOR KILOWATTS MONITORING	14			
APPENDIX ONE	EQUIPMENT RESTART DURING A POWER LOSS WITH THE GENERATOR RUNNING	14			
APPENDIX TWO	EQUIPMENT RESTART WITH POWER RESTORED AFTER A POWER LOSS	14			
N/A	SELF-HEALING CAPABILITIES OF NETWORK	N/A			
N/A	REDUNDANT SCADA SERVER FAILOVER AND RECOVERY	N/A			

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