



Issued for Bid

for

**TWIN CREEKS RECLAIMED WATER
RE-PUMP STATION IMPROVEMENTS –
PHASE II**

**JEA Project No.: 8004340
MM Project No. 502398244**

June 2020

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Twin Creeks Reclaimed Water Re-Pump Station Improvements – Phase II

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SUMMARY OF WORK

PART 1 – GENERAL

1.01 LOCATION OF WORK

- A. The work for this Contract is located at JEA's proposed Twin Creeks Reclaimed Water Re-Pump Station and Ground Storage Tank, located at 106 County Road 210 West in St. Johns, Florida 32259.

1.02 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required to access the site and construct a new repump building including pump room, electrical room, and restroom to serve as the Twin Creeks Reclaimed Water Re-pump Station as shown on the Drawings and as specified herein.
- B. CONTRACTOR shall strictly follow JEA's Water & Sewer Standards Manual, issued January 1, 2019 or latest version, during the construction of the improvements. CONTRACTOR shall use a Request for Information in the event of a discrepancy.
- C. CONTRACTOR shall strictly follow JEA's Facilities Standards Manual latest version, during the construction of the improvements.
- D. The project will be executed in a two-phase method – Phase I includes the construction of the prestressed concrete ground storage tanks and Phase II includes the construction of the re-pump facility and all associated work as shown on the Drawings. This work will occur mostly concurrently with the construction of the tanks beginning prior to the NTP of the re-pump station. The CONTRACTOR will be required and should include in his base bid all costs associated with coordinating his work with the tank CONTRACTOR including scheduling of work that is to be completed on the tanks after it is constructed. It is assumed that the tanks will be built within a 11-month timeframe with an NTP expected for May 2020.
- E. The following scope of work will be defined as the base bid for this contract and shall include but is not necessarily limited to the following:
 - 1. Mobilization/demobilization, general requirements, and insurance
 - 2. Coordination with the tank CONTRACTOR to complete the work shown on the Drawings
 - 3. Site work
 - a. Clearing, grubbing, grading, seeding, and sodding
 - b. Sedimentation and erosion control measures
 - c. Paving, sidewalks, and concrete pads for new equipment and building
 - d. Stormwater improvements including stormwater inlets, piping, and stormwater ponds
 - e. Duplex grinder pump station
 - f. Landscaping and fencing
 - 4. Yard piping including yard valves and connections to piping
 - a. Sodium hypochlorite injection vault and injection quill

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- b. New reclaimed water supply and re-pump station discharge piping from the station to an existing stub out of the reclaimed main located along County Road No. 210. The tank fill and pump suction piping will be installed under the ground storage tanks to the isolation valves just outside of the ground storage tanks by the tank CONTRACTOR. CONTRACTOR shall coordinate with the tank CONTRACTOR for tank fill and pump suction connections.
- c. Effluent flow measurement and bypass valving and flow measurement
- 5. 2,784 square foot single wythe split-face block wall building which will include a pump room, electrical room, and restroom and the following:
 - a. Four horizontal split case pumps and provisions for a future fifth horizontal split case pump
 - b. Sump pump
 - c. Process piping, valves, and appurtenances
 - d. Motor-operated 3-ton bridge crane
 - e. HVAC system including fans, louvers, and associated duct work
 - f. Control panels and PLC control system equipment
 - g. Switchboard and VFDs
 - h. Low voltage power distribution equipment
 - i. Lighting and receptacles
 - j. Automatic transfer switch with bypass isolation for normal and emergency power sources
 - k. Security panel and controls
 - l. Lightning protection system
- 6. Sodium hypochlorite feed and storage system
 - a. Duplex chemical pump skid
 - b. Concrete pad, containment, and PEMB
 - c. One single walled storage tank and appurtenances
 - d. Chemical feed piping, valves, and appurtenances
 - e. Lightning protection system
 - f. Remote I/O cabinet
 - g. Lighting and receptacles
- 7. All instrumentation and electrical components including conduit, wires, motors, control panels, cabling, and other field instruments for a fully functioning system
- 8. All instrumentation and electrical components including conduit, wires, motors, control panels, cabling, lighting, and other field instruments for a fully functioning system of the GSTs
- 9. Generator, fuel storage tank, and concrete pad
- 10. Coordination efforts with JEA to provide a fully integrated system
- 11. All testing required during construction
- 12. All permits necessary to complete the work

1.03 PERMITS AND REGULATIONS

- A. The CONTRACTOR'S responsibility includes compliance with federal, state and local regulations which in any way affect the work or implementation of the Project.
- B. Approved permits are located in **Appendix B**.

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1.04 WORK DESCRIPTION AND SEQUENCE

- A. Perform work in a sequence to ensure completion of the Work in the Contract Time. Completion dates of the various stages shall be in accordance with the approved construction schedule submitted by the CONTRACTOR.
- B. The CONTRACTOR shall submit a written schedule to the ENGINEER for approval prior to commencing work. Completion dates of the various stages shall be in accordance with the approved construction schedule submitted by the CONTRACTOR.
- C. Substantial Completion: To satisfy the definition of Substantial Completion, a consecutive five 24-hour days period of successful operation of the Twin Creeks systems as per Section 01465 as well as all on-site work including punch list times required by the CONTRACT shall have been completed to where the CONTRACTOR can vacate the site and only the elements of a submittal and closeout nature remain for the attainment of Final Completion and as previously described.
- D. Final Completion: The last stage of construction shall be final construction and shall include the final remaining items subject to ENGINEER'S approval as well as all items listed in Section 01700, Contract Closeout.

1.05 CONTRACTOR'S USE OF PREMISES

- A. CONTRACTOR will not have complete use of the premises for the performance of the Work. CONTRACTOR shall coordinate activities with any other CONTRACTOR who will be performing work in the same general area.
 - 1. Coordination of work within the site will be required with the tank CONTRACTOR
 - 2. Coordination of work outside the plant property will be required for connection to utilities with the developer CONTRACTOR
- B. CONTRACTOR shall limit the use of the premises for his/her Work and for storage to allow for:
 - 1. Work by other contractors
 - 2. OWNER occupancy
 - 3. Public Use
- C. Coordinate uses of premises with OWNER and other contractors. The CONTRACTOR will have to work with the tank CONTRACTOR (who will be onsite and mobilized prior to the start of this project) for location of trailers, storage of materials, and coordination of work efforts.
- D. CONTRACTOR shall assume full responsibility for security of all his/her and his/her subcontractor's materials and equipment stored on the site.
- E. If directed by the OWNER or ENGINEER, move any stored items which interfere with operations of OWNER or other contractors.

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- F. Obtain and pay for use of additional storage or work areas if needed to perform the Work.

1.06 CONTRACTOR'S STAGING, STORAGE, AND STOCKPILE AREA

- A. A staging, storage and stockpile will be made available by the OWNER at the project site and shall be within the limits of disturbance. The CONTRACTOR is not allowed to store any equipment outside these limits. Should the CONTRACTOR require additional space for trailers or storage this shall be obtained by them and at their cost or included in the base bid.

1.07 OWNER OCCUPANCY

- A. Owner will occupy premises during performance of the work for the conduct of his/her normal operations. CONTRACTOR shall coordinate all construction operations with ENGINEER to minimize conflict and to facilitate OWNER usage.

1.08 SECURITY

- A. The CONTRACTOR shall ensure that each employee, representative, Supplier, and others acting for the CONTRACTOR use designated staging areas and parking areas.
- B. The CONTRACTOR shall employ watchmen on the work when necessary and shall erect and maintain strong and suitable barriers and lights as necessary to prevent the happening of any accident to a person, to the property, to the work, and to any materials stored onsite.
- C. The CONTRACTOR shall employ any additional temporary fencing and gates to adequately protect the work and shall provide all access required by the ENGINEER and the OWNER.
- D. Stored materials shall be kept in a neat and orderly manner. Materials that are subject to deteriorations by exposure to the sun, rain, or other elements shall be kept adequately covered and protected. Refer to Section 01600 for additional details.
- E. The CONTRACTOR shall be responsible for protecting all stored materials and the project site safe from theft and vandalism. The CONTRACTOR shall employ security personnel and erect additional fences as necessary at no additional cost to the OWNER.

1.09 USE OF JEA STANDARDS

- A. The JEA standards identified in the Water Treatment Plant Standards, January 1, 2019 and Water and Sewer Standards Manual, January 1, 2019 edition will be used for the following items:
 - 1. Butterfly Valves WTP Standards Exhibit XI-I
 - 2. Gate Valves WTP Standards Exhibit XI-I
 - 3. Check Valves (Rubber Flapper) WTP Standards Exhibit XI-I

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|----|--------------------|-------------------------------------|
| 4. | Ductile Iron Pipe | W&S Manual Section 350 AW-101 |
| 5. | Valve Boxes | W&S Manual Section 351 VII, AW-301 |
| 6. | Grassing | W&S Manual Section 441 |
| 7. | Air Release Valves | WTP Standards Exhibit XI-I |
| 8. | Tapping Sleeves | W&S Manual Section 351 VIII, AW-202 |
| 9. | Tapping Valves | W&S Manual Section 351 VIII, AW-304 |
- B. Any and all materials coming into contact with potable water shall meet all pertinent AWWA and NSF 61 Standards, latest editions and shall be certified and stamped as such.
- C. The CONTRACTOR shall refer to these standards and details for acceptable manufacturers, materials of construction, and/or other details to provide these items as shown on the Drawings.
- D. Although the items listed above are approved JEA standard equipment and materials, the CONTRACTOR will be required to provide all required submittals and operation and maintenance manuals in accordance with Sections 01300 and 01730 for review and approval by the ENGINEER.

1.10 BASIS OF DESIGN AND MODIFICATIONS FOR ALTERNATE EQUIPMENT

- A. Drawings indicate the extent and general arrangement of the Work. If any departures from the Drawings are deemed necessary by the CONTRACTOR to accommodate the materials and equipment he proposes to furnish, details of such departures and reasons therefore shall be submitted. No such departures shall be made without the prior written approval of the ENGINEER and JEA. Approved changes shall be made without additional cost to the JEA.
- B. The specific equipment proposed for use by the CONTRACTOR on the project may require changes to structures, auxiliary equipment, piping, electrical, mechanical, controls, or other work to provide a completely satisfactory operating installation. The CONTRACTOR shall submit to the ENGINEER for approval all necessary Drawings and details showing such changes to verify conformance with the overall project structural and architectural requirements and overall project operating performance. The lump sum bid price shall include all costs in connection with the preparation of new drawings and details and all changes in construction work to accommodate the proposed equipment, including increase in the costs.
- C. In the event that the ENGINEER is required to provide additional engineering services as a result of substitution of materials or equipment, which are not listed as "or equal", or changes by the CONTRACTOR in dimension, weight, power requirements, etc. of the equipment accessories furnished, or if the ENGINEER is required to examine and evaluate any changes proposed by the CONTRACTOR for the convenience of the CONTRACTOR, then the ENGINEER'S charges in connection with such additional services shall be charged to the CONTRACTOR by the JEA.

PART 2 – PRODUCTS (NOT USED)

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PART 3 – EXECUTION (NOT USED)

END OF SECTION 01010

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CONSTRUCTION SEQUENCE

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

- A. This project consists of work on property owned by JEA at the Twin Creeks Wastewater Pump Station, located at 106 CR 210 West in St Johns, FL 32259. The improvements will involve construction of the re-pump building, sodium hypochlorite storage and feed system, and other improvements as shown on the Drawings. All coordination of phasing and sequencing of construction shall be approved and confirmed in writing by the OWNER and ENGINEER to be considered valid.
- B. The project will be executed in a two-phase method – Phase I includes the construction of the prestressed concrete ground storage tanks and Phase II includes the construction of the re-pump facility and all associated work as shown on the Drawings. This work will occur mostly concurrently with the construction of the tanks beginning prior to the NTP of the re-pump station. The CONTRACTOR will be required and should include in his base bid all costs associated with coordinating his work with the tank CONTRACTOR including scheduling of work that is to be completed on the tanks after it is constructed. It is assumed that the tanks will be built within a 11-month timeframe with an NTP expected for May 2020.
- C. Notification requirements and submittals required herein and as described in other technical specifications will be required and shall be coordinated in the overall schedule. The construction progress schedules required as part of JEA's front end documents shall properly reflect the constraints and sequencing outlined herein.
 - 1. Startups, tie-ins, and training shall not occur on Fridays.
 - 2. A minimum of 14 business day notice shall be provided to both the OWNER and ENGINEER for all pre-startup checkouts, startup of any system, and tie-ins (piping, electrical, or instrumentation in nature).
 - 3. Startup plans by equipment as well as a system wide startup plan shall be received at least 30 days prior to the day anticipated for review and approval by the OWNER and ENGINEER.
- D. Refer to Sections 01465 and 01730 for additional requirements and Division 11 through 16 on specific equipment startup and testing requirements.
- E. Special precautions are necessary to ensure that no damage occurs to the existing facilities including piping, utilities, roads, interiors of structures and structures. Any temporary facilities, materials, equipment, and labor required to ensure that no damage occurs shall be provided by the CONTRACTOR as part of the Work and at no additional cost to the OWNER.
- F. The OWNER reserves the right to postpone connections to existing utilities due to operational concerns and/or weather-related concerns.

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1.02 DEFINITIONS AND TERMS

- A. Construction Scheduling Constraints: Constraints for performance of the Work, required because of special sequencing with other parts of the Work, calendar time constraints and special testing, commissioning and procedures are identified in this Section. These constraints are in addition to the standard procedures such as maintaining working drawings, testing, commissioning, training, etc. These constraints shall be included in the CONTRACTOR's progress schedule.
- B. Special Conditions: Certain special conditions related to performance of the Work are identified in this Section and shall be included in the CONTRACTOR's progress schedule.

1.03 NOTIFICATION REQUIREMENTS

- A. The CONTRACTOR shall give a **minimum of 14 business days advance written notice** to the ENGINEER of each component proposed for shutdown, tie-in, or disruption, all of which shall be subject to OWNER's approval and limitations. Shutdowns, tie-ins, or disruptions specifically mentioned in the Section must conform to this requirement and any others requested by the ENGINEER or OWNER.
- B. The CONTRACTOR shall contact Carl Colee (Development Review Inspectors Supervisor) at least 48 hours in advance of the pre-construction meeting.

1.04 SUBMITTAL REQUIREMENTS

- A. CONTRACTOR shall submit shop drawings and working drawings in accordance with Section 01300 to show details, describe timelines for said work, and description of working plan of all construction sequencing including any temporary services, bypasses, shutdowns, tie-ins, and connections to existing systems.
- B. The CONTRACTOR shall submit a proposed construction sequence within two weeks of receiving a notice to proceed (NTP).

1.05 SITE CONDITIONS

- A. The CONTRACTOR shall submit to the ENGINEER and the OWNER a description and schedule as to how the common areas will be utilized. Coordinate uses of premises with OWNER and other contractors. The CONTRACTOR will have to work with the tank CONTRACTOR (who will be onsite and mobilized prior to the start of this project) for location of trailers, storage of materials, and coordination of work efforts.
- B. Various components of construction may involve work near structures, tanks, and piping requiring the CONTRACTOR to field verify the connections on intended on the Drawings. Furthermore, the CONTRACTOR shall provide any corrective measure or temporary facilities necessary to perform the work at no additional cost

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to the OWNER. Where temporary shoring/sheeting is required to allow new construction to proceed while protecting adjacent existing structures, the CONTRACTOR shall engage the services of a company to design and install engineered systems signed and sealed by a Florida PE.

- C. Where reclaimed water is required in large quantity for preoperational or watertightness testing or other use, the CONTRACTOR shall provide all necessary facilities and pay all costs associated with delivering water from the point of supply to the point of use. The OWNER will provide the water free of charge. The CONTRACTOR shall be responsible for temporary installation of the water meter, back flow preventer, and piping for use on an interim basis until any newly proposed systems are installed, tested, and put into service.
 - 1. Reclaimed water for the watertightness testing of the GSTs at Twin Creeks shall be provided by one of the following methods.
 - a. Fill the tanks through the new potable water main extension and fire hydrant or
 - b. Fill the tanks through the new supply reclaimed water main and fill valve with a jumper piping to connect to the piping underneath the tank.

The CONTRACTOR is responsible for coordinating with the tank CONTRACTOR to ensure that whatever method of filling the tank is installed, tested, and available in sufficient time for filling the tank for testing. The final piping connections for inlet and outlet to each tank shall not be made until the watertightness and settlement testing are completed and approved. With either method selected, the CONTRACTOR shall coordinate with JEA on the rate and times of day that can be used to fill the tank so as not to cause an issue with demands or pressure in the system.

- D. During all start-up and performance testing activities, the CONTRACTOR shall make available the manpower, equipment, and manufacturer's representatives required to make any necessary adjustments and training. Chemicals and fuels shall be provided by the CONTRACTOR to demonstrate performance of each system. The CONTRACTOR shall provide a full tank volume of fuel and all chemicals at the time of startup.
- E. Protective covers for equipment, furnishings, and water filled basins shall be provided by the CONTRACTOR.
- F. Existing wastewater pump station systems shall be avoided and maintained in operational state at all times.
- G. There is currently no reuse or potable water on the site for use by the CONTRACTOR. CONTRACTOR shall supply all water for their own use.

1.06 FIELD OFFICE

- A. The CONTRACTOR's field office shall be set up and fully equipped and all utilities connected within 30 days from the Notice to Proceed. The office shall be removed

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not earlier than the date of substantial completion and not later than the date of final payment. The CONTRACTOR shall be responsible for all work and/or coordination associated with connection to all utilities. The CONTRACTOR shall provide a site plan for review by the ENGINEER and OWNER prior to mobilization to confirm intent of their field office.

1.07 CONSTRUCTION CONSTRAINTS

- A. The CONTRACTOR shall meet the constraints below and shall consider these constraints when developing the plan of construction. The list is not intended to release the CONTRACTOR from the responsibility to coordinate Work in any manner which will ensure project completion within the time allowed. The following areas are not necessarily listed in their required sequence of construction. A suggested sequence within each area, where necessary, is included. However, the overall general sequence is outlined below. Should the CONTRACTOR wish to deviate from this overall sequence they shall obtain permission and approval prior to proceeding.
1. Perform additional clearing and grubbing, site preparation, and tree and brush removal as required to perform the work shown on the Drawings.
 2. Construct access road for the site, either to the requirements of the Drawings or temporary measures until the proposed access road is installed per the Drawings. CONTRACTOR shall coordinate with the tank CONTRACTOR on use of the access road.
 3. Construct stormwater improvements on the site to ensure that any dewatering activities and drainage on the site is maintained throughout construction activities.
 4. Install new service transformer and power to the site as required to facilitate temporary construction power and startup / commissioning activities.
 5. Install any required conduit and pipe below the re-pump building.
 6. Fill site as necessary to obtain the elevations reflected on the Drawings.
 7. Construct the new pump building.
 8. Construct new sodium hypochlorite feed and storage facility.
 9. CONTRACTOR shall coordinate with the tank contractor to ensure appropriate measures are installed in sufficient time for filling the tank for testing (watertightness and settlement).
 10. Perform remaining civil work including yard piping up to existing connection points, storm drainage, grading, and paving.
 11. Schedule tie-ins piping connections and coordinate with JEA and other CONTRACTORS to complete the work.
 12. Perform field operational tests including all SCADA and automatic functions prior to startup. This shall be implemented and demonstrated to confirm that the station is ready to begin the 5-day operational test required for substantial completion. Operation is "hand" without all instruments, SCADA, and controls in place is not an acceptable means and does not dictate startup.
 13. All potable water disinfection testing shall be completed prior to starting the 5-day operational testing period.

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14. Once the new facilities are on-line deemed ready for operation, test the system as per requirements of Division 1, technical specifications, and Drawings.
15. Complete all landscaping and fencing.

B. Sitework

1. Erosion control and temporary fencing of all construction areas shall be performed within 30 days after the Notice to Proceed. All erosion control devices and storm drainage piping and inlets affected by construction shall be installed prior to any excavation in those areas.
2. Construct the new stormwater infrastructure for diversion of surface water runoff and dewatering throughout construction.
3. Construction of the permanent or temporary stormwater management system is encouraged to properly maintain site drainage during construction.
4. The CONTRACTOR shall also include in his bid sufficient funds to maintain the new system throughout the construction process and base his maintenance budget on a normal annual rainfall for the geographical region.
5. All underground pipes, conduits, cables, duct banks, and structures installation work shall be organized and scheduled to accomplish the following:
6. If possible, underground work in each area shall be performed concurrently to avoid subsequent trenching through the same areas.
7. Yard electrical work and piping work shall be shown on the same working drawings and fully coordinated horizontally and vertically.
8. New bituminous pavement and sidewalk replacement shall not be installed until all piping, cables, conduits, and duct banks under the paved area have been installed. Roads shall be stabilized with crushed stone until that time. Any weak areas in base course or existing pavement shall be removed and replaced prior to the final surface course installation.
9. Locations and numbers of sedimentation control facilities shall be adjusted as the work progresses so that all site runoff flows through sedimentation control facilities at all times. At no time shall undesilted water be allowed to leave the site. Maintenance and upgrading of facilities shall be scheduled weekly and after all rain events.
10. The CONTRACTOR shall check the stormwater daily for sedimentation and erosion control and shall provide additional measures or means to minimize any impacts to adjacent property.
11. Dewatering activities shall be properly protected and desilted and permitted. Refer to the geotechnical report in **Appendix A** as well as Section 02140 for additional details. The CONTRACTOR should expect to encounter groundwater and that dewatering will be required to complete the work.
12. The CONTRACTOR shall submit a Notice of Intent to Use Noticed General Permit for Short Term Construction Dewatering to the St. Johns River Water Management District prior to starting any dewatering activity at the project site.

C. Access Driveway

1. A new site access driveway and road as reflected on the Drawings shall be constructed by the CONTRACTOR. In addition, the CONTRACTOR shall use

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an access road on the northern side of the facility for construction access. Any additional stone or stabilization required for daily construction shall be provided by the CONTRACTOR. Construction of any temporary roads or access including stabilization as part of the project, these costs shall be included in the CONTRACTOR's base bid. No additional monies will be provided for access to and during the site during construction.

2. Provide and maintain a construction entrance meeting FDOT standards off of CR 210 to the site.
- D. Pump Building Construction
1. Construction of the pump building can begin after the necessary site clearing and necessary fill has occurred in the area of the building.
 2. Once the building has been deemed ready for operation and all electrical, controls, and SCADA components and pumping systems have been preliminarily tested the performance testing and startup can begin.
- E. Ground Storage Tank Construction
1. The ground storage tanks will be constructed by others, outside of this Contract.
 2. CONTRACTOR shall be responsible for all electrical and instrumentation related on located on or adjacent to the tank, all piping connections, and other work necessary to commission the GST's.
 3. The CONTRACTOR shall be responsible for providing water required to test the tanks.
 4. The CONTRACTOR shall include sufficient time and monies to coordinate their work with the work of the tank CONTRACTOR.
- F. Electrical
1. Power to the site and any power required for all construction activities shall be coordinated and paid for by the CONTRACTOR.
 2. CONTRACTOR shall coordinate the location of any new conduits to avoid disruption of the existing Twin Creeks wastewater pump station or other utilities. Detailed locations of new underground electrical shall be coordinated by the CONTRACTOR and included in the CONTRACTOR's yard piping working drawings which also show other utilities, conduits, duct banks, and yard structures.
 3. SCADA Fiber Communications: JEA is responsible for bringing fiber optic services to the facility, incoming facility fiber terminations, fiber communications equipment, and commissioning of the communications system. CONTRACTOR shall be responsible for raceway infrastructure within the limits of the Twin Creeks facility as well as fiber optic cable and terminations for interconnection with the adjacent Twin Creeks Wastewater Pump Station.

1.08 PERMITS

- A. The CONTRACTOR shall arrange for all required inspections and shall close out the permits at the end of the Contract.
- B. A copy of any approved permits is attached in Appendix B.

SECTION 01014

CONSTRUCTION SEQUENCE

1.09 TESTING

- A. All facilities and systems at both sites shall be tested as a condition precedent to substantial completion. See Section 01465 and equipment specifications for additional requirements. Start-up plans for the facility and equipment shall be submitted, reviewed, and approved by the ENGINEER.
- B. All equipment and facilities shall be tested according to respective process component specifications herein and more specifically:
 - 1. Pre-startup Testing: All components, subsystems, and systems in each process component and associated process component shall be checked before electrical and process fluids are applied, and these checks shall verify completeness, leakage, electrical, instrumentation connections and circuit correctness, and correct installation. Equipment suppliers and all trades must certify that the respective systems are ready for operation. The ENGINEER shall inspect and must agree that each system is ready for energizing and process fluids. The ENGINEER and OWNER shall be present for verification of pre-startup testing. All systems in contact with potable water shall be properly disinfected in accordance with JEA and the state of Florida disinfection procedures.
 - 2. Operational Testing: All process systems shall be operated with clean and/or reclaimed as applicable water to verify that all components, subsystems, and systems operate correctly and meet individual performance requirements and that electrical, control, and instrumentation systems function satisfactorily. Corrections, adjustments, replacements, calibrations, and training shall take place during this stage. All systems must be functionally complete and 100 percent satisfactory and ready for process start-up and continuous operation at the conclusion of this stage. The ENGINEER and OWNER shall be present for verification of operational testing. Final training shall take place during operational testing. Operational testing shall be deemed complete prior to beginning the 5-day operational testing as part of substantial completion.
 - 3. Performance Testing: Performance testing shall be conducted after the respective process systems and all associated process systems have been started and are operating continuously and satisfactorily. Demonstration of successful performance testing shall be a condition precedent to final completion. The ENGINEER and OWNER shall be present for verification of performance testing.
- C. Final Piping Connections and Pressure Testing
 - 1. Final connections shall be tested. The tie-in shall be coordinated with the scheduled a minimum of 14 days in advance with the OWNER. The CONTRACTOR shall pressure test all piping as required after making connections.
- D. Pump Building Testing
 - 1. The CONTRACTOR shall submit a plan for testing operation of the building including both tanks, HVAC, re-pumps, electrical, SCADA, and all controls.

SECTION 01014

CONSTRUCTION SEQUENCE

2. During all start-up and performance testing activities, the CONTRACTOR shall make available the manpower, equipment, and manufacturer's representatives required to make any necessary adjustments and training.
3. All SCADA programming, controls, and simulation under an automatic operation shall be completed prior to full startup and the operational testing period. OWNER will provide all control programming and HMI graphics to CONTRACTOR for integration into the complete facility control system.
4. The CONTRACTOR shall test the re-pumps with reclaimed water from the new ground storage tanks with the pressure control valve and all other controls in place.
5. After the connections are made the CONTRACTOR shall operate the system in automatic mode for 5 consecutive days without any interruption and perform performance testing requirements. Upon successful completion of the performance testing, the CONTRACTOR may submit for substantial completion.

1.10 JEA SERVICE

- A. JEA is the electric service provider for the Twin Creeks facility. JEA intends to pull a new 26kV electric service feeder from the existing Twin Creeks Wastewater Pump Station loop feed service transformer to the proposed Twin Creeks Reclaimed Re-pump facility service transformer.
- B. CONTRACTOR is responsible for raceways between the existing and new transformers as shown on the electrical drawings. Coordinate with JEA early in the project to ensure services are installed to facility construction and commissioning.
 1. JEA contact:
Costa Theodoridis
Distribution Engineer (Commercial)
JEA ELECTRIC SERVICES T-11
(904)-665-6734
21 W Church Street
Jacksonville FL 32202
Theoc@jea.com
 2. Costa Theodoridis will initiate JEA Engineering process

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01014

SECTION 01050

PROJECT CONTROLS (SURVEYING)

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. Provide and pay for field engineering services required for project, including but not limited to:
 - 1. Survey work required for project controls and layout and to execute project.
 - 2. Certified as-built surveys specified herein.
 - 3. Civil, structural, or other professional engineering services specified or required to execute CONTRACTOR's construction methods.
- B. Retain the services of a registered land surveyor licensed in the state of Florida to:
 - 1. Identify existing control points and property line corners indicated on the Drawings.
 - 2. Verify and record all existing structure locations in the vicinity of, or adjacent to, the proposed Work; and, the locations of all proposed structures and facilities.
 - 3. Maintain an accurate record of locations of all new buried piping, valves, and duct banks and existing buried piping and other buried existing facilities (piping, conduits, and structures) encountered and/or relocated during construction of the new work.
 - 4. Maintain accurate locations of all new structures, including corner locations, and equipment locations within the project site.
- C. All survey work as described herein shall be completed by the registered land surveyor on a monthly basis and provided at each monthly progress meeting.

1.02 RELATED WORK

- A. Project Record Documents is included in Section 01720.
- B. Summary of Work is included in Section 01010.
- C. Contract Closeout is included in Section 01700.

1.03 SUBMITTALS

- A. Submit, to the ENGINEER, the name, address and state registration and license number of proposed registered land surveyor.
- B. On request of the ENGINEER, submit documentation to verify accuracy of field engineering work.

SECTION 01050

PROJECT CONTROLS (SURVEYING)

- C. At the end of the project, and prior to final payment, submit certified as-built drawing(s) (with the Surveyor's title block, signed and sealed by registered Land Surveyor) of the items listed throughout this Section. All surveys shall be tied to the applicable grid system and shall indicate all pre-existing and new project benchmarks. Vertical control shall conform to the project elevation datum designated on the plans.
1. Certified site survey at 1-in = 40-ft scale or larger, but not greater than 1-in = 20-ft scale, on 22-in by 34-in sheet(s) and electronic (PDF) version, indicating the building corners, sidewalks, paved areas and location of all above ground structures within the project site or limits of construction.
 2. Certified survey, drawn to the same scale as the ENGINEER's yard piping drawings, showing the locations, lines and grades in plan and profile views of all below-grade lines (piping and all electrical ducts) exterior to buildings and other buried facilities (e.g., valves, tanks, etc.). This requirement includes all utilities installed as a part of the scope of this project, as well as existing lines encountered during the installation of the new Work.
 3. Certified survey showing the location, pipes and grades of all lines 2 inches in diameter and larger buried and exterior to buildings and other buried facilities (e.g. valves, tanks, vaults, etc.) installed as a result of the work. This shall be at the same scale as the ENGINEER's yard piping drawing.
 4. Certified survey showing elevations of all flow control points, such as weirs, elevations of all new structures and equipment etc. in the wastewater treatment plant.

1.04 QUALIFICATIONS OF SURVEYOR

- A. Registered land surveyor, licensed in the state of Florida.

1.05 SURVEY REFERENCE POINTS

- A. Existing basic horizontal and vertical control points for the project are those designated on Drawings.
- B. Locate and protect control points prior to starting site work and preserve all permanent reference points during construction.
1. Make no changes or relocations without prior written notice to and approval by the ENGINEER.
 2. Report to the ENGINEER when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
 3. Require the surveyor to correctly replace project control points which may be lost or destroyed. Establish replacements based on original survey control.

SECTION 01050

PROJECT CONTROLS (SURVEYING)

1.06 PROJECT SURVEY REQUIREMENTS

- A. Establish a minimum of two permanent bench marks on site, referenced to data established by survey control points.
 - 1. Record locations, with horizontal and vertical data, on the as-built survey.
 - 2. Permanent benchmarks shall be installed and spaced for convenient reference and use at locations along the pipeline route and/or on the plant site.
 - 3. Benchmarks shall be installed to North American Vertical Datum (NAVD 1988) standards and shall include horizontal and vertical data, as well as the installation date.
- B. Establish lines and levels; locate and lay out:
 - 1. Site improvements.
 - a. Stakes for grading, fill and topsoil placement.
 - b. Utility slopes and invert elevations.
 - c. Sidewalks, pavement, fencing, storm drainage facilities, and other finish surface work.
 - d. Locations, sizes, and depths of manholes, valves, and fittings.
 - 2. Batter boards for structures.
 - 3. Building foundation, column locations and floor levels.
 - 4. Controlling lines and levels required for mechanical and electrical trades.
 - 5. Slabs and floor levels.
- C. If lines, levels, or layouts are lost or destroyed, or if required by the OWNER or ENGINEER, verify layouts by same methods.
- D. Establish all lines and grades prior to construction of line work for all force mains, transmission mains, storm drainage piping, gravity sewers and other new utility lines at 100-ft increments, at defined breaks in grade, and at manholes.

The following dimensional references must be depicted on the as-built drawings.

- 1. Depths of various elements of foundation in relation to finish first floor datum.
- 2. All underground piping with elevations and dimensions. Changes to piping location. Horizontal and vertical locations of all underground utilities and appurtenances, referenced to permanent surface improvements. Actual installed pipe material, class, etc. All pipes and valves shall be labeled using the method as per the contract drawings.
- 3. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.
- 4. Field changes of dimension and detail.
- 5. Changes made by field order or by change order.

SECTION 01050

PROJECT CONTROLS (SURVEYING)

6. Details not on original contract drawings.
 7. Equipment and piping relocations.
 8. All underground duct banks with elevations and dimensions, horizontal and vertical locations of underground duct banks, and manholes along duct banks.
 9. All underground cable elevations and horizontal locations of underground cables.
 10. All existing and new structures clearly indicated.
 11. All elevations of new structures (including weirs) clearly indicated.
- E. All work will be performed in accordance with the Minimum Technical Standards set forth by the Florida Board of Land Surveyors.
- F. As a condition of completing the County permit, after approval, and upon completion of the proposed project, an "As-Built" survey is required. The as-built will show all easements, all on and off-site physical improvements (i.e., paving, buildings, walkways, buffer, fencing, dumpster enclosures accessible routes) and identify street names and shall be in compliance with Part 6.04.00 C of the Land Development Code (LDC) prior to issuance of any Certificates of Occupancy (COs). A copy of these requirements can be obtained from Section 15.0 As-Built in the Development Review Manual whose link is <http://www.sjcfcl.us/DevelopmentReview/DRManual.aspx>. St. Johns County Development Review inspector shall be contacted 24 hours prior to all necessary site work inspections and 5 days prior to the final inspection.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 RECORDS

- A. Maintain a complete, accurate log of all control and survey work as it progresses.
- B. Update the project as-built survey on a monthly basis, based on the work performed during the month. Submit one copy of up to date as-built documentation with Contractor's monthly applications for payment.
- C. Maintain an accurate record of new and existing piping, conduit and structure changes, revisions, relocations, and modifications.

END OF SECTION 01050

SECTION 01110

ENVIRONMENTAL PROTECTION PROCEDURES

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. The work covered by this Section consists of furnishing all labor, materials and equipment and performing all work required for the prevention of environmental pollution in conformance with applicable laws and regulations, during and as the result of construction operations under this Contract. For the purpose of this Section, environmental pollution is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to man; or degrade the utility of the environment for aesthetic and/or recreational purposes.
- B. The control of environmental pollution requires consideration of air, water and land, and involves management of noise and solid waste, as well as other pollutants.
- C. CONTRACTOR shall schedule and conduct all work in a manner that will minimize the erosion of soils in the area of the work. CONTRACTOR shall provide erosion control measures such as diversion channels, sedimentation or filtration systems, berms, staked hay bales, seeding, mulching or other special surface treatments as are required to prevent silting and muddying of streams, rivers, impoundments, lakes, etc. All erosion control measures shall be in place in an area prior to any construction activity in that area. Specific requirements for erosion and sedimentation controls are shown in the contract drawings.
- D. This Section is intended to ensure that construction is achieved with a minimum of disturbance to the existing ecological balance between a water resource and its surroundings. These are general guidelines. It is the CONTRACTOR's responsibility to determine the specific construction techniques to meet these guidelines.
- E. All phases of sedimentation and erosion control shall comply with and be subject to the laws of the State of Florida. CONTRACTOR shall prepare a sedimentation and erosion control drawing meeting the requirements of the law. Furnish two copies of the approved Drawing to the ENGINEER no less than two weeks prior to starting the work.
- F. Archaeological review has been completed. However, in the event that unexpected archaeological and historical resources are encountered during ground disturbing activities, all work shall halt and the St. Johns County Environmental Division, Historic Resource Management office contacted immediately.

1.02 APPLICABLE REGULATIONS

- A. Comply with all applicable Federal, State and local laws and regulations concerning environmental pollution control and abatement.

SECTION 01110

ENVIRONMENTAL PROTECTION PROCEDURES

1.03 NOTIFICATIONS

- A. The ENGINEER will notify the CONTRACTOR in writing of any non-compliance with the foregoing provisions or of any environmentally objectionable acts and corrective action to be taken. State or local agencies responsible for verification of certain aspects of the environmental protection requirements shall notify the CONTRACTOR in writing, through the ENGINEER, of any non-compliance with State or local requirements. After receipt of such notice from the ENGINEER or from the regulatory agency through the ENGINEER, immediately take corrective action. Such notice, when delivered to the CONTRACTOR or his authorized representative at the site of the work, shall be deemed sufficient for the purpose. If the CONTRACTOR fails or refuses to comply promptly, the ENGINEER or OWNER may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of a claim for extension of time or for excess costs or damages by the CONTRACTOR unless it is later determined that the CONTRACTOR was in compliance.

1.04 IMPLEMENTATION

- A. Prior to commencement of the work, CONTRACTOR shall meet with the ENGINEER to develop mutual understandings relative to compliance with these provisions and administration of the environmental pollution control program.
- B. CONTRACTOR shall remove temporary environmental control features, when approved by the ENGINEER and incorporate permanent control features into the project at the earliest practicable time.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 EROSION CONTROL

- A. CONTRACTOR shall provide positive means of erosion control such as shallow ditches around construction to carry off surface water. Erosion control measures, such as siltation basins, hay check dams, mulching, jute netting and other equivalent techniques, shall be used as appropriate. Flow of surface water into excavated areas shall be prevented. Ditches around construction area shall also be used to carry away water resulting from dewatering of excavated areas. At the completion of the work, ditches shall be backfilled and the ground surface restored to original condition.

3.02 PROTECTION OF STREAMS AND SURFACE WATERS

- A. Care shall be taken to prevent, or reduce to a minimum, any damage to any stream or surface water from pollution by debris, sediment, or other material, or from the manipulation of equipment and/or materials in or near such streams. Water that has been used for washing or processing, or that contains oils or sediments that will

SECTION 01110

ENVIRONMENTAL PROTECTION PROCEDURES

reduce the quality of the water in the stream, shall not be directly returned to the stream. Such waters shall be diverted through a settling basin or filter before being directed into streams or surface waters.

- B. The CONTRACTOR shall not discharge water from dewatering operations directly into any live or intermittent stream, channel, wetlands, surface water or any storm sewer. Water from dewatering operations shall be treated by filtration, settling basins, or other approved method to reduce the amount of sediment contained in the water to allowable levels.
- C. All preventative measures shall be taken to avoid spillage of petroleum products and other pollutants. In the event of any spillage, prompt remedial action shall be taken in accordance with a contingency action plan approved by the Florida Department of Environmental Protection and the US EPA. The CONTRACTOR shall submit two copies of approved contingency plans to the ENGINEER.
- D. Water being flushed from structures or pipelines after disinfection with sodium hypochlorite shall be treated with a dechlorination solution in a method approved by the ENGINEER, prior to discharge.

3.03 PROTECTION OF LAND RESOURCES

- A. Restore land resources within the project boundaries and outside the limits of permanent work shall be restored to a condition, after completion of construction that will appear to be natural and not detract from the appearance of the project. Confine all construction activities to areas shown on the Drawings.
- B. Outside of areas requiring earthwork for the construction of the new facilities, the CONTRACTOR shall not deface, injure, or destroy trees or shrubs, nor remove or cut them without prior approval. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorage unless specifically authorized by the ENGINEER. Where such special emergency use is permitted, first wrap the trunk with a sufficient thickness of burlap or rags over which softwood cleats shall be tied before any rope, cable, or wire is placed. The CONTRACTOR shall in any event be responsible for any damage resulting from such use.
- C. Protect trees that may possibly be defaced, bruised, injured, or otherwise damaged by the construction equipment, dumping or other operations, by placing boards, planks, or poles around them. Monuments and markers shall be protected similarly.
- D. Any trees or other landscape features scarred or damaged by the CONTRACTOR'S equipment or operations shall be restored as nearly as possible to their original condition. The OWNER will decide the method of restoration to be used and whether damaged trees shall be treated and healed or removed and disposed of.
 - 1. All scars made on trees by equipment, construction operations, or by the removal of limbs larger than 1-inch in diameter shall be coated as soon as possible with an approved tree wound dressing. All trimming or pruning shall be performed in an approved manner by experienced workmen with saws or pruning shears. Tree trimming with axes will not be permitted.

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ENVIRONMENTAL PROTECTION PROCEDURES

2. Climbing ropes shall be used where necessary for safety. Trees that are to remain, either within or outside established clearing limits, that are subsequently damaged by the CONTRACTOR and are beyond saving in the opinion of the OWNER, shall be immediately removed and replaced.
- E. The locations of the CONTRACTOR'S storage and other construction activities, required temporarily in the performance of the work, shall be cleared portions of the job site or areas to be cleared as by the OWNER and ENGINEER and shall not be within wetlands or floodplains. The CONTRACTOR shall submit a layout of the proposed storage areas to the OWNER and ENGINEER for approval at least 10 days prior to scheduled start. The preservation of the landscape shall be an imperative consideration in the selection of all sites and in the construction of buildings. Drawings showing storage facilities shall be submitted for approval of the ENGINEER.
- F. If the CONTRACTOR proposes to construct temporary roads or embankments and excavations for plant and/or work areas, he shall submit the following for approval at least ten days prior to scheduled start of such temporary work.
 1. A layout of all temporary roads, excavations, embankments and drainage to be constructed within the work area.
 2. Details of temporary road construction.
 3. Drawings and cross sections of proposed embankments and their foundations, including a description of proposed materials.
 4. A landscaping drawing showing the proposed restoration of the area. Indicate the proposed removal of any trees and shrubs outside the limits of existing clearing area. Indicate locations of guard posts or barriers required to control vehicular traffic and protect trees and shrubs to be maintained undamaged. The Drawing shall provide for the obliteration of construction scars as such and shall provide for a natural appearing final condition of the area. Modification of the CONTRACTOR'S approved drawings shall be made only with the written approval of the ENGINEER. No unauthorized road construction, excavation or embankment construction including disposal areas will be permitted.
- G. CONTRACTOR shall remove all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess of waste materials, or any other vestiges of construction as directed by the ENGINEER. It is anticipated that excavation, filling and plowing of roadways will be required to restore the area to near natural conditions which will permit the growth of vegetation thereon. The disturbed areas shall be prepared and seeded as approved by the ENGINEER or OWNER.
- H. All debris and excess material will be disposed of outside wetland or floodplain areas in an environmentally sound manner.

3.04 PROTECTION OF AIR QUALITY

- A. Burning – The use of burning at the project site for the disposal of refuse and debris will not be permitted unless authorized by the OWNER and a Large Land Clearing Burning Permit is acquired under the State of Florida.

SECTION 01110

ENVIRONMENTAL PROTECTION PROCEDURES

- B. Dust Control – Maintain all excavations, embankment, stockpiles, access roads, plant sites, waste areas, borrow areas and all other work areas within or without the project boundaries free from dust which could cause the standards for air pollution to be exceeded and which would cause a hazard or nuisance to others. CONTRACTOR shall control dust resulting from clearing and grubbing operations to prevent nuisance to adjacent property owners and the general public. CONTRACTOR shall use dust control methods and materials approved by the ENGINEER.
- C. An approved method of stabilization consisting of sprinkling or other similar methods will be permitted to control dust. The use of petroleum products is prohibited. The use of chlorides may be permitted with approval from the ENGINEER.
- D. Sprinkling, to be approved, must be repeated at such intervals as to keep all parts of the disturbed area at least damp at all times, and the CONTRACTOR shall have sufficient competent equipment on the job to accomplish this. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs, as determined by the OWNER.

3.05 NOISE CONTROL

- A. CONTRACTOR shall make every effort to minimize noises caused by the construction operations. Equipment shall be equipped with silencers or mufflers designed to operate with the least possible noise in compliance with Federal and State regulations. CONTRACTOR shall meet the local ordinances regarding noise control.
- B. All equipment to be furnished under this Contract, unless specified otherwise in the technical specifications, shall be designed to ensure that the sound pressure level does not exceed 85 decibels over a frequency range of 37.8 to 9600 cycles per second at a distance of 3-ft from any portion of the equipment, under any load condition, when tested using standard equipment and methods. Noise levels shall include the noise from the motor. Mufflers or external baffles shall not be acceptable for the purpose of reducing noise. Data on noise levels shall be included with the shop drawing submittal.

3.06 MAINTENANCE OF POLLUTION CONTROL FACILITIES DURING CONSTRUCTION

- A. During the life of this contract, CONTRACTOR shall maintain all facilities constructed for pollution control as long as the operations creating the particular pollutant are being carried out or until the material concerned has become stabilized to the extent that pollution is no longer being created.

3.07 ENVIRONMENTAL AND PUBLIC NUISANCE

- A. CONTRACTOR shall not create a public nuisance including but not limited to encroachment on adjacent lands, flooding of adjacent lands, or excessive noise or dust. CONTRACTOR shall eliminate noise to as great an extent as practicable at all times.

SECTION 01110
ENVIRONMENTAL PROTECTION PROCEDURES
END OF SECTION 01110

SECTION 01200
PROJECT MEETINGS

PART 1 – GENERAL

1.01 REQUIREMENTS INCLUDED

- A. The ENGINEER shall schedule, administer, and prepare meeting minutes for the pre-construction meeting, periodic progress meetings, and specially called meetings throughout progress of the work.
- B. Representatives of CONTRACTORS, SUBCONTRACTORS and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.
- C. The CONTRACTOR shall attend meetings to ascertain that work is expedited consistent with Contract Documents and construction schedules.
- D. The CONTRACTOR shall contact Carl Colee (Development Review Inspectors Supervisor) at least 48 hours in advance of the pre-construction meeting.

1.02 RELATED WORK

- A. Section 01300: Submittals
- B. Section 01310: Construction Scheduling
- C. Section 01720: Project Record Documents
- D. Section 01730: Operating and Maintenance Data

1.03 PRE-CONSTRUCTION MEETING

- A. Schedule a pre-construction meeting.
- B. Location: A central site, convenient for all parties, designated by the OWNER.
- C. Attendance:
 - 1. Owner's Representative
 - 2. ENGINEER and his professional consultants
 - 3. Resident Project Representative (if assigned)
 - 4. CONTRACTOR'S Superintendent
 - 5. Major SUBCONTRACTORS
 - 6. Major suppliers
 - 7. Others as appropriate.
- D. Suggested Agenda:
 - 1. Distribution and discussion of:
 - a. List of major SUBCONTRACTORS and suppliers
 - b. Projected construction schedules
 - 2. Critical work sequencing
 - 3. Major equipment deliveries and priorities

SECTION 01200

PROJECT MEETINGS

4. Project coordination
 - a. Designation of responsible personnel
 - b. Submittals
 - c. Applications for payment
5. Procedures and processing of:
 - a. Field Decisions
 - b. Proposal requests
 - c. Submittals
 - d. Change orders
 - e. Application for payment
6. Adequacy of distribution of Contract Documents
7. Procedures for maintaining Record Documents
8. Use of premises:
 - a. Office, work and storage areas
 - b. Owner's requirements
9. Construction facilities, controls and construction aids
10. Temporary utilities
11. Housekeeping procedures

1.04 PROGRESS MEETINGS

- A. Schedule regular periodic meetings. A total of 12 progress meetings have been allocated over the entire construction period and will be scheduled by the ENGINEER after the schedule has been reviewed.
- B. Hold called meetings as required by progress of the work.
- C. Location of the meetings: Project field office of CONTRACTOR or ENGINEER.
- D. Attendance shall be similar to pre-construction meeting and as deemed appropriate by the ENGINEER or OWNER.
- E. Suggested Agenda:
 1. Review, approval of minutes of previous meeting
 2. Review of work progress since previous meeting
 3. Field observations, problems, and/or conflicts
 4. Problems which impede construction schedule
 5. Review of offsite fabrication, delivery schedules
 6. Corrective measures and procedures to regain projected schedule
 7. Revisions to construction schedule
 8. Progress, schedule, during succeeding work period
 9. Coordination of schedules
 10. Review submittal schedules; expedite as required
 11. Maintenance of quality standards
 12. Pending changes and substitutions
 13. Review proposed changes for:
 - a. Effect on construction schedule and on completion date
 - b. Effect on other contracts of the Project
 14. Other business
 15. Critical/long lead item

SECTION 01200

PROJECT MEETINGS

- F. The CONTRACTOR shall attend progress meetings and is to study previous meeting minutes and current agenda items in order to be prepared to discuss pertinent topics such as deliveries of materials and equipment, progress of the work, etc.
- G. The CONTRACTOR shall provide an updated schedule, summary of work performed since the previous meeting, and summary of work to be performed within 30 to 45 days at each progress meeting for the remaining work.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01200

SECTION 01300

SUBMITTALS

PART 1- GENERAL

1.01 SCOPE OF WORK

- A. This Section specifies the general methods and requirements of submissions applicable to Shop Drawings, Product Data, Samples and Operations and Maintenance Manuals. Detailed submittal requirements are specified in the Technical Sections.
- B. Submittals are categorized into two types: Action Submittals and Informational Submittals, as follows:
 - 1. Action Submittals: Written and graphic information submitted by the CONTRACTOR that requires the ENGINEER'S approval. The following are examples of action submittals:
 - a. Shop drawings (including working drawings and product data)
 - b. Samples
 - c. Operation and maintenance manuals
 - d. Site usage plan (CONTRACTOR's staging – including trailer siting and material laydown area)
 - e. Schedule of values
 - f. Payment application format
 - 2. Informational Submittal: Information submitted by the CONTRACTOR that is required to be reviewed by the ENGINEER prior to work being completed. ENGINEER will provide review comments that may require revisions. Informational submittals will be marked "Reviewed" by the ENGINEER when submittal is considered acceptable. The following are examples of informational submittals:
 - a. Shop drawing schedule
 - b. Construction schedule
 - c. Statements of qualifications
 - d. Health and Safety Plans
 - e. Construction photography and videography
 - f. Work plans
 - g. Maintenance of traffic plans
 - h. Outage requests
 - i. Proposed testing procedures
 - j. Test records and reports
 - k. Vendor training outlines/plans
 - l. Test and start-up reports
 - m. Certifications
 - n. Record Drawings
 - o. Record Shop Drawings
 - p. Submittals required by laws, regulations and governing agencies
 - q. Submittals required by funding agencies
 - r. Other requirements found within the technical specifications
 - s. Warranties and bonds
 - t. As-Built surveys
 - u. Contract close-out documents

SECTION 01300

SUBMITTALS

- C. All submittals shall be delivered directly to the Mott MacDonald office located at: 10245 Centurion Parkway North, Suite 320, Jacksonville, FL 32256.
- D. All submittals shall be clearly identified by reference to section number, paragraph, drawing, or detail, as applicable.
- E. Submittals shall be clean and legible and of sufficient size for presentation of data.
- F. Submittal reviews after the "B" submittal will be back-charged to the CONTRACTOR for the ENGINEER'S time by the OWNER for each additional review. This shall be tracked monthly by the ENGINEER and deducted from each monthly pay application. The OWNER will then reimburse the ENGINEER for these additional services through an amendment.

1.02 RELATED WORK

- A. Additional requirements may be specified in the General Conditions for the Contract.
- B. Additional submittal requirements may be specified in the respective technical Specification Sections.
- C. Operation and Maintenance manuals are included in Section 01730.
- D. Warranties are included in Section 01740.
- E. Project Record Documents are included in Section 01720.

1.03 CONTRACTOR'S RESPONSIBILITIES

- A. All submittals shall be clearly identified as follows:
 - 1. Date of submission
 - 2. Project number
 - 3. Project Name
 - 4. Contractor identification
 - a. Contractor
 - b. Supplier
 - c. Manufacturer
 - d. Manufacturer or supplier representative
 - 5. Identification of the product
 - 6. Reference to Contract drawing(s)
 - 7. Reference to specification section number, page and paragraph(s)
 - 8. Reference to applicable standards, such as ASTM or Federal Standards numbers
 - 9. Indication of CONTRACTOR's approval
 - 10. CONTRACTOR's Certification statement
 - 11. Identification of deviations from the Contract Documents, if any
 - 12. Reference to previous submittal (for resubmittals)

SECTION 01300

SUBMITTALS

- B. Submittals shall be clear and legible, and of sufficient size for legibility and clarity of the presented data.
- C. Submittal Log
Maintain a log of all submittals. The submittal log shall be kept accurate and up to date. This log should include the following items (as applicable):
1. Description
 2. Submittal number
 3. Date transmitted to the ENGINEER
 4. Date returned to CONTRACTOR (from ENGINEER)
 5. Status of Submittal (Approved/Not Approved/etc.)
 6. Date of Resubmittal to ENGINEER and Return from ENGINEER (if applicable and repeat as necessary)
 7. Date material released for fabrication
 8. Projected (or actual) delivery date
- D. Numbering System
Utilize a 9-character submittal identification numbering system in the following manner:
1. The first character shall be a D, S, M or I which represents Shop Drawing (including working drawings and product data), Sample, Manual (Operation & Maintenance) or Informational, respectively.
 2. The next five digits shall be the applicable Section Number.
 3. The next two digits shall be the numbers 01 to 99 to sequentially number each separate item or drawing submitted under each specific Specification Section, in the order submitted.
 4. The last character shall be a letter, A to Z, indication the submission (or resubmission) of the same submittal, i.e., "A" = 1st submission, "B" = 2nd submission, "C" = 3rd submission, etc. A typical submittal would be as follows:
- D-03300-008-B
- D = Shop Drawing
03300 = Section for Concrete
08 = the eighth different submittal under this section
B = the second submission (first resubmission) of the particular Shop Drawing
- E. Variances
Notify the ENGINEER in writing, at the time of submittal, of any deviations in the submittals from the requirements of the Contract Documents.

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F. Action Submittals

1. Shop Drawings, Working Drawings, Product Data and Samples
 - a. Shop drawings as defined in the General Conditions, and as specified in individual Sections include, but are not necessarily limited to, custom prepared data such as fabrication and erection/installation (working) drawings, scheduled information, setting diagrams, actual shop work manufacturing instructions, custom templates, wiring diagrams, coordination drawings, equipment inspection and test reports, including performance curves and certificates, as applicable to the work.
 - b. CONTRACTOR shall verify all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data, and coordinate each item with other related shop drawings and the Contract requirements.
 - c. All details on shop drawings shall show clearly the relation of the various parts to the main members and lines of the structure and where correct fabrication of the work depends upon field measurements shall be made and noted on the drawings before being submitted.
 - d. All shop drawings submitted by subcontractors and vendors shall be reviewed by the CONTRACTOR for field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data, and that it has been coordinated with other related shop drawings and the Contract requirements. Submittals directly from subcontractors or vendors will not be accepted by the ENGINEER.
 - e. The CONTRACTOR shall be responsible the accuracy of the subcontractor's or vendor's submittal; and, for their submission in a timely manner to support the requirements of the CONTRACTOR's construction schedule. Shop drawings found to be inaccurate or otherwise in error shall be returned to the subcontractor or vendor to correct before submission to the ENGINEER. All shop drawings shall be approved by the CONTRACTOR.
 - f. Delays to construction due to the untimely submission of submittals will constitute inexcusable delays, for which CONTRACTOR shall not be eligible for additional cost nor additional contract time. Inexcusable delays consist of any delay within the CONTRACTOR's control.
 - g. Submittals for equipment specified under Divisions 02, 03, 11, 13, 14, 15 and 16 shall include a listing of installations where identical or similar equipment manufactured by that manufacturer has been installed and in operation for a period of at least five years.
2. Working Drawings
 - a. Detailed installation drawings (equipment, piping, electrical conduits and controls, HVAC work, and plumbing, etc.) shall be prepared and submitted for review and approval by the ENGINEER prior to installing such work. Installation drawings shall be-to-scale and shall be fully dimensioned.
 - b. Piping working drawings shall show the laying dimensions of all pipes, fittings, valves, as well as the equipment to which it is being connected. In addition, all pipe supports shall be shown.
 - c. Equipment working drawings shall show all equipment dimensions, anchor bolts, support pads, piping connections and electrical

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- connections. In addition, show clearances required around such equipment for maintenance of the equipment.
- d. Electrical working drawings shall show conduits, junction boxes, disconnects, control devices, lighting fixtures, support details, control panels, lighting and power panels, and Motor Control Centers. Coordinate all locations with the Contract Documents and the CONTRACTOR's other working drawings.
3. Product Data
- a. Product data, as specified individual Specification Sections, include, but are not limited to, the manufacturer's standard prepared data for manufactured products (catalog data), such as the product specifications, installation instructions, availability of colors and patterns, rough-in diagrams and templates, product photographs (or diagrams), wiring diagrams, performance curves, quality control inspection and reports, certifications of compliance (as specified or otherwise required), mill reports, product operating and maintenance instructions, recommended spare parts and product warranties, as applicable.
4. Samples
- a. Furnish, samples required by the Contract Documents for the ENGINEER's approval. Samples shall be delivered to the ENGINEER as specified or directed. Unless specified otherwise, provide at least two samples of each required item. Materials or equipment for which samples are required shall not be used in the work unless and until approved by the ENGINEER.
 - b. Samples specified in individual Specification Sections, include, but are not limited to: physical examples of the work (such as sections manufactured or fabricated work), small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens for coordination of visual effect, graphic symbols, and other specified units of work.
 - c. Approval of a sample shall be only for the characteristics or use named in such approval and shall not be construed to change or modify and Contract Requirements.
 - d. Approved samples not destroyed in testing shall be sent to the ENGINEER or stored at the site of the work. Approved samples of the hardware in good condition will be marked for identification and may be used in the work. Materials and equipment incorporated in work shall match the approved samples. Samples which fail testing or are not approved will be returned to the CONTRACTOR at his expense, if so requested at time of submission.
5. Professional Engineer (P.E.) Certification Form
- a. If specifically required in any of the technical Sections, submit a Professional Engineer (P.E) Certification for each item required, signed and sealed by the P.E. licensed or registered in the state wherein the work is located.
6. CONTRACTOR's Certification
- a. Each shop drawing, working drawings, product data, and sample shall have affixed to it the following Certification Statement: *"Certification Statement: by this submittal, I hereby represent that I have determined*

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and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have checked and coordinated each item with other applicable approved shop drawings and all Contract requirements.”

- b. Shop drawings, working drawings, and product data sheets 11-in x 17-in and smaller shall be bound together in an orderly fashion and bear above Certification Statement on the cover sheet. The transmittal cover sheet for each identified shop drawing shall fully describe the packaged data and include a listing of all items within the package.
 7. The review and approval of shop drawings, working drawings, product data, or samples by the ENGINEER shall not relieve the CONTRACTOR from the responsibility for the fulfillment of the terms of the Contract. All risks of error and omissions are assumed by the CONTRACTOR and the ENGINEER will have no responsibility therefor.
 8. Project work, materials, fabrications, and installation shall conform to approved shop drawings (including working drawings and product data) and applicable supplies.
 9. No portion of the work requiring a shop drawing (including working drawings and product data) or sample shall be started, nor shall any materials be fabricated or installed before approval of such item. Procurement, fabrication, delivery or installation of products or materials that do not conform to approved shop drawings shall be at the CONTRACTOR's risk. Furthermore, such products or materials delivered or installed without approved shop drawings, or in non-conformance with the approved shop drawings will not be eligible for progress payment until such time as the product or material is approved or brought into compliance with approved shop drawings. Neither the OWNER nor ENGINEER will be liable for any expense or delay due to corrections or remedies required to accomplish conformity.
 10. Operation and Maintenance Data
 - a. Operation and maintenance data shall be submitted in assembled manuals as specified. Such manuals shall include detailed instructions for OWNER personnel on safe operation procedures, controls, start-up, shut down, emergency procedures, storage, protection, lubrication, testing, trouble shooting, adjustments, repair procedures, and other maintenance requirements.
 11. Payment Application Format
 - a. If an application form is included in the Contract Documents, use that form unless otherwise approved by the ENGINEER and OWNER. If an application form is not included in the Contract Documents, CONTRACTOR may propose a form for approval.
 12. Site Usage
 - a. Submit a proposed site staging plan, including but not limited to the location of office trailers, storage trailers and material laydown. Such a plan shall be a graphic presentation (drawing) of the proposed locations; and, shall include on-site traffic modifications, and temporary utilities, as may be applicable.
- G. Informational Submittals
1. Shop Drawing Schedule

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- a. Prepare and submit a schedule indicating when shop drawings are required to be submitted to support the as-planned construction schedule. The submittal schedule shall allow sufficient time for preparation and submittal, review and approval, and fabrication and delivery to support the construction schedule.
2. Construction Schedule
 - a. Prepare and submit construction schedules and monthly status reports as specified.
3. Statements of Qualifications
 - a. Provide evidence of qualification, certification, or registration, as required in the Contract Documents, to verify qualifications of licensed land surveyor, professional engineer, materials testing laboratory, specialty subcontractor, technical specialist, consultant, specialty installer, and other professionals.
4. Health and Safety Plans
 - a. When specified, prepare and submit a general company Health and Safety Plan (HSP), modified or supplemented to include job-specific considerations.
5. Construction Photography and Videography
 - a. Provide periodic construction photographs and videography as specified – including but not limited to preconstruction photographs and/or video, monthly progress photos and/or video and post-construction photographs and/or videos.
6. Work Plans
 - a. Prepare and submit copies of all work plans needed to demonstrate to the OWNER that CONTRACTOR has adequately through-out the means and methods of construction and their interface with existing facilities.
7. Maintenance of Traffic Plans
 - a. Prepare maintenance of traffic plans where and when required by the Contract Documents and by local ordinances or regulations. If CONTRACTOR is not already knowledgeable about local ordinances and regulations regarding maintenance of traffic requirements, become familiar with such requirements, and include all costs for permits and fees to implement the traffic management plan, in the bid amount. In addition, unless a supplemental payment provision is provided in the bid form, include the cost of police attendance, when required.
8. Outage Requests
 - a. Provide sufficient notification of any outages (electrical, flow processes, etc.) as may be required to tie-in new work into existing facilities. Unless specified otherwise elsewhere, a minimum of seven calendar days' notice shall be provided.
9. Proposed Testing Procedures
 - a. Prepare and submit testing procedures it proposes to use to preform testing required by the various technical specifications.
10. Test Records and Reports
 - a. Provide copies of all test records and reports as specified in the various technical specifications.
11. Vendor Training Outlines/Plans

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- a. At least two weeks before scheduled training of OWNER's personnel, provide lesson plans for vendor training in accordance with the specification for O&M manuals.
- 12. Test and Start-Up Reports
 - a. Manufacturer shall perform all pre-start up installation inspection, calibrations, alignments, and performance testing as specified in the respective Specification Section. Provide copies of all such test and start up reports.
- 13. Certifications
 - a. Provide various certifications as required by the technical specifications. Such certifications shall be signed by an officer (of the Firm) or other individual authorized to sign documents on behalf of that entity.
 - b. Certifications may include, but are not limited to:
 - 1) Welding certifications and welders qualifications.
 - 2) Certifications of Installation, Testing and Training for all equipment.
 - 3) Material Testing reports furnished by an independent testing firm.
 - 4) Certifications from manufacturer(s) for specified factory testing.
 - 5) Certifications required indicating compliance with any sustainability or LEEDS accreditation requirements indicated in the Contract Documents.
- 14. Record Drawings
 - a. No later than Substantial Completion, submit a record of all changes during construction not already incorporated into drawings in accordance with specification on Project Record Documents.
- 15. Submittals Required by Laws, Regulations, and Governing Agencies
 - a. Prepare and submit all documentation required by state or local law, regulation or government agency directly to the applicable agency. This includes, but is not limited to, notifications, reports, certifications, certified payroll (for projects subject to wage requirements) and other documentation required to satisfy all requirements. Provide to ENGINEER one copy of each submittal made in accordance with this paragraph.
- 16. Submittals Required by Funding Agencies
 - a. Prepare and submit all documentation required by funding agencies. This includes, but is not limited to segregated pay applications and change orders when required to properly allocate funds to different funding sources; and certified payrolls for projects subject to wage requirements. Provide one copy of each submittal made in accordance with this paragraph to the ENGINEER.
- 17. Other Requirements of the Technical Specifications Sections
 - a. Comply with all other requirements of the technical specifications.
- 18. Warranties
 - a. Assemble a book(let) of all warranties as specified in the various technical specifications and in accordance with the specification on Warranties and provide to the ENGINEER.
- 19. As-Built Surveys
 - a. Engage the services of a licensed land surveyor in accordance with the Project Controls specification. Prior to Final Completion, provide an As-Built survey of the constructed facility, as specified.

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20. Contract Close-Out Documents

- a. Submit Contract documentation as indicated in the specification for Contract Close-out.

PART 2- PRODUCTS (NOT USED)

PART 3- EXECUTION

3.01 SUBMITTAL SCHEDULE

- A. Provide an initial submittal schedule at the pre-construction meeting for review by OWNER and ENGINEER. Incorporate comments from OWNER or ENGINEER into a revised submittal schedule.
- B. Maintain the submittal schedule and provide sufficient copies for review by OWNER and ENGINEER. An up-to-date submittal schedule shall be provided at each project progress meeting.

3.02 TRANSMITTALS

- A. Prepare separate transmittal sheets for each submittal. Each transmittal sheet shall include at least the following: the CONTRACTOR's name and address, OWNER's name, project name, project number, submittal number, description of submittal and number of copies submitted.
- B. Submittals shall be transmitted or delivered directly to the office of the ENGINEER, as indicated in the Contract Documents or as otherwise directed by the ENGINEER.
- C. Provide copies of transmittals (only, i.e., without copies of the respective submittal) directly to the Resident Project Representative.

3.03 PROCEDURES

- A. Action Submittals
 1. CONTRACTOR's Responsibilities
 - a. Coordination of Submittal Times: Prepare and transmit each submittal sufficiently in advance of performing the related work or other applicable activities, or within the time specified in the individual work of other related Sections, so that the installation will not be delayed by processing times including disapproval and resubmittal (if required). Coordinate with other submittals, testing, purchasing, fabrication, delivery and similar sequenced activities. Extensions to the Contract Time will not be approved for the CONTRACTOR's failure to transmit submittals sufficiently in advance of the Work.
 - b. The submittals of all shop drawings (including working drawings and product data) shall be sufficiently in advance of construction requirements to allow for possible need of re-submittals, including the specified review time for the ENGINEER.

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- c. ENGINEER's review time for shop drawings and O&M manuals involving only one engineering discipline shall be no more than 30 calendar days. ENGINEER's review time for shop drawings and O&M manuals that require review by more than one engineering discipline shall be no more than 45 calendar days. Resubmittals will be subject to the same review time.
 - d. Submittals of operation and maintenance data shall be provided within 30 days of approval of the related shop drawing(s).
 - e. Before submission to the ENGINEER, review shop drawings as follows:
 - 1) Make corrections and add field measurements, as required.
 - 2) Use any color for its notations except red (reserved for the ENGINEER's notations) and black (to be able to distinguish notations on black and white documents).
 - 3) Identify and describe each deviation or variation from Contract Documents.
 - 4) Include the required CONTRACTOR's Certification statement.
 - 5) Provide field measurements (as needed).
 - 6) Coordinate with other submittals.
 - 7) Indicate relationships to other features of the Work.
 - 8) Highlight information applicable to the Work and/or delete information not applicable to the Work.
 - f. Submit the following number of copies:
 - 1) Shop drawings (including working drawings and product data)- Submit no fewer than five, and no more than seven; three of which will be retained by the ENGINEER/OWNER.
 - 2) Product Data – three copies
 - 3) Samples – as stated in the representative Sections.
 - 4) Site Usage Plan – three copies.
 - 5) Schedule of Values – two copies.
 - 6) Payment application format – two copies
 - g. If CONTRACTOR considers any correction indicated on the shop drawings to constitute a change to the Contract Documents, provide written notice thereof to the ENGINEER immediately; and do not release for manufacture before such notice has been received by the ENGINEER.
 - h. When the shop drawings have been completed to the satisfaction of the ENGINEER, carry out the construction in accordance therewith; and make no further changes therein except upon written instructions from the ENGINEER.
2. Engineer's Responsibilities
- a. ENGINEER will not review shop drawings (including working drawings and product data) that do not include the CONTRACTOR's approval stamp. Such submittals will be returned to the CONTRACTOR, without action, for correction.
 - b. Partial shop drawings (including working drawings and product data) will not be reviewed. If, in the opinion of the ENGINEER, a submittal is incomplete, that submittal will be returned to the CONTRACTOR for completion. Such submittals may be returned with comments from ENGINEER indicating the deficiencies requiring correction.

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- c. If shop drawings (including working drawings and product data) meet the submittal requirements, ENGINEER will forward copies to appropriate reviewer(s). Otherwise, noncompliant submittals will be returned to the CONTRACTOR without action – with the ENGINEER retaining one copy.
 - d. Submittals which are transmitted in accordance with the specified requirements will be reviewed by the ENGINEER within the time specified herein. The time for review will commence upon receipt of submittal by ENGINEER.
3. Review of Shop Drawings (Including Working Drawings and Product Data) and Samples
- a. The review of shop drawings, working drawings, data and samples will be for general conformance with the design concept and Contract Documents. They shall not be construed:
 - 1) As permitting any departure from the Contract requirements.
 - 2) As relieving the CONTRACTOR of responsibility for any errors, including details, dimensions, and materials.
 - 3) As approving departures from details furnished by the ENGINEER, except as otherwise provided herein.
 - b. The CONTRACTOR remains responsible for details and accuracy, for coordinating the work with all other associated work and trades, for selecting fabrication processes, for techniques of assembly, and for performing work in a safe manner.
 - c. If the shop drawings (including working drawings and product data) or samples as submitted describe variations and indicate a deviation from the Contract requirements that, in the opinion of the ENGINEER are in the interest of the OWNER and are so minor as not to involve a change in Contract Price or Contract Time, the ENGINEER may return the reviewed drawings without noting an exception.
 - d. Only the ENGINEER will utilize the color “RED” in marking submittals.
 - e. Shop drawings will be returned to the CONTRACTOR with one of the following codes:
 - 1) Code 1 – “APPROVED” – This code is assigned when there are no notations or comments on the submittal. When returned under this code the CONTRACTOR may release the equipment and/or material for manufacture.
 - 2) Code 2 – “APPROVED AS NOTED” – This code is assigned when a confirmation of the notations and comments IS NOT required by the CONTRACTOR. The CONTRACTOR may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product.
 - 3) Code 3 – “APPROVED AS NOTED/CONFIRM” – This combination of codes is assigned when a confirmation of the notations and comments is required by the CONTRACTOR. The CONTRACTOR may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product. This confirmation shall specifically address each omission and nonconforming item that was noted. Confirmation is to be received by the ENGINEER,

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within 15 calendar days of the date of the ENGINEER's transmittal requiring the confirmation.

- 4) Code 4 – “APPROVED AS NOTED/RESUBMIT” – This combination of codes is assigned when notations and comments are extensive enough to require a resubmittal of the entire package. This resubmittal is to address all comments, omissions and non-conforming items that were noted. Resubmittal is to be received by the ENGINEER within 30 calendar days of the date of the ENGINEER's transmittal requiring the resubmittal.
 - 5) Code 5 – “NOT APPROVED” – This code is assigned when the submittal does not meet the intent of the contract documents. The CONTRACTOR must resubmit the entire package revised to bring the submittal into conformance. It may be necessary to resubmit using a different manufacturer/vendor to meet the requirements of the contract documents.
 - 6) Code 6 – “COMMENTS ATTACHED” – This code is assigned where there are comments attached to the returned submittal, which provide additional data to aid the CONTRACTOR.
 - 7) Code 7 – “RECEIPT ACKNOWLEDGED” (Not subject to ENGINEER's Review or Approval) – This code is assigned to acknowledge receipt of a submittal that is not subject to the ENGINEER's review and approval, and is being filed for informational purposes only. This code is generally used in acknowledging receipt of means and methods of construction work plans, field conformance test reports, and health and safety plans.
 - 8) Codes 1 through 5 designate the status of the reviewed submittal with Code 6 showing there has been an attachment of additional data.
4. Electronic Transmission
- a. ACTION SUBMITTALS may be transmitted by electronic means provided the following conditions are met:
 - 1) The above-specified transmittal form is included.
 - 2) All other requirements specified above have been met including, but not limited to, coordination by the CONTRACTOR, review and approval by the CONTRACTOR, and the CONTRACTOR's Certification.
 - 3) The submittal contains no pages or sheets larger than 11 x 17 inches.
 - 4) With the exception of the transmittal sheet, the entire submittal is included in a single file.
 - 5) The electronic files are PDF format (with printing enabled).
 - 6) In addition, transmit three hard copy (paper) originals to the ENGINEER of which one will be returned to the CONTRACTOR.
 - 7) The ENGINEER's review time will commence upon receipt of the hard copies of the submittal.
 - 8) Submittals that require certification, corporate seal, or professional embossment (i.e. P.E.'s, Surveyors, etc.) transmit at least two hard-copy originals to the ENGINEER. In addition, provide

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additional photocopied or scanned copies, as specified above, showing the required certification, corporate seal, or professional seal.

B. Informational Submittals

1. CONTRACTOR's Responsibilities
 - a. Number of copies: Submit three copies, unless otherwise indicated in individual Specification sections.
 - b. Refer to individual technical Specification Sections for specific submittal requirements.
2. Engineer's Responsibilities
 - a. The ENGINEER will review each informational submittal within 10 days. If the informational submittal complies with the Contract requirements, ENGINEER will file for the project record and transmit a copy to the OWNER. ENGINEER may elect not to respond to CONTRACTOR regarding informational submittals meeting the Contract requirements.
 - b. If an informational submittal does not comply with the Contract requirements, ENGINEER will respond accordingly to the CONTRACTOR within 15 days. Thereafter, the CONTRACTOR shall perform the required corrective action, including retesting, if needed, until the submittal, in the opinion of the ENGINEER, is in conformance with the Contract Documents.
3. Electronic Transmission
 - a. INFORMATIONAL SUBMITTALS may be transmitted by electronic means providing all of the following conditions are met:
 - 1) The above-specified transmittal form is included.
 - 2) The submittal contains no pages or sheets larger than 11 x 17 inches.
 - 3) With the exception of the transmittal sheet, the entire submittal is included in a single file.
 - 4) The electronic files are PDF format (printing enabled).
 - 5) Submittals that require certification, corporate seal, or professional embossment (i.e. P.E.'s, Surveyors, etc.) transmit two hard-copy originals to the ENGINEER.

END OF SECTION 01300

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SUBMITTALS

ATTACHMENT A

Professional Design Services Performance Certification

1. My name is _____

2. My Florida State Professional Engineering License number is _____

3. My license expires _____, 20____

4. The Project for which I have performed professional design services is described as:

5. The Specification Section(s) under which I have performed my services is/are:

6. The name and address of the individual or entity for whom I have performed my professional design services is:

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ATTACHMENT A (continued)

Professional Design Services Performance Certification (continued)

7. I hereby certify that, to the best of my knowledge, information and belief, I have performed or supervised the performance of the professional design services hereunder, and that said services have been performed in accordance with all applicable local, state and federal codes, rules and regulations and in accordance with the standard of care currently expected of professional engineers/architects performing similar services for projects of similar size and complexity in the State of Florida.

Signature

Typed or Printed Name

Name of Firm

Street Address

[SEAL] _____
City/State/Zip Code

Telephone: _____

Fax: _____

SECTION 01370

SCHEDULE OF VALUES AND SCHEDULE OF ASSETS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Submit to the ENGINEER a schedule of values and schedule of assets allocated to the various portions of the Work, within 14 days after the effective date of the Agreement.
- B. Upon request of the ENGINEER, support the values with data which will substantiate their correctness.
- C. The schedule of values, unless objected to by the ENGINEER, shall be used only as the basis for the CONTRACTOR's applications for payment.

1.02 RELATED REQUIREMENTS

- A. Standard General Conditions of the Construction Contract are included in the Front End Documents.

1.03 FORM AND CONTENT OF SCHEDULE OF VALUES

- A. Type schedule on an 8-1/2-inch x 11-inch or 8-1/2-inch x 14-inch white paper furnished by the OWNER; CONTRACTOR's standard forms and automated printout will be considered for approval by the ENGINEER upon CONTRACTOR's request. Identify schedule with:
 - 1. Title of Project and location.
 - 2. ENGINEER and Project number.
 - 3. Name and Address of CONTRACTOR.
 - 4. Contract designation.
 - 5. Date of submission.
- B. Schedule shall list the installed value of the component parts of the Work in sufficient detail to serve as a basis for computing values for progress payments during construction.
- C. Identify each line item with the number and title of the respective major section of the specifications.
- D. For each major line item list sub-values of major products or operations under the item.
- E. For the various portions of the Work:
 - 1. Each item shall include a directly proportional amount of the CONTRACTOR's overhead and profit.
 - 2. For items on which progress payments will be requested for stored materials, break down the value into:
 - a. The cost of the materials, delivered and unloaded, with taxes paid. Paid invoices are required for materials upon request by the ENGINEER.
 - b. The total installed value.

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SCHEDULE OF VALUES AND SCHEDULE OF ASSETS

- F. The sum of all values listed in the schedule shall equal the total Contract Sum.
- G. Any items on the bid form denoted as allowances shall be accompanied with actual receipts showing the actual costs. The OWNER will only reimburse the CONTRACTOR for actual costs incurred and shall not include any additional markups. All remaining unused allowance amounts will be returned to the OWNER at the end of construction.
- H. Any items on the bid form denoted as unit price items shall be field verified by the ENGINEER and/or RPR for each payment application. All remaining unused portions of each unit price item will be returned to the OWNER at the end of construction.

1.04 SUBSCHEDULE OF UNIT MATERIAL VALUES

- A. Submit a sub-schedule of unit costs and quantities for:
 - 1. Products on which progress payments will be requested for stored products.
- B. The form of submittal shall parallel that of the Schedule of Values, with each item identified the same as the line item in the Schedule of Values.
- C. The unit quantity for bulk materials shall include an allowance for normal waste.
- D. The unit values for the materials shall be broken down into:
 - 1. Cost of the material, delivered and unloaded at the site, with taxes paid.
 - 2. Copies of invoices for component material shall be included with the payment request in which the material first appears.
- E. The installed unit value multiplied by the quantity listed shall equal the cost of that item in the Schedule of Values.

1.05 FORM AND CONTENT OF SCHEDULE OF ASSET VALUES

- A. Refer to **Appendix C** for a listing of the schedule of assets and forms that need to be filled out and provided by the CONTRACTOR on the project.
- B. For each asset listed, provide a constructed cost which will include an allocation of construction activities including but not limited to, demolition, sitework, specialties, materials, labor, general conditions, and overhead and profit associated with the construction of the asset.
- C. The combined value of the assets will equal the bid price for the project and will require adjustments as necessary due to change orders. The schedule of asset values will be updated on a monthly basis and will be included in the monthly pay request application for approval.
- D. The OWNER reserves the right to edit this list prior to the first pay application and may add up to 10 percent more items than have been identified in the list.

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SCHEDULE OF VALUES AND SCHEDULE OF ASSETS

- E. This spreadsheet shall be updated on a MONTHLY basis and presented to the ENGINEER and OWNER for review.

END OF SECTION 01370

SECTION 01410

TESTING AND TESTING LABORATORY SERVICES

PART 1- GENERAL

1.01 REQUIREMENTS INCLUDED

- A. The CONTRACTOR will employ and pay for the services of an Independent Testing Laboratory to perform testing specifically indicated in the Contract Documents. This testing includes all required testing to determine soil/density, concrete compressive strength, asphalt testing, and reinforcement testing.
 - 1. CONTRACTOR shall cooperate with the laboratory to facilitate the execution of its required services.
 - 2. Selection of the testing laboratory shall be approved by the ENGINEER.
- B. The OWNER will reimburse the CONTRACTOR for the costs of all passing laboratory tests from the laboratory based on actual invoices. Failed tests will be back-charged to the CONTRACTOR at the time of final payment. All required testing shall be coordinated with and scheduled by the CONTRACTOR.
- C. JEA will be responsible for any required water quality testing and bacteriological clearance of water mains and or other potable water components.

1.02 RELATED REQUIREMENTS

- A. Conditions of the Contract: Inspections and testing required by laws, ordinances, rules, regulations, orders or approvals of public authorities.
- B. Respective sections of specifications: Certification of products.
- C. Each specification section listed: Laboratory tests required, and standards for testing.
- D. Testing Laboratory inspection, sampling and testing is required for but not limited to the following:
 - 1. Section 02100: Site Preparation
 - 2. Section 02220: Excavating, Backfilling, and Grading for Structures
 - 3. Section 02221: Trenching, Bedding, and Backfill for Pipes, and Site Earthwork
 - 4. Section 02400: Graded Aggregate Base
 - 5. Section 02500: Superpave Asphalt Concrete
 - 6. Section 02610: Site Drainage
 - 7. Section 03300: Cast-in-Place Concrete

1.03 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

- A. Laboratory is not authorized to:
 - 1. Release, revoke, alter or enlarge on requirements of Contract Documents.
 - 2. Approve or accept any portion of the Work.
 - 3. Perform any duties of the CONTRACTOR.

SECTION 01410

TESTING AND TESTING LABORATORY SERVICES

1.04 CONTRACTOR'S RESPONSIBILITIES

- A. Cooperate with laboratory personnel and provide access to Work.
- B. Secure and deliver to the laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.
- C. Provide to the laboratory the preliminary design mix proposed to be used for concrete, and other material mixes which require control by the testing laboratory.
- D. Materials and equipment used in the performance of work under this Contract are subject to inspection and testing at the point of manufacture or fabrication. Standard specifications for quality and workmanship are indicated in the Contract Documents. The ENGINEER may require the CONTRACTOR to provide statements or certificates from the manufacturers and fabricators that the materials and equipment provided by them are manufactured or fabricated in full accordance with the standard specifications for quality and workmanship indicated in the Contract Documents. All costs of this testing and providing statements and certificates shall be a subsidiary obligation of the CONTRACTOR, and no extra charge to the OWNER shall be allowed on account of such testing and certification.
- E. Furnish incidental labor and facilities:
 - 1. To provide access to Work to be tested.
 - 2. To obtain and handle samples at the Project site or at the source of the product to be tested.
 - 3. To facilitate inspections and tests.
 - 4. For storage and curing of test samples.
- F. Notify laboratory sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.
 - 1. When tests or inspections cannot be performed after such notice, reimburse OWNER for laboratory personnel and travel expenses incurred due to CONTRACTOR's negligence.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01410

SECTION 01465

EQUIPMENT TESTING AND STARTUP

PART 1- GENERAL

1.01 SCOPE OF WORK

- A. The CONTRACTOR shall provide a competent field services technician of the MANUFACTURERs of all equipment furnished under Divisions 11, 13, 14, 15, and 16 to supervise installation, adjustment, commissioning, site acceptance testing, performance testing, and startup of the equipment.

1.02 RELATED WORK

- A. Operation and maintenance data is included in Section 01730.
- B. Submittals are included in Section 01300.
- C. Performance and acceptance testing and startup requirements are included in the respective sections of Division 11, 13, 14, 15 and 16.

1.03 SUBMITTALS

- A. The CONTRACTOR shall provide the name, address, and resume of proposed field services technicians at least 30 days in advance of the need of such services.
- B. Submit, in accordance with Section 01300, 16991, and 16993, detailed testing procedures for shop factory tests, factory acceptance testing (FAT), site acceptance testing (SAT), field performance tests, and final acceptance tests as specified in various equipment specifications.
- C. Submittals shall include at a minimum the following:
 - 1. Testing schedule including proposed dates and times of testing.
 - 2. Summary of power, lighting, chemicals, water, sludge, gas, etc. needs and identification of who will provide them.
 - 3. Outline specific assignments of the responsibilities of the CONTRACTOR and MANUFACTURER's factory representative or field personnel.
 - 4. 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, Standard Methods, etc.)
 - 5. Sample of forms that will be used to collect and record test data and to present tabulated test results.
- D. Provide copies of all final testing reports including field, shop, performance, and acceptance testing.

1.04 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. MANUFACTURER's sales and marketing personnel will not be accepted as field

SECTION 01465

EQUIPMENT TESTING AND STARTUP

service technicians.

PART 2- PRODUCTS (NOT USED)

PART 3- EXECUTION

3.01 PRELIMINARY/PRE-STARTUP 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 and 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. Upon completion of this work, the manufacturer's field service technician shall submit a signed report of his/her inspection, operation, adjustments and tests.

3.02 WITNESS REQUIREMENTS

- A. Shop tests or factory tests may be witnessed by the OWNER and/or OWNER'S representatives, as required by the various equipment specifications. Factory test reports must be provided and approved prior to shipment of any equipment to the site. Refer to Section 16991 for additional details and requirements for factory acceptance testing of the control system.
- B. Commissioning and site acceptance testing shall be performed in the presence of the OWNER and/or OWNER'S representatives. Refer to Section 16992 and 16993 for additional details and requirements for commissioning and site acceptance testing.

3.03 STARTUP AND ACCEPTANCE OF THE PUMPS, GST, AND RELATED SYSTEMS

- A. General requirements
 - 1. Successfully execute the step-by-step procedure of startup and performance demonstration specified herein.
 - 2. The startup and performance demonstration shall be successfully executed prior to Substantial Completion and acceptance by the OWNER of the new re-pump station, ground storage tanks, and all auxiliary systems. CONTRACTOR shall coordinate with the tank CONTRACTOR to ensure that the ground storage tanks are tested and complete prior to CONTRACTOR's substantial completion.
 - 3. All performance tests and inspections shall be scheduled at least 5 working days in advance or as otherwise specified with the OWNER and the ENGINEER. All performance tests and inspections shall be conducted during the work week of Monday through Thursday, unless otherwise specifically authorized.

SECTION 01465

EQUIPMENT TESTING AND STARTUP

B. Preparation for Startup

1. OWNER and ENGINEER shall perform at their discretion a complete disciplinary walkdown of the facility and all related systems prior to startup and run in activities. Any deficiencies noted during these walkdowns shall be completed by the CONTRACTOR prior to startup and run in activities.
2. Upon completion of the facilities and all related systems, piping systems shall be flushed with potable water and hydraulically water tightness tested for 24 hours. CONTRACTOR shall check for leaks, cracks, and defects.
3. 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 various pumps, fans, and other remaining equipment shall be made. The Pump Manufacturer shall certify the pumping system is ready for operation. All systems shall be cleaned and purged as required. All sumps, tanks, basins, pump wells, and pipelines which are hydraulically checked shall be drained and returned to their original condition once testing is completed.
4. All instruments and controls shall be calibrated through their full range. I/O loop checks shall be completed in their entirety on site with the proposed control system as well as all network functionality.
5. 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. The following shall be addressed prior to equipment operation:
 - a. Label and tag all equipment, valves, and components
 - b. Fill out all panel schedules
 - c. Label all circuit conductors and terminations
 - d. Install all arc flash hazard warning labels

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 OWNER shall receive spare parts, safety equipment, tools, and maintenance equipment, lubricants, approved O&M manuals.
2. Demonstrate a five day consecutive 24 hour day period of successful operation of the facility as a prerequisite of Substantial Completion and Acceptance. All systems shall be in automatic mode, all SCADA functions shall be completed, and verification of remote SCADA shall be completed.
3. In the event of failure to demonstrate satisfactory performance of the facility on the first or any subsequent attempt, all necessary alterations, 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 until the facility has operated continuously to the satisfaction of the OWNER and ENGINEER for the specified duration.
4. The OWNER will furnish all operating personnel (other than vendor's or subcontractor's) needed to operate equipment during the testing period; however, said personnel will perform their duties under the CONTRACTOR'S direct supervision. Until the performance testing is completed and units and systems are accepted by the OWNER as substantially complete, the CONTRACTOR shall be fully responsible for the operation and maintenance of the facilities.

SECTION 01465

EQUIPMENT TESTING AND STARTUP

5. The OWNER will provide all water and electricity required for the testing. However, the CONTRACTOR shall provide all necessary personnel (field, vendor, subcontractors) on an 8 hour per day basis at the facilities on a 24 hour per day basis locally during the startup period. All chemicals and fuel for generator and hypochlorite system (one full tanks' volume of each fuel and/or chemical) shall be provided by the time of startup and performance testing by the CONTRACTOR. Major equipment suppliers shall include, but not be limited, to the following:
 - a. Instrumentation, programming, and control equipment – will require coordination with JEA for programming efforts
 - b. Re-pumps with VFDs
 - c. New GST's fill and drain valves and controls
 - d. GSTs fill valve, station bypass, station discharge and controls
 - e. Sodium hypochlorite feed and storage system
 - f. Grinder pump station
 - g. 3-ton bridge cranes
 - h. Switchboards
 - i. Automatic transfer switch
 - j. Generator and fuel storage tank
 - k. HVAC systems
6. Do not, at any time during startup, allow for 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.

END OF SECTION 01465

SECTION 01501

CONTROL OF WORK

PART 1- GENERAL

1.01 STAFFING AND EQUIPMENT

- A. The CONTRACTOR shall furnish personnel and equipment which will be efficient, appropriate and large enough to secure a satisfactory quality of work and a rate of progress which will insure the completion of the work within the time stipulated in the Proposal. If any time such personnel appears to the ENGINEER to be inefficient, inappropriate or insufficient for securing the quality of work required or for producing the rate of progress aforesaid, he may order the CONTRACTOR to increase the efficiency, change the character or increase the personnel and equipment, and the CONTRACTOR shall conform to such order. Failure of the ENGINEER to give such order shall in no way relieve the CONTRACTOR of his obligations to secure the quality of the work and rate of progress required.

1.02 PRIVATE LAND

- A. The CONTRACTOR shall not enter or occupy private land outside of easements, except by permission of the Owner.

1.03 PIPE LOCATIONS

- A. Pipelines shall be located substantially as indicated on the Drawings, but the ENGINEER reserves the right to make such modifications in locations as may be found desirable to avoid interference with existing structures or for other reasons. Where fittings are noted on the Drawings, such notation is for the CONTRACTOR's convenience and does not relieve him from laying and jointing different or additional items where required.

1.04 OPEN EXCAVATIONS

- A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons, and damage to property. The CONTRACTOR shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access to private property during construction shall be removed when no longer required. The length of open trench will be controlled by the particular surrounding conditions, but shall always be confined to the limits prescribed by the ENGINEER. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the ENGINEER may require special construction procedures such as limiting the length of open trench, prohibiting stacking excavated material in the street, and requiring that the trench shall not remain open overnight.
- B. The CONTRACTOR shall take precautions to prevent injury to the public due to open trenches. All trenches, excavated material, equipment, or other obstacles which could be dangerous to the public shall be well lighted at night.

SECTION 01501

CONTROL OF WORK

1.05 TEST PITS

- A. Test pits for the purpose of locating underground pipeline or structures in advance of the construction shall be excavated and backfilled by the CONTRACTOR as required to complete the work and/or at the direction of the ENGINEER. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the ENGINEER.

1.06 MAINTENANCE OF TRAFFIC

- A. Unless permission to close a road is received in writing from the OWNER, the CONTRACTOR shall place all excavated material so that vehicular and pedestrian traffic may be maintained at all times. If the construction operations cause traffic hazards, the CONTRACTOR shall repair the road surface, provide temporary ways, erect wheel guards or fences, or take other measures for safety satisfactory to the ENGINEER.
- B. Detours around construction will be subject to the approval of the OWNER and the ENGINEER. Where detours are permitted, the CONTRACTOR shall provide all necessary barricades and signs as required to divert the flow of traffic. The CONTRACTOR shall expedite construction operations while traffic is detoured.

1.07 CARE AND PROTECTION OF PROPERTY

- A. The CONTRACTOR shall be responsible for the preservation of all public and private property and use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the CONTRACTOR, the CONTRACTOR shall restore such property to a condition similar or equal to that existing before the damage was done, or make good the damage in other manner acceptable to the ENGINEER.

1.08 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES

- A. The CONTRACTOR shall assume full responsibility for the protection of all buildings, structures, and utilities, public or private, including poles, signs, services to buildings, utilities in the street, gas pipes, water pipes, hydrants, sewers, drains and electric and telephone cables, whether or not they are shown on the Drawings. The CONTRACTOR shall carefully support and protect all such structures and utilities from injury of any kind. Immediately repair any damage resulting from the construction operations.
- B. Assistance will be given to the CONTRACTOR in determining the location of existing services. The CONTRACTOR, however, shall bear full responsibility for obtaining all locations of underground structures and utilities (including existing water services, drain lines and sewers). The CONTRACTOR shall maintain services to buildings and pay costs or charges resulting from damage thereto.

SECTION 01501

CONTROL OF WORK

- C. The CONTRACTOR shall notify all utility companies in writing at least 72 hours (excluding Saturdays, Sundays and Legal holidays) before excavating in any public way.
- D. If, in the opinion of the ENGINEER, permanent relocation of a utility owned by the OWNER is required, the ENGINEER may direct the CONTRACTOR, in writing, to perform the work. Work so ordered will be paid for at the Contract unit prices or through an agreed upon change order.
- E. Along the proposed pipe lines as indicated on the plans, the CONTRACTOR shall remove the surface materials only to such widths as will permit a trench to be excavated which will afford sufficient room for proper efficiency and proper construction. All applicable regulations shall be followed. Where sidewalks, driveways, pavements, and curb and gutter are encountered, care shall be taken to protect against fracture or disturbance beyond reasonable working limits. All fractured, broken, or disturbed surfaces shall be restored to their original condition prior to completion of the work.
- F. Restoration of all surfaces including road subbase, soil cement, limerock base, asphaltic concrete surface, portland cement concrete pavement and driveways, sidewalks, and concrete curbs shall be in strict accordance with Drawings. All grassing and mulching shall be done. Sites shall be restored to existing conditions. Any modifications from existing conditions shall require prior approval from OWNER of existing structure, property, or utility.
- G. Lawn areas shall be left in as good or better condition as before starting the work. Where sod is to be removed, it shall be carefully restored with new sod of the same type. Solid sodding shall be placed on all slopes greater than 4:1, within 10 feet of all proposed structures and where existing sod is removed or disturbed by the work. In addition, CONTRACTOR shall restore all storm drains, culverts, inlets, and storm manholes to equal or better condition.
- H. Any fence, or part thereof, that is damaged or removed during the course of the work shall be replaced or repaired by the CONTRACTOR and shall be left in as good a condition as before the starting of the work. The manner in which the fence is repaired and replaced and the materials used shall be subject to the approval of the ENGINEER.
- I. All trees and shrubs not shown to be removed on the plans shall be protected by the CONTRACTOR at his expense. No excavated materials shall be placed so as to injure such trees and shrubs. Trees or shrubs destroyed by negligence of the CONTRACTOR or his employees shall be replaced by him with new stock of similar size and age at the sole expense of the CONTRACTOR.

1.09 WATER FOR CONSTRUCTION PURPOSES

- A. CONTRACTOR shall obtain a temporary water meter from JEA. Water used during construction will be billed to the CONTRACTOR.
- B. In locations where public water supply is available, the CONTRACTOR may be

SECTION 01501

CONTROL OF WORK

allowed to use water without charge for construction purposes.

- C. The express approval of the OWNER shall be obtained before water is used. Waste of water shall be sufficient cause for withdrawing the privilege of unrestricted use. Hydrants shall only be operated under the supervision of the OWNER's personnel.

1.10 MAINTENANCE OF FLOW

- A. The CONTRACTOR shall provide for the flow of sewers, drains and water courses interrupted during the progress of the work, and immediately cart away and remove all offensive matter. Discuss the entire procedure of maintaining existing flow with the ENGINEER at least seven (7) days prior to the interruption of any flow.

1.11 CLEANUP AND DISPOSAL OF EXCESS MATERIAL

- A. During the course of the work, the CONTRACTOR shall keep the site of operations as clean and neat as possible. The CONTRACTOR shall dispose of all residue resulting from the construction work and, at the conclusion of the work, remove and haul away any surplus excavation, broken pavement, lumber, equipment, temporary structures and any other refuse remaining from the construction operations and leave the entire site of the work in a neat and orderly condition.
- B. In order to prevent environmental pollution arising from the construction activities related to the performance of this Contract, the CONTRACTOR shall comply with all applicable Federal, State and local laws and regulations concerning waste material disposal, as well as the specific requirements stated in this Section and in other related sections.
- C. Disposal of excess excavated material in wetlands, stream corridors and plains is strictly prohibited even if the permission of the property OWNER is obtained. Any violation of this restriction by the CONTRACTOR or any person employed by him will be brought to the immediate attention of the responsible regulatory agencies, with a request that appropriate action be taken against the offending parties. The CONTRACTOR will be required to remove the fill and restore the area impacted at no increase in the Contract Price.

1.12 GRADES, SURVEY LINES, AND PROTECTION OF MONUMENTS

- A. All work shall be constructed in accordance with the lines and grades shown on the drawings. The full responsibility for keeping alignment and grade shall rest upon the CONTRACTOR.
- B. Bench marks and base line controlling points shall be established prior to beginning work. Reference marks for lines and grades as the work progresses will be located to cause as little inconvenience to the prosecution of the work as possible. The CONTRACTOR shall so place excavation and other materials as to cause no inconvenience in the use of the reference marks provided. CONTRACTOR shall remove any obstructions placed contrary to this provision.

SECTION 01501

CONTROL OF WORK

- C. The CONTRACTOR shall furnish and maintain, at his own expense, stakes and other such materials and give such assistance, including qualified helpers, for setting reference marks to the satisfaction of the ENGINEER. The CONTRACTOR shall check reference marks by such means, as he may deem necessary. The CONTRACTOR shall, at his own expense, establish all working or construction lines and grades as required from the reference marks and shall be solely responsible for the accuracy thereof.
- D. Property corners and survey monuments shall be preserved using care not to disturb or destroy them. If a property corner or survey monument is disturbed or destroyed during construction, whether by accident, careless work, or required to be disturbed or destroyed by construction work, said property corner or survey monument shall be restored by a land surveyor registered in the state of Florida. All costs for this work shall be paid for by the CONTRACTOR.

PART 2- PRODUCTS (NOT USED)

PART 3- EXECUTION

3.01 COOPERATION WITHIN THIS CONTRACT

- A. All firms or persons authorized to perform any work under this Contract shall cooperate with the CONTRACTOR and his subcontractors or trades, and shall assist in incorporating the work of other trades where necessary or required.
- B. Cutting and patching, drilling and fitting shall be carried out where required by the trade or subcontractor having jurisdiction, unless otherwise indicated herein or directed by the ENGINEER.

3.02 PROTECTION OF CONSTRUCTION AND EQUIPMENT

- A. All newly constructed work shall be carefully protected from injury in any way. No wheeling or walking or placing of heavy loads on it shall be allowed and all portions injured shall be reconstructed by the CONTRACTOR at his own expense.
- B. All structures shall be protected in a manner approved by the ENGINEER. Should any of the floors or other parts of the structures become heaved, cracked or otherwise damaged, all such damaged portions of the work shall be completely repaired and made good by the CONTRACTOR at his own expense and to the satisfaction of the ENGINEER. If, in the final inspection of the work, any defects, faults or omissions are found, the CONTRACTOR shall cause the same to be repaired or removed and replaced by proper materials and labor required. Further, the CONTRACTOR shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein, for at least the guarantee period described in the contract.
- C. Further, the CONTRACTOR shall take all necessary precautions to prevent damage to any structure due to water pressure during and after construction and until such structure is accepted and taken over by the Owner.

SECTION 01501

CONTROL OF WORK

END OF SECTION 01501

SECTION 01600

DELIVERY, STORAGE, AND HANDLING

PART 1- GENERAL

1.01 SCOPE OF WORK

- A. This Section specifies the general requirements for the delivery handling, storage and protection for all items required in the construction of the work. Specific requirements, if any, are specified with the related item.

1.02 TRANSPORTATION AND DELIVERY

- A. Transportation and handling shall be in accordance with MANUFACTURER's instructions.
- B. The CONTRACTOR shall schedule delivery to reduce long term on-site storage prior to installation and/or operation. Under no circumstances shall equipment be delivered to the site more than two months prior to installation without written authorization from the ENGINEER. Should equipment (anything with a motor, electrical, and instrumentation) need to be stored longer than two months, an approved climate controlled storage unit shall be provided by the CONTRACTOR at no additional cost to the OWNER.
- C. The CONTRACTOR shall coordinate delivery with installation to ensure minimum holding time for items that are hazardous, flammable, easily damaged or sensitive to deterioration.
- D. Products shall be delivered to the site in MANUFACTURER's original sealed containers or other packing systems, complete with instructions for handling, storing, unpacking, protecting and installing.
- E. All items delivered to the site shall be unloaded and placed in a manner which will not hamper the CONTRACTOR's normal construction operation or those of subcontractors and other contractors and will not interfere with the flow of necessary traffic.
- F. The CONTRACTOR shall provide necessary equipment and personnel to unload all items delivered to the site.
- G. The CONTRACTOR shall promptly inspect shipment to assure that products comply with requirements, quantities are correct and items are undamaged. For items furnished by others (i.e. OWNER, other Contractors), perform inspection in the presence of the OWNER's Representative. Notify ENGINEER verbally, and in writing, of any problems.
- H. If any item has been damaged, such damage shall be repaired at no additional cost to the OWNER.

SECTION 01600

DELIVERY, STORAGE, AND HANDLING

1.03 STORAGE AND PROTECTION

- A. The CONTRACTOR shall store and protect products in accordance with the MANUFACTURER's instructions, with seals and labels intact and legible. Storage instruction shall be studied by the CONTRACTOR who is to review with the OWNER's Representative. Instruction shall be carefully followed and a written record of this kept by the CONTRACTOR. Arrange storage to permit access for inspection.
- B. The CONTRACTOR shall store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- C. Cement and lime shall be stored under a roof and off the ground and shall be kept completely dry at all times. All structural, miscellaneous and reinforcing steel shall be stored off the ground or otherwise to prevent accumulations of dirt or grease and in a position to prevent accumulations of standing water and to minimize rusting. Beams shall be stored with the webs vertical. Precast concrete shall be handled and stored in a manner to prevent accumulations of dirt, standing water, staining, chipping, or cracking. Brick, block, and similar masonry products shall be handled and stored in a manner to reduce breakage, cracking and spalling to a minimum.
- D. All mechanical and electrical equipment and instruments shall be stored in a weather tight building to prevent injury. The building may be a temporary structure on the site or elsewhere, but it must be satisfactory to the OWNER's Representative. Building shall be provided with adequate ventilation to prevent condensation. Maintain temperature and humidity within range required by MANUFACTURER.
 - 1. All equipment shall be stored fully lubricated with oil, grease and other lubricants unless otherwise instructed by the MANUFACTURER.
 - 2. Moving parts shall be rotated a minimum of once weekly to ensure proper lubrication and to avoid metal-to-metal "welding". Upon installation of the equipment, the CONTRACTOR shall start the equipment, at least half load, once weekly for an adequate period of time to ensure that the equipment does not deteriorate from lack of use.
 - 3. Lubricants shall be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. New lubricants shall be put into the equipment at the time of acceptance.
 - 4. Prior to acceptance of the equipment, the CONTRACTOR shall have the MANUFACTURER inspect the equipment and certify that its condition has not been detrimentally affected by the long storage period. Such certifications by the MANUFACTURER shall be deemed to mean that the equipment is judged by the MANUFACTURER to be in a condition equal to that of equipment that has been shipped, installed, tested and accepted in a minimum time period. As such, the MANUFACTURER will guaranty the equipment equally in both instances. If such a certification is not given, the equipment shall be judged to be defective. It shall be removed and replaced at the CONTRACTOR's expense.

SECTION 01600

DELIVERY, STORAGE, AND HANDLING

- E. All paint and other coating products shall be stored in areas protected from the weather. Follow all storage requirements set forth by the paint and coating MANUFACTURER's.

END OF SECTION 01600

SECTION 01700

CONTRACT CLOSEOUT

PART 1- GENERAL

1.01 REQUIREMENTS

- A. Comply with requirements stated in Conditions of the Contract and in Specifications for administrative procedures in closing out the Work.

1.02 RELATED WORK

- A. Conditions of the Contract. Fiscal provisions, legal submittals and additional administrative requirements.
- B. Section 01710: Cleaning
- C. Section 01720: Project Record Documents
- D. Section 01730: Operating and Maintenance Data
- E. Section 01740: Warranties
- F. The respective sections of Specifications: Closeout Submittals Required of Trades.

1.03 CONTRACTOR'S CLOSEOUT SUBMITTALS TO ENGINEER

- A. Evidence of compliance with requirements of governing authorities.
- B. Project Record Documents: To requirements of Section 01720.
- C. Operating and Maintenance Data, Instructions to OWNER's Personnel: To requirements of Section 01730.
- D. Warranties: To requirements of Section 01740.
- E. Spare Parts and Maintenance Materials: To requirements of Section 01730.
- F. Evidence of Payment and Release of Liens: To requirements of General and Supplementary Conditions.
- G. Certificate of Insurance for Products and Completed Operations.
- H. Final Schedule of asset data as per Section 01370.

1.04 FINAL ADJUSTMENT OF ACCOUNTS

- A. Submit a final statement of accounting to the ENGINEER.
- B. Statement shall reflect all adjustments to the Contract Sum:
 - 1. The original Contract Sum.
 - 2. Additions and deductions resulting from:
 - a. Previous Change Orders

SECTION 01700

CONTRACT CLOSEOUT

- b. Allowances
- c. Unit Prices
- d. Deductions for uncorrected Work
- e. Penalties and Bonuses
- f. Deductions for liquidated damages
- g. Deductions for reinspection payments
- h. Other adjustments
- 3. Total Contract Sum, as adjusted.
- 4. Previous payments.
- 5. Sum remaining due.

- C. ENGINEER will prepare a final Change Order, reflecting approved adjustments to the Contract Sum which were not previously made by Change Orders.

1.05 FINAL APPLICATION FOR PAYMENT

- A. CONTRACTOR shall submit the final Application for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

1.06 FINAL CLEANING

- A. CONTRACTOR shall complete final cleaning prior to submittal of the final application for payment.
- B. Complete the following cleaning operations:
 - 1. Remove labels that are not permanent labels
 - 2. CONTRACTOR shall clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision obscuring materials. Replace chipped or broken glass and other transparent materials.
- C. Clean exposed exterior and interior hard-surfaces, finishes to dust-free conditions, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective conditions. Leave concrete floors broom clean. Vacuum carpeted surface.
- D. The CONTRACTOR shall wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
- E. Clean the site, including landscape development areas of rubbish, litter and other foreign substances. Sweep paved areas broom clean, remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted to a smooth even-textured surface.

1.07 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

SECTION 01700

CONTRACT CLOSEOUT

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01700

SECTION 01710

CLEANING

PART 1- GENERAL

1.01 REQUIREMENTS

- A. Execute cleaning, during progress of the Work, and at completion of the Work, as required by JEA General Conditions and Contract Documents.

1.02 RELATED WORK

- A. Conditions of the Contract
- B. Each Specification Section: Cleaning for specific products or work.

1.03 DISPOSAL REQUIREMENTS

- A. Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, and anti-pollution laws.

PART 2- PRODUCTS

2.01 MATERIALS

- A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.
- B. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.
- C. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3- EXECUTION

3.01 DURING CONSTRUCTION

- A. Execute periodic cleaning to keep the Work, the site and adjacent properties free from accumulations of waste materials, rubbish and windblown debris, resulting from construction operations.
- B. Provide on-site containers for the collection of waste materials, debris and rubbish.
- C. Remove waste materials, debris and rubbish from the site periodically and dispose of at legal disposal areas away from the site.

3.02 DUST CONTROL

- A. Clean interior spaces, piping, and equipment prior to the start of finish painting and continue cleaning on an as needed basis until painting is finished.

SECTION 01710

CLEANING

- B. Schedule operations so that dust and other contaminants resulting from cleaning process will not fail on wet or newly coated surfaces.

3.03 FINAL CLEANING

- A. Employ skilled workmen for final cleaning.
- B. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight exposed interior and exterior surfaces.
- C. Wash and shine glazing and mirrors.
- D. Polish glossy surfaces to a clear shine.
- E. Ventilating Systems:
 - 1. Clean permanent filters and replace disposable filters if units were operated during construction.
 - 2. Clean ducts, blowers and coils if units were operated without filters during construction.
- F. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.
- G. Prior to final completion, or OWNER occupancy, CONTRACTOR shall conduct an inspection of sight exposed interior and exterior surfaces, and all work areas, to verify that the entire Work is clean.

END OF SECTION 01710

SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1- GENERAL

1.01 REQUIREMENTS

- A. Maintain at the site for the OWNER and ENGINEER one record copy of:
 - 1. Drawings
 - 2. Specifications
 - 3. Change Orders and other Modifications to the Contract
 - 4. Engineer's Field Orders or written instructions
 - 5. Approved Shop Drawings, Working Drawings and Samples
 - 6. Field Test records
 - 7. Construction photographs
 - 8. All applicable permits

1.02 RELATED WORK

- A. Section 01300: Submittals
- B. Section 01370: Operation and Maintenance Data

1.03 MAINTENANCE OF DOCUMENTS AND SAMPLES

- A. Store documents and samples in CONTRACTOR's field office apart from documents used for construction.
 - 1. Provide files and racks for storage of documents.
 - 2. Provide locked cabinet or secure storage space for storage of samples.
- B. File documents and samples in accordance with Construction Specifications Institute (CSI) format.
- C. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.
- D. Make documents and samples available at all times for inspection by the ENGINEER.
- E. As a prerequisite for monthly progress payments, the CONTRACTOR is to exhibit the currently updated "record documents" for review by the ENGINEER and the OWNER.

1.04 RECORDING

- A. Provide felt tip marking pens for recording information in "Red".
- B. Label each document "PROJECT RECORD" in neat large printed letters.
- C. Record information concurrently with construction progress.
 - 1. Do not conceal any work until required information is recorded.

SECTION 01720

PROJECT RECORD DOCUMENTS

- D. Drawings: Legibly mark to record actual consideration:
1. Depths of various elements of foundation in relation to finish first floor datum.
 2. All underground piping with elevations and dimensions. Changes to piping location. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements. Actual installed pipe material, class, etc.
 3. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure (this includes electrical conduits).
 4. Field changes of dimension and detail.
 5. Changes made by field order or by change order.
 6. Details not on original contract drawings.
 7. Equipment and piping relocations.
 8. Major architectural and structural changes including relocation of doors, windows, etc.
 9. Architectural schedule changes according to CONTRACTOR's records and shop drawings.
 10. Locations, elevations, sizes, types and materials of all manholes (including pipe invert, manhole rim, and bottom elevations), valves, water and sewer services, fire hydrants and all associated structures, hose bibbs, and fittings.
 11. With reference to electrical work the exact routing of conduit runs shall be shown on these drawings.

1.05 SUBMITTAL

- A. At Contract close-out, deliver Record Documents to the ENGINEER for the OWNER. The information submitted by the CONTRACTOR into the Record Drawings and Record Documents will be assumed to be correct, and the CONTRACTOR shall be responsible for the accuracy of such information, and shall bear the costs resulting from the correction of incorrect data.
- B. Accompany submittal with transmittal letter in duplicate, containing:
1. Date
 2. Project title and number
 3. Contractor's name and address
 4. Title and number of each Record Document
 5. Signature of Contractor or his authorized representative
- C. Delivery of Record Drawings and Record Documents to the ENGINEER will be a prerequisite to Final Payment.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01720

SECTION 01730

OPERATING AND MAINTENANCE DATA

PART 1- GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Compile product data and related information appropriate for OWNER's maintenance and operation of products furnished under this Contract.
 - 1. Prepare operating and maintenance data as specified in this Section and as referenced in other pertinent sections of Specifications.
 - 2. Provide a minimum of two hard copies and an electronic copy of the manuals at both the draft and final submittals.
- B. Instruct OWNER's personnel in maintenance of products and in operation of equipment and systems.

1.02 RELATED REQUIREMENTS

- A. Section 01300: Submittals
- B. Section 01700: Contract Closeout
- C. Section 01720: Project Record Documents
- D. Section 01740: Warranties

1.03 QUALITY ASSURANCE

- A. Preparation of data shall be done by personnel:
 - 1. Trained and experienced in maintenance and operation of described products.
 - 2. Familiar with requirements of this Section.
 - 3. Skilled as technical writer to the extent required to communicate essential data.
 - 4. Skilled as draftsman competent to prepare required drawings.

1.04 OPERATING MANUALS

- A. The VENDOR shall provide operation and maintenance instructions for all electrical, mechanical, and instrumentation and controls equipment furnished under various technical specifications Sections.
- B. Four complete sets of operations and maintenance manuals approved by the ENGINEER covering all equipment furnished under Divisions 11, 13, 14, 15, and 16 shall be delivered at least 30 days prior to scheduled start-up directly to the OWNER.
- C. An electronic copy of the manual shall be provided as well as hard copy submittal.
- D. Separate manuals shall be provided for each type of equipment, or each Section number. Each manual shall contain the following specific requirements. Manuals that do not meet the requirements shall be rejected and Equipment Supplier/Manufacturer will bear all expenses to resubmit the manual to meet the following requirements.

SECTION 01730

OPERATING AND MAINTENANCE DATA

E. Manual Format

1. Size: 8 1/2 inches x 11 inches.
2. Paper: 20 pound minimum, white, for typed pages.
3. Text: Manufacturer's printed data, or neatly typewritten.
4. Drawings:
 - a. Provide reinforced punched binder tab, bind in with text.
 - b. Reduce larger drawings and fold to size of text pages but not larger than 11 inches x 17 inches.
5. Provide fly-leaf for each separate product, or each piece of operating equipment.
 - a. Provide typed description of product, and major component parts of equipment.
 - b. Provide indexed tabs.
6. Cover: Identify each volume with typed or printed, title "OPERATING AND MAINTENANCE INSTRUCTIONS" List:
 - a. Title of Project.
 - b. Identity of separate structure as applicable.
 - c. Identity of general subject matter covered in the manual.

F. Binders

1. Commercial quality three-post binders with durable and cleanable plastic covers.
2. Maximum post width: 2 inches or as applicable.
3. When multiple binders are used, correlate the data into related consistent groupings.

1.05 CONTENT OF MANUAL

A. Neatly typewritten table of contents for each volume, arranged in systematic order.

1. CONTRACTOR, name of responsible principal, address, and telephone number.
2. A list of each product required to be included, indexed to content of the volume.
3. List, with each product, name, address, email, and telephone number of:
 - a. Subcontractor, manufacturer, or installer.
 - b. Local manufacturer's representative
 - c. Maintenance contractor, as appropriate.
 - d. Identify area of responsibility of each.
 - e. Local source of supply for parts replacement.
4. Identify each product by product name and other identifying symbols as set forth in Contract Documents.

B. Product Data

1. Include only those sheets which are pertinent to the specific product.
2. Annotate each sheet to:
 - a. Clearly identify specific product or part installed
 - b. Clearly identify data applicable to installation
 - c. Delete references to inapplicable information

SECTION 01730

OPERATING AND MAINTENANCE DATA

- C. Asset Management, Spare Parts, and Preventative Maintenance Plan
 1. Provide with the preliminary and final O&M manual a detailed listing of spare parts including part numbers and cost.
 2. Provide detailed list of each major component's preventative maintenance plans for review and comment.
 3. This information shall be input by the CONTRACTOR into the asset management forms provided by the ENGINEER and submitted fully prior to final completion.
- D. Drawings
 1. Supplement product data with drawings as necessary to clearly illustrate:
 - a. Relations of component parts of equipment and systems.
 - b. Control and flow diagrams.
 2. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
 3. Do not use Project Record Documents as maintenance drawings.
 4. Final approved vendor shop drawings shall be included in the last tab of the final O&M manual.
 - a. Shop drawings shall be 11x17 inch and tri-folded in the back of the hard copy manuals.
 - b. Shop drawings shall be identical to final approved shop drawings, except where field changes dictate otherwise. In which case, the revised shop drawings shall be subject to review in accordance with specification section 01730.
 - c. Typical drawings to include shall be:
 - 1) Electrical wiring diagrams & schematics
 - 2) Equipment layout and arrangements
 - 3) Assembly and installation drawings
 - 4) Equipment elevations and cross sections
- E. Written text, as required to supplement product data for the particular installation:
 1. Organize in consistent format under separate headings for different procedures.
 2. Provide logical sequence of instructions of each procedure.
 3. Copy of each warranty, bond and service contract issued.
 4. Provide information sheet for OWNER's personnel, give:
 - a. Proper procedures in event of failure.
 - b. Instances which might affect validity of warranties or bonds.
- F. Electronic Transmission of O&M Manuals
 1. Electronic O&M manuals shall meet the following conditions:
 - a. All other requirements specified above have been met, including, but not limited to, coordination by the CONTRACTOR, review and approval by the CONTRACTOR.
 - b. With the exception of the transmittal sheet, the entire submittal is included in a single file.
 - c. Files are Portable Document Format (PDF) – with the printing function enabled.
 - d. The Vendor provided equipment, sub-system, or system manuals shall be in PDF format, compliant with the Adobe PDF specification (latest

SECTION 01730

OPERATING AND MAINTENANCE DATA

version). The manual shall be searchable image. The optical character recognition of the image shall be a 95% confidence level. The manuals shall be linked and bookmarked as follows:

- 1) Provide links from all Table of Contents, List of Tables, List of Figures, etc., entries to the actual occurrence in the body of the manual.
- 2) Create bookmarks for all linked Table of Contents entries.
- e. All drawings shall be in PDF format, compliant with the Adobe PDF Specification (latest version). The manual shall be PDF Searchable Image. The Optical Character Recognition of the image shall be at a 95% confidence level. The drawings shall be linked as follows:
 - 1) External links from the Drawing Index (if it exists) to each drawing.
 - 2) External links from references within drawings to other drawings.
2. When electronic copies are provided, transmit two hard-copy (paper) originals to the Engineer with an electronic copy.
3. The electronic copy of the O&M manual must be identical in organization, format, and content to the hard copies of the manual.

1.06 EQUIPMENT ATTRIBUTE WORKSHEETS

- A. Equipment attribute worksheets shall be provided for all equipment meeting the asset definition as follows:
 1. Asset Definition
 - a. Maintenance is recommended
 - b. Assets have a value greater than \$1,000
 - c. Assets are complete
 2. This asset definition is intended to give a general indication of which equipment must be included in the equipment attribute worksheets. The ENGINEER will provide the specific list of equipment that the VENDOR must provide information for:
 - a. The information requirements are shown in detail in the table. The data requirements include nameplate data, manufacturer and supplier information, information specific to the type of equipment, spare parts, and recommended preventative maintenance activities.
 - b. An electronic copy of the equipment attribute worksheets must be delivered in Excel format and submitted to the Engineer on CD-ROM and submitted with the O&M manuals.
 - c. Provide MONTHLY updates to the equipment attribute worksheets as a condition of payment.

1.07 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to startup of equipment and facilities, instruct OWNER's designated operating and maintenance personnel in operation, adjustment and maintenance of products, equipment, and systems. Refer to individual specifications for training requirements.
- B. Operating and maintenance manual shall constitute the basis of instruction.
 1. Review contents of manual with personnel in full detail to explain all aspects of operations and maintenance.

SECTION 01730

OPERATING AND MAINTENANCE DATA

- C. Unless specified otherwise under the respective equipment specification section, vendor training/instruction shall consist of eight hours of training for each type of equipment. Such training/instruction shall be scheduled and held at times to accommodate the work schedules of OWNER'S personnel, including splitting the required training/instruction time into separate sessions and/or presented at reasonable times other than the CONTRACTOR's "normal working hours" or the OWNER's normal day shift.
- D. At least two weeks prior to the schedule for vendor training, a detailed lesson plan, representative of the material to be covered during instruction, shall be submitted to the ENGINEER for approval. Lesson plans shall consist of in-depth outlines of the training material, including a table of contents, resume of the instructor, materials to be covered, start-up procedures, maintenance requirements, safety considerations, and shut-down procedures.
- E. Vendor's training/instruction will be considered acceptable based on the completed *Owner's Acknowledgement of Manufacturer's Instruction* as indicated on the Equipment Manufacturer's Certification of Installation, Testing, and Instruction appended to this Section.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

FORM TO FOLLOW
END OF SECTION 01730

SECTION 01730

OPERATING AND MAINTENANCE DATA

EQUIPMENT MANUFACTURER'S CERTIFICATE OF INSTALLATION, TESTING, AND INSTRUCTION

Owner: JEA

Project: Twin Creeks Reclaimed Water Re-Pump Station Improvements

Contract No. _____

Mott MacDonald Project No. 502398244

EQUIPMENT SPECIFICATION SECTION _____

I _____, Authorized representative of
(Print Name)

_____, hereby certify that
(Print Manufacturer's Name)

(Print equipment name and model with serial No.)

installed for the subject project [has] [have] been installed in a satisfactory manner, [has] [have] been satisfactorily tested, [is] [are] ready for operation, and that Owner assigned operating personnel have been suitably instructed in the operation, lubrication, and care of the unit[s] on

Date: _____

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

OWNER'S ACKNOWLEDGMENT OF MANUFACTURER'S INSTRUCTION

[I] [We] the undersigned, authorized representatives of the _____ and/or Plant Operating Personnel have received classroom and hands on instruction on the operation and maintenance of the subject equipment and [am] [are] prepared to assume normal operational responsibility for the equipment:

_____	DATE: _____
_____	DATE: _____
_____	DATE: _____

SECTION 01740

WARRANTIES

PART 1- GENERAL

1.01 REQUIREMENTS

- A. Compile specified warranties as per JEA's general conditions and per the technical specification requirements.
- B. Co-execute submittals when so specified.
- C. Review submittals to verify compliance with Contract Documents.
- D. Submit to the ENGINEER for review and transmittal to OWNER.

1.02 RELATED WORK

- A. JEA Standard and General Conditions
- B. Section 01700: Contract Closeout

1.03 SUBMITTAL REQUIREMENTS

- A. Assemble warranties and service and maintenance contracts, executed by each of the respective manufacturers, suppliers, and subcontractors.
- B. Number of original signed copies required: Two each.
- C. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.
 - 1. Product or work item
 - 2. Vendor or manufacturer, with name of principal, address and telephone number
 - 3. Scope
 - 4. Date of beginning of warranty, bond or service and maintenance contract
 - 5. Duration of warranty, bond or service maintenance contract
 - 6. Provide information for OWNER's personnel:
 - a. Proper procedure in case of failure
 - b. Instances which might affect the validity of warranty
 - 7. Contractor, name of responsible principal, address and telephone number

1.04 FORM OF SUBMITTALS

- A. Prepare in duplicate packets
- B. Format:
 - 1. Size 8-1/2 inches x 11 inches, punch sheets for standard 3-post binder.
 - a. Fold larger sheets to fit into binders.
 - 2. Cover: Identify each packet with typed or printed title "WARRANTIES":
 - a. Title of Project
 - b. Name of Contractor

SECTION 01740

WARRANTIES

- C. Binders: Commercial quality, three-post binder, with durable and cleanable plastic covers and maximum post width of 2 inches. Include divider tabs for each warranty item and correlate to the table of contents.

1.05 WARRANTY SUBMITTAL REQUIREMENTS

- A. For all major pieces of equipment, submit a warranty from the equipment manufacturer. The manufacturer's warranty period shall be concurrent with the CONTRACTOR's for one (1) year commencing at the time of acceptance by the OWNER or as specified in the equipment or material specifications.
- B. The CONTRACTOR shall be responsible for obtaining certificates for equipment warranty for all major equipment specified under Division 11, 13, 14, 15 and 16 and which has a 1 HP motor or which lists for more than \$1,000. The ENGINEER reserves the right to request warranties for equipment not classified as major. The CONTRACTOR shall still warrant equipment not considered to be "major" in the CONTRACTOR's one-year warranty period even though certificates of warranty may not be required.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01740

SECTION 02050

DEMOLITION AND MODIFICATIONS

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. CONTRACTOR shall furnish all labor, materials, equipment and incidentals required and demolish, modify, remove and dispose of work shown on the Drawings.
- B. Included, but not limited to, are demolition, modifications and removal of existing materials, equipment or work necessary to install the new work as shown on the Drawings and as specified herein and to connect with existing work in an approved manner.
- C. The existing Twin Creeks Wastewater Pump Station will be in operation during the entire construction period and the CONTRACTOR shall conduct their operations so as to cause the least possible interference and/or inconvenience with the normal operations of the facility.
- D. CONTRACTOR shall refer to the Drawings for limit and extent of demolition.
- E. Blasting and the use of explosives will not be permitted for any demolition work.

1.02 RELATED WORK

- A. Summary of Work is included in Section 01010.
- B. Construction Sequence is included in Section 01014.
- C. Submittals are included in Section 01300.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, the proposed methods and operations of demolition of the structures and modifications prior to the start of work. Include in the schedule the coordination of shutoff, capping and continuation of utility service as required.
- B. Furnish a detailed sequence of demolition and removal work to ensure the uninterrupted progress of the OWNER's operations. Sequence shall be compatible with sequence of construction and shutdown coordination requirements as specified in Section 01014. Should the CONTRACTOR need to perform additional meetings with plant operations staff to confirm tie-in locations/demolition/maintenance of plant operations, the CONTRACTOR shall schedule so as to develop a complete understanding of the demolition work and how it should be sequenced.
- C. If necessary before commencing demolition work, all modifications necessary to bypass the affected structure shall be completed. Actual work shall not begin until

SECTION 02050

DEMOLITION AND MODIFICATIONS

the ENGINEER has inspected and approved the modifications and authorized commencement of the demolition work in writing.

1.04 JOB CONSTRUCTION

- A. Protection
 - 1. Execute the demolition and removal work to prevent damage or injury to structures, occupants thereof and adjacent features which might result from falling debris or other causes, and so as not to interfere with the use, and free and safe passage to and from adjacent structures.
 - 2. Closing or obstructing of roadways, sidewalks and passageways adjacent to the work by the placement or storage of materials will not be permitted and all operations shall be conducted with a minimum interference to traffic on these ways.
 - 3. Erect and maintain barriers, lights, sidewalk sheds and other required protective devices.
- B. Scheduling
 - 1. Carry out operations so as to avoid interference with operations and work in the existing facilities.
- C. Notifications
 - 1. At least 48 hours prior to commencement of a demolition or removal, notify the ENGINEER in writing of proposed schedule. OWNER shall inspect the existing equipment and identify and mark those items which are to remain the property of the OWNER. No removals shall be started without the permission of the ENGINEER.
- D. Conditions of Structures
 - 1. The OWNER and the ENGINEER assume no responsibility for the actual condition of the structures to be demolished or modified.
 - 2. Conditions existing at the time inspection for bidding purposes will be maintained by the OWNER insofar as practicable. However, variations within a structure may occur prior to the start of demolition work.
- E. Repairs to Damage
 - 1. Promptly repair damage caused to adjacent facilities by demolition operation when directed by ENGINEER and at no additional cost to the OWNER. Repairs shall be made to a condition at least equal to that which existed prior to construction.
- F. Traffic Access
 - 1. Conduct demolition and modification operations and the removal of equipment and debris to ensure minimum interference with roads, streets, walks both on-site and off-site and to ensure minimum interference with occupied or used facilities.
 - 2. Special attention is directed towards maintaining safe and convenient access to the existing facilities by plant personnel and plant associated vehicles.
 - 3. Do not close or obstruct streets, walks or other occupied or used facilities

SECTION 02050

DEMOLITION AND MODIFICATIONS

without permission from the ENGINEER. Furnish alternate routes around closed or obstructed traffic in access ways.

1.05 RULES AND REGULATIONS

- A. The building Code of the State of Florida shall control the demolition, modification or alteration of the existing buildings or structures.
- B. No building or structure, or any part thereof, shall be demolished until an application has been filed with the Building Inspector and a permit issued. The fee for this permit shall be the CONTRACTOR's responsibility.

1.06 DISPOSAL OR TRANSFER OF MATERIALS

- A. Salvageable material and equipment listed hereinafter shall become the property of the OWNER. Dismantle all such items to a size that can be readily handled and deliver them to a designated storage area.
- B. The following materials and items of equipment shall remain the property of the OWNER and delivered to JEA's service center on the West side of Jacksonville, Florida. Any such material damaged due to improper handling will not be accepted and the replacement value of the material deducted from the payment to the CONTRACTOR. The CONTRACTOR is responsible for dismantling, loading, transport, and unloading of the below noted to the location described above.
 - 1. Existing shed.
- C. Equipment, materials, and components to be demolished, salvaged, and/or disposed of are designated on the Drawings. Items to be disposed of by the CONTRACTOR shall become the CONTRACTOR's property and shall be removed from the site and properly disposed of.
- D. The storage or sale of removed items on the site will not be allowed.

1.07 UTILITIES

- A. Carry out operations so as to avoid interference with operations and work in the existing facilities.
- B. Do not interrupt existing utilities serving occupied or used facilities, except when authorized by the OWNER. Provide necessary bypass during interruptions to existing utilities as acceptable to the OWNER.
- C. Cooperate with the OWNER to shut off utilities serving structures of the existing facilities as required by demolition operations.
- D. Be solely responsible for making all necessary arrangements and for performing any necessary work involved with the discontinuance or interruptions of all public and private utilities or services under the jurisdiction of the utility companies.

SECTION 02050

DEMOLITION AND MODIFICATIONS

1.08 DUST AND NOISE CONTROL

- A. Take all measures necessary to minimize the amount of dust and noise resulting from demolition activity.
- B. Use water sprinkling, temporary enclosures and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with governing regulations pertaining to environmental protection.
 - 1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding and pollution.
 - 2. Clean adjacent structures, facilities, and improvements of dust, dirt and debris caused by demolition operations. Return adjacent areas to conditions existing prior to the start of the work.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 SEQUENCE OF WORK

- A. The sequence of demolition and modifications shall be strictly coordinated with the OWNER and shall comply with the schedule submitted and approved by the OWNER. Refer to Section 01014 for details regarding the sequencing of work.

3.02 GENERAL

- A. All materials and equipment removed from existing work shall become the property of the CONTRACTOR, except for those which the OWNER has identified and marked for his/her use. All materials and equipment marked by the OWNER to remain shall be carefully removed, so as not to be damaged, cleaned and stored on or adjacent to the site in a protected place specified by the ENGINEER or loaded onto trucks provided by the OWNER.
- B. Dispose of all demolition materials, equipment, debris and all other items not marked by the OWNER to remain, off the site and in conformance with all existing applicable laws and regulations.
- C. Pollution Controls
 - 1. Use water sprinkling, temporary enclosures and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with governing regulations pertaining to environmental protection.
 - a. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding and pollution.
 - b. Clean adjacent structures, facilities, and improvements of dust, dirt and debris caused by demolition operations. Return adjacent areas to conditions existing prior to the start of the work.

SECTION 02050

DEMOLITION AND MODIFICATIONS

3.03 STRUCTURAL REMOVALS

- A. Remove structures to the lines and grades shown unless otherwise directed by the ENGINEER. Where no limits are shown, the limits shall be 4-inch outside the item to be installed. The removal of concrete beyond these limits shall be at the CONTRACTOR's expense and these excess removals shall be reconstructed to the satisfaction of the ENGINEER with no additional compensation to the CONTRACTOR.
- B. All concrete, brick, tile, concrete block, roofing materials, reinforcement, structural or miscellaneous metals, plaster, wire mesh and other items contained in or upon the structure shall be removed and taken from the site, unless otherwise approved by the ENGINEER. Demolished items shall not be used in backfill adjacent to structures or in pipeline trenches.
- C. After removal of parts or all of slabs and like work which tie into new work or existing work, the point of junction shall be neatly repaired so as to leave only finished edges and surface exposed.
- D. Remove concrete slabs to a depth of not less than 24 inches below grade.

3.04 MECHANICAL REMOVALS

- A. Mechanical removals shall consist of dismantling and removing of piping, pumps, motors, equipment, and other appurtenances as specified, shown, or required for the completion of the work. It shall include cutting, capping, and plugging as required.
- B. Existing process, water, chemical, gas, fuel oil and other piping not required for the new work shall be removed where shown or where it will interfere with new work.
- C. When underground piping is to be altered or removed, the remaining piping shall be properly capped. Abandoned underground piping may be left in place unless it interferes with new work or is shown or specified to be removed.
- D. Any changes to potable water piping and other plumbing and heating system work shall be made in conformance with all applicable codes and under the same requirements as other underground piping. All portions of the potable water system that have been altered or opened shall be pressure tested and disinfected in accordance with JEA Standards, FDEP requirements and local codes. Other plumbing piping and heating piping shall be pressure tested only.

3.05 ELECTRICAL REMOVALS

- A. Electrical removals shall consist of the removal of existing transformers, distribution switchboards, control panels, variable frequency drives, motors, conduits and wires, poles and overhead wiring, panel boards, lighting fixtures, instrumentation, handholes / manholes, or miscellaneous electrical equipment all as shown on the Drawings, specified herein, or required to perform the work.

SECTION 02050

DEMOLITION AND MODIFICATIONS

- B. All existing electrical equipment and fixtures to be removed shall be removed with such care as may be required to prevent unnecessary damage, to keep existing systems in operation and to maintain the integrity of the grounding systems.
- C. Conduits and wires shall be abandoned or removed which are part of the existing station or electrical modifications. Above grade conduits which serve no purpose in the proposed installation shall be removed in their entirety. All wires in abandoned conduits shall be salvaged and stored as specified or directed by OWNER. Abandoned conduits concealed in floor or ceiling slabs or in walls, shall be cut flush with slab or wall at the point of entrance. The conduits shall be properly plugged and the area repaired in a flush, smooth and approved manner. Exposed conduits and their supports shall be disassembled and removed from the site. Repair all areas of work to prevent rust spots on exposed surfaces.
- D. Where shown or otherwise required, wiring in the underground duct system which serve no purpose in the proposed installation shall be removed in their entirety. All such wiring shall be salvaged and stored as specified or directed by OWNER. Verify the function of all wiring before disconnection and removing it. Ducts which are not to be reused shall be plugged where they enter buildings and made watertight.
- E. Wiring shown to be spared out as shown on the Drawings, shall be pulled back to the nearest junction box or manhole. Wiring ends shall be coiled, taped, and identified with their from / to location for future use.

3.06 CLEAN-UP

- A. Remove from the site all debris resulting from the demolition operations as it accumulates. Upon completion of the work, all materials, equipment, waste and debris of every sort shall be removed and premises shall be left, clean, neat and orderly.
- B. Restore items intended to remain that have been damaged by demolition work at no cost to the OWNER.
- C. Re-grade site, sod, and seed areas as per the Drawings and/or Specifications.

END OF SECTION 02050

SECTION 02100

SITE PREPARATION

PART 1- GENERAL

1.01 SCOPE OF WORK

- A. This Section covers clearing, grubbing and stripping along the construction sites, complete as specified herein.
- B. The CONTRACTOR shall clear and grub all the area within the limits of construction/disturbance or as required to complete the work which includes, but is not limited to, utility easements and project area. The width of the area to be cleared shall be established by the ENGINEER prior to the beginning of any clearing or as shown on the Drawings.

1.02 RELATED WORK

- A. Section 02910 related to Sodding

PART 2- PRODUCTS (NOT USED)

PART 3- EXECUTION

3.01 CLEARING

- A. The surface of the ground, for the area to be cleared and grubbed shall be completely cleared of all timber, brush, stumps, roots, grass, weeds, rubbish and all other objectionable obstructions resting on or protruding through the surface of the ground. However, those trees which are designated by the ENGINEER shall be preserved as hereinafter specified. Clearing operations shall be conducted so as to prevent damage to existing structures and installations, and to those under construction, and so as to provide for the safety of employees and others. Clearing for structures shall consist of topsoil and vegetation removal.

3.02 GRUBBING

- A. Grubbing shall consist of the complete removal of all stumps, roots larger than 1-1/2 inches in diameter, matted roots, brush, timber, logs and any other organic or metallic debris not suitable for foundation purposes, resting on, under or protruding through the surface of the ground to a depth of 18 inches below the subgrade. All depressions excavated below the original ground surface for or by the removal of such objects, shall be refilled with suitable materials and compacted to a density conforming to the surrounding ground surface.

3.03 STRIPPING

- A. In areas so designated, top soil shall be stockpiled. Topsoil so stockpiled shall be protected until it is placed as specified. Any topsoil remaining after all work is in place shall be disposed of by the CONTRACTOR.

SECTION 02100

SITE PREPARATION

3.04 DEMUCKING, BACKFILLING AND SPECIAL COMPACTION REQUIREMENTS

- A. All organic surface soils and muck shall be removed under all structures, tanks, pipes, slabs, roads, and walls, plus a five foot margin all around.
- B. Refer to the geotechnical report for additional details.

3.05 DISPOSAL OF CLEARED, GRUBBED, AND DEMUCKED MATERIAL

- A. The CONTRACTOR shall dispose of all material and debris from the clearing and grubbing operation by hauling such material and debris away to an approved disposal facility. Disposal by burning or burial will not be permitted. The cost of disposal (including hauling) of cleared and grubbed material and debris shall be included in the contract prices.
- B. If the land owner desires the timber or small trees, the CONTRACTOR shall cut and neatly pile it in 4-foot lengths for removal by the land owner; otherwise the CONTRACTOR shall dispose of it by hauling away from the project site.

3.06 PRESERVATION OF TREES

- A. Those trees which are designated on the drawings for preservation shall be carefully protected from damage. The CONTRACTOR shall erect such barricades, guards, and enclosures as may be considered necessary by him for the protection of the trees during all construction operations.

3.07 PRESERVATION OF DEVELOPED PRIVATE PROPERTY

- A. The CONTRACTOR shall exercise extreme care to avoid unnecessary disturbance of developed private property as applicable. Trees, shrubbery, gardens, lawn and other landscaping, which in the opinion of the ENGINEER must be removed, shall be replaced and replanted to restore the construction easement to the condition existing prior to construction.
- B. All soil preparation procedures and replanting operations shall be under the supervision of a nurseryman experienced in such operations.
- C. Improvements to the land such as fences, walls, outbuildings, etc., which of necessity must be removed shall be replaced with equal quality materials and workmanship.
- D. The CONTRACTOR shall clean up the construction site across developed private property directly after construction is completed upon approval of the ENGINEER.

END OF SECTION 02100

SECTION 02140

DEWATERING

PART 1 – GENERAL

1.01 SUMMARY OF WORK

- A. Any dewatering required to perform and complete the work under this Contract is the sole responsibility of the CONTRACTOR and no additional payment will be made. Any dewatering operation(s), overtime, equipment rental or any and all other expenses/costs related to dewatering shall be borne solely by the CONTRACTOR.
- B. Seasonal high groundwater level is estimated to be 12 to 18 inches above the groundwater elevations encountered at the time of the borings, but may exceed this elevation during periods of rainfall. Dewatering likely will be required for some excavation/grading, structures, and piping that extend below existing grade. More detailed information on expected groundwater levels are contained in the geotechnical report from Meskel & Associates Engineering provided in **Appendix A**.

1.02 RELATED WORK

- A. Section 02220 – Excavating, Backfilling, and Grading for Structures
- B. Section 02221 – Trenching, Bedding, and Backfilling for Pipes

1.03 SUBMITTALS

- A. Provide a dewatering plan in accordance with Section 01300 which addresses the dewatering activities to be employed by the CONTRACTOR of each structure.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. The CONTRACTOR shall furnish all materials and equipment necessary to carry out all dewatering required to perform and complete all work under this contract.

PART 3 - EXECUTION

3.01 GENERAL

- A. At all times, the CONTRACTOR is to maintain and operate proper and adequate surface and subsurface dewatering in order to keep the construction site dry and in such condition that construction of structures and utilities and placement and compaction of fill and backfill may proceed unhindered by saturation of the area. The CONTRACTOR shall maintain existing drainage at all times to allow for unimpeded, continuous drainage. Any temporary drainage shall be done in such a manner as to NOT impact existing structures, surface waters, existing drainage or construction operations in an adverse manner as determined by the ENGINEER.
- B. The CONTRACTOR is to prevent surface water and subsurface or groundwater from flooding or spilling into excavations, and from flooding the project site or surrounding area. CONTRACTOR is to remove all water in order to prevent softening of structure

SECTION 02140

DEWATERING

or pipe foundation bottoms, undercutting footings, and creating soil consistency changes detrimental to the stability of sub grades and foundations. The CONTRACTOR is further to provide and maintain pumps, well points, sumps, suction and discharge lines, or other dewatering system components necessary to convey all water away from excavations.

- C. The CONTRACTOR is to obtain, at his own cost, any permits required for construction dewatering.
- D. Any and all discharges shall be in compliance with local, state and federal laws, regulations and guidelines including FAC Chapter 62-621.300. All water collected from construction activities shall be contained on site. The CONTRACTOR shall obtain any required permits related to dewatering, and no separate payment for permit fees will be made.
- E. CONTRACTOR shall discuss any and all discharges with the OWNER and ENGINEER prior to proceeding with permits and actual discharge operations. No discharges shall be allowed without the required permits approved and on site. Furnish a copy of all permits to OWNER and ENGINEER for their records.
- F. Where dewatering will occur in the vicinity of structures, the CONTRACTOR shall monitor for adverse effects to structures or wells due to dewatering and shall be responsible to remedy same to the satisfaction of the State and/or authorities having jurisdiction. Discharges from dewatering activities which contain silt or hydrogen sulfide are subject to the following controls:
 - 1. All discharges from dewatering activities to surface waters, wetlands or storm sewers shall be free of sediments. Care shall be taken not to damage or kill vegetation by excessive watering or by damaging silt accumulation in the discharge area. If discharges are sediment laden, techniques shall be employed to remove sediment prior to discharge including construction of a sedimentation basin where necessary to protect vegetation and to achieve environmental objectives.
 - 2. Sewer inlets within construction areas shall be protected with perimeter hay bales or with other permit-approved inlet protection as approved by the ENGINEER or OWNER.

END OF SECTION 02140

SECTION 02220

EXCAVATING, BACKFILLING, AND GRADING FOR STRUCTURES

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. This Section includes excavation, filling, and grading to attain the subgrades and grades indicated on the Drawings.
- B. Supplemental foundation and site preparation notes are indicated on the Drawings. Extensive grubbing and site preparation will be required for this project.
- C. Furnish and install temporary excavation support systems, including sheeting, shoring, and bracing, to ensure the safety of personnel and protect adjacent structures, piping, etc., in accordance with Federal, State and local laws, regulations, and requirements.
- D. Furnish and install temporary dewatering and surface water control systems and operate to dewater and maintain in a dry condition. Control drainage into excavations and remove seepage water and rainwater.
- E. All excavation and backfill for structures, utilities, and pavements shall be in accordance with the geotechnical engineering report. The geotechnical report for this project is included as **Appendix A**. Where discrepancies exist between this specification and the referenced geotechnical report, the referenced geotechnical report shall take precedence if more restrictive.
- F. The CONTRACTOR shall be responsible for calculating the required cut and fill calculations for the entire site. All new fill or reuse of soils on the site for fill shall meet the requirements of Sections 02220 and 02221. All hauling costs and subsequent backfill and compaction shall be by the CONTRACTOR.
- G. The soils beneath and up to 5 feet around the perimeter of the proposed ground storage tanks (2 GST total) shall be excavated 6 inches from existing grade. The excavated material shall be removed, dewatered, hauled, and disposed of in an approved landfill or State of Florida approved disposal facility. The cost for this excavation, stockpiling, dewatering, loading, hauling, and disposal shall be included in the CONTRACTOR's base bid. No additional payment for this work will be considered.

1.02 RELATED WORK

- A. Section 01410: Testing and Testing Laboratory Services
- B. Section 02100: Site Preparation
- C. Section 02140: Dewatering
- D. Section 02221: Trenching Bedding, Backfill for Pipes, and Site Earthwork

1.03 QUALITY ASSURANCE

SECTION 02220

EXCAVATING, BACKFILLING, AND GRADING FOR STRUCTURES

- A. Codes and Standards: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.
- B. Testing and Inspection Service:
 - 1. The CONTRACTOR shall engage soil testing and inspection service for quality control testing during earthwork operations. See Section 01410 for additional details.
- C. All excavation, trenching, sheeting, bracing shall comply with the requirements of OSHA excavation safety standards (29 CFR Part 1926.650 Subpart P), State of Florida "Trench Safety Act" (Part IV, Chapter 553 of the Florida Statutes) and local requirements. Where conflict between OSHA, State and local requirements exists, the most stringent requirements shall apply.

1.04 SUBMITTALS

- A. Submit, in accordance with Section 01300, an excavation work plan that includes the proposed methods of construction, including earthwork operations, excavation limits, slopes, ramp access, fill material moisture conditioning and handling, compaction equipment, and material sources for the various portions of the work.
- B. Coordinate this submittal with the requirements of dewatering and support of excavation submittals.

1.05 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM D698 – Test Method for Laboratory Compaction Characteristics of Soils Using Standard Efforts.
 - 2. ASTM D1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu ft (2,700kN-m/cu m)).
 - 3. ASTM D 2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.06 QUALITY ASSURANCE

- A. At all structures, prior to the placement of bedding material, concrete work mats, structural fill or structural concrete, coordinate with the soils testing laboratory to verify the suitability of the existing subgrade soil and to perform in-place soil density tests as required to verify that the compaction of the subgrade is sufficient.
- B. Prior to and during the placement of backfill and fill coordinate with the soils testing laboratory to perform in-place soil density tests to verify that the backfill/fill material has been compacted in accordance with the compaction requirements specified elsewhere. The ENGINEER may designate areas to be tested.

SECTION 02220

EXCAVATING, BACKFILLING, AND GRADING FOR STRUCTURES

1.07 DEFINITIONS

- A. Where the phrase "in-the-dry" is used in this Section, it shall be defined to mean a soil condition such that the in-place moisture content of the soil at that time is no more than two percentage points above the optimum moisture content of that soil as determined by the laboratory test of the moisture-density relation appropriate to the specified level of compaction.
- B. Where used in this Section "structures" refers to all buildings, wet wells, manholes and below grade vaults. Stormwater structures and duct banks are not considered structures in this context.

1.08 JOB CONDITIONS

- A. The CONTRACTOR shall examine the site taking into consideration all conditions that may affect his work. The OWNER and ENGINEER will not assume responsibility for variations of sub-soil quality or conditions.
- B. Existing Utilities: Locate existing underground utilities in the areas of work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.
 - 1. Should unidentified, or incorrectly identified, piping or other utilities be encountered during excavation, consult the ENGINEER and the OWNER of such piping or utility immediately for directions.
 - 2. Cooperate with OWNER and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility OWNER.
 - 3. Demolish and completely remove from site existing underground utilities indicated to be removed.
- C. Protection of Persons and Property
 - 1. Barricade open excavations occurring as part of this work and post with warning lights. Operate warning lights as recommended by authorities having jurisdiction.
 - 2. Protect structures, utilities, sidewalks, pavements, and other facilities from possible damage which may result from settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

PART 2 – PRODUCTS

2.01 SOIL MATERIALS

- A. Definitions:
 - 1. Backfill and Fill Materials: Satisfactory soil materials for this project are defined as a non-plastic, inorganic, granular soil having less than 12 percent material passing the No. 200 mesh sieve and containing less than 4 percent organic material.

SECTION 02220

EXCAVATING, BACKFILLING, AND GRADING FOR STRUCTURES

PART 3 – EXECUTION

3.01 INSPECTION

- A. Examine the areas and conditions under which excavating, filling, and grading are to be performed. Notify the ENGINEER of any unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected.
- B. Examine and accept existing grade of all structures prior to commencement of work and report to ENGINEER if elevations of existing subgrade varies from elevations shown on Drawings.

3.02 EXCAVATION

- A. Excavation consists of the removal and disposal of material encountered when establishing required grade elevations.
- B. Excavation classifications: The following classifications of excavation will be made when unanticipated rock excavation or unclassified excavation is encountered in the work. Do not perform such work until material to be excavated has been cross-sectioned and classified by ENGINEER or specialized geotechnical consultant.
 - 1. Authorized earth excavation includes removal and disposal of pavements and other obstructions visible on ground surface, underground structures and utilities indicated to be demolished and removed, material of any classification indicated in soil boring data on subsurface conditions, and other materials encountered that are not classified as rock excavation or unauthorized excavation.
 - 2. Unauthorized excavation consists of removal of material beyond the limits needed to establish required grade and subgrade elevations without specific direction of ENGINEER. Unauthorized excavation, as well as remedial work directed by the ENGINEER shall be at the CONTRACTOR'S expense.
 - a. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending the indicated bottom elevation of the footing or base to the excavation bottom, without altering required top elevation. Lean (unreinforced) concrete fill may be used to bring bottom elevations to proper position, when acceptable to ENGINEER.
 - b. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by ENGINEER.
- C. Additional Excavation: When excavation has reached required subgrade elevations, notify the ENGINEER or RPR who will inspect conditions.
 - 1. If unsuitable bearing materials are encountered at the required subgrade elevations, carry excavations deeper and replace the excavated material as directed by the ENGINEER.
- D. Stability of Excavations: Slope sides of excavations to comply with local codes and ordinances having jurisdiction or as shown on the Drawings. Shore and brace where sloping is not possible because of space restrictions or stability of material

SECTION 02220

EXCAVATING, BACKFILLING, AND GRADING FOR STRUCTURES

excavated.

1. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.
- E. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition.
1. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction. Provide design drawings of all shoring and bracing signed and sealed by a Registered Professional ENGINEER in the state of Florida.
 2. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.
- F. Dewatering: The CONTRACTOR is solely responsible for all dewatering methods and providing proper equipment to perform such actions. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
1. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations. Maintain groundwater table level a minimum of two-foot below excavation level.
 2. Convey water removed from excavations and rain water to collecting or run-off areas. Establish and maintain temporary drainage ditches and other diversions outside excavation limits for each structure. Do not use trench excavations as temporary drainage ditches.
 3. While dewatering for new construction near existing structures, depletion of the groundwater level underneath these existing structures may cause settlement. To avoid this settlement, the groundwater level under these structures shall be maintained by appropriate methods of construction as approved by the ENGINEER.
- G. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.
1. Locate and retain soil materials away from edge of excavations.
 2. Dispose of excess soil material and waste materials as herein specified.
 3. All stockpiled materials shall be properly segregated based on usage and tested prior to use by the testing firm onsite.
- H. Excavation for Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 feet, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection, or as shown on the Drawings.

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EXCAVATING, BACKFILLING, AND GRADING FOR STRUCTURES

1. In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive concrete.
- I. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

3.03 COMPACTION

- A. Unless otherwise specified in the geotechnical report, the prepared subgrade must meet the following minimum compaction requirements. In the event a discrepancy exists between this paragraph and the geotechnical report, the ENGINEER shall be notified immediately, and the strictest recommendations shall govern.
 1. Mat Foundation Structures: Mat foundation bearing soils should be compacted to at least 98 percent of the soils modified Proctor maximum density, to a depth of at least 2 feet below the foundation bearing level.
 2. Lawn or Unpaved Areas: Compact top 6-inches subgrade and each layer of backfill or fill.
 3. Walkways: Compact top 6-inches of subgrade to 98 percent maximum dry density.
 4. Pavements and Steps: Compact top 6-inches of subgrade to 98 percent maximum dry density.

3.04 STRUCTURAL BACKFILL AND FILL SOILS

- A. General: Place material in layers to required subgrade elevations, for each area classification listed below.
 1. In excavations, use satisfactory excavated or borrow material.
 2. Under grassed areas, use satisfactory excavated or borrow material.
 3. Under walks and pavements, use subbase material.
- B. Backfill excavations as promptly as work permits, but not until completion of the following:
 1. Acceptance by ENGINEER of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
 2. Inspection, testing, approval, and recording locations of underground utilities.
 3. Removal of concrete formwork.
 4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials.
 5. Removal of trash and debris.
 6. Permanent or temporary horizontal bracing is in place on horizontally supported walls. Layout and location of bracing shall consider loads of the structure as well as the effects of the soil and groundwater.
- C. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow strip, or break-up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

SECTION 02220

EXCAVATING, BACKFILLING, AND GRADING FOR STRUCTURES

1. When existing ground surface has a density less than that specified under "Compaction" for the particular area classification, break up the ground surface, pulverize, moisture-condition to the optimum moisture content, and compact to required depth and percentage of maximum density.
- D. Placement and Compaction: Place structural backfill and fill materials in layers not more than 12-inches loose depth for material compacted by vibratory drum roller equipment as specified in the geotechnical report, and not more than 8-inches loose depth for material compacted if the roller is operated in the static mode. If hand-held compaction equipment is used, the lift thickness should be reduced further to 6-inches.
 1. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content. Compact each layer to required percentage of the modified Proctor maximum dry density specified. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
 2. Place backfill and fill materials evenly adjacent to structures, to required elevations. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around structure to approximately same elevation in each lift.
 3. Large compaction equipment shall not be used within 5 feet of walls.

3.05 GRADING

- A. General: Uniformly grade areas within limits of grading under this Section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.
- B. Grading Outside Building Lines: Grade areas adjacent to building lines, as shown on the Drawings, to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes, and as follows:
 1. Lawn or Unpaved Areas: Finish areas to within not more than 0.10 feet above or below the required elevation.
 2. Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 0.10 feet above or below the required subgrade.
- C. Grading Surface of Fill Under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2-inch when tested with a 10-foot straightedge.
- D. Compaction:
 1. After grading, compact subgrade surfaces to the depth and percentage of modified Proctor maximum dry density and/or the standard maximum dry density specified.

SECTION 02220

EXCAVATING, BACKFILLING, AND GRADING FOR STRUCTURES

3.06 FIELD QUALITY CONTROL

- A. Quality Control Testing During Construction: Allow testing service to inspect and approve subgrades and fill layers before further construction work is performed.
- B. If in opinion of ENGINEER, based on testing service reports and inspection, subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no additional expense.

3.07 MAINTENANCE

- A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
 - 1. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
- B. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

3.08 DISPOSAL OF SURPLUS AND WASTE MATERIAL

- A. All surplus and/or unsuitable excavated material shall be disposed of in one of the following ways as directed by the ENGINEER.
 - 1. Transport to soil storage area on OWNER's property and stockpile or spread as directed by the ENGINEER.
 - 2. Transport from OWNER's property and legally dispose of at an approved disposal facility. Any permit required for the hauling and disposing of this material beyond OWNER's property shall be obtained prior to commencing hauling operations.

END OF SECTION 02220

SECTION 02221

TRENCHING, BEDDING, BACKFILL FOR PIPES, AND SITE EARTHWORK

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. The CONTRACTOR shall furnish all labor, materials, equipment, and incidentals necessary to perform all excavation, backfill, fill, grading and slope protection required to complete the piping work shown on the Drawings and specified herein. The work shall include, but not necessarily be limited to: manholes, vaults, duct conduit, pipe, roadways and paving, and general site earthwork; all backfilling, fill and required borrow; grading; disposal or surplus and unsuitable materials; and all related work such as sheeting, bracing, and water handling.
- B. Furnish and install temporary excavation support systems, including sheeting, shoring and bracing, to ensure the safety of personnel and protect adjacent structures, piping, etc., in accordance with Federal, State and local laws, regulations, and requirements.
- C. Furnish and install temporary dewatering and surface water control systems and operate to dewater and maintain in-a-dry condition. Control drainage into excavations and remove seepage water and rainwater.
- D. All excavation and backfill for structures, utilities, and pavements shall be in accordance with the geotechnical engineering report. The geotechnical report for this project is included as **Appendix A**. Where discrepancies exist between this specification and the referenced geotechnical report, the referenced geotechnical report shall take precedence.
- E. The CONTRACTOR shall be responsible for calculating the required cut and fill calculations for the entire site. All new fill or reuse of soils on the site for fill shall meet the requirements of Sections 02220 and 02221. All hauling costs and then subsequent backfill and compaction shall be by the CONTRACTOR.
- F. The soils beneath and up to 5 feet around the perimeter of the proposed ground storage tanks (two GST total) shall be excavated 6 inches from existing grade. The excavated material shall be removed, dewatered, hauled, and disposed of in an approved landfill or State of Florida approved disposal facility. The cost for this excavation, stockpiling, dewatering, loading, hauling, and disposal shall be included in the CONTRACTOR's base bid. No additional payment for this work will be considered.

1.02 RELATED WORK

- A. Section 02100: Site Preparation
- B. Section 02140: Dewatering
- C. Section 02220: Excavating, Backfilling, and Grading for Structures

SECTION 02221

TRENCHING, BEDDING, BACKFILL FOR PIPES, AND SITE EARTHWORK

1.03 TRENCH PROTECTION

- A. The CONTRACTOR shall construct and maintain sheeting and bracing as required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect adjacent structures, existing piping and/or foundation material from disturbance, under-mining, or other damage. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed they shall be immediately filled and rammed.
- B. For pipe trench sheeting, no sheeting is to be withdrawn if driven below mid-diameter of any pipe, and no wood sheeting shall be cut off at a level lower than 1 foot above the top of any pipe unless otherwise directed by the ENGINEER. If during the progress of the work the ENGINEER decides that additional wood sheeting should be left in place, he may direct the CONTRACTOR in writing. If steel sheeting is used for trench sheeting, removal shall be as specified above, unless written approval is given by the ENGINEER for an alternate method of removal.
- C. All sheeting and bracing not left in place shall be carefully removed in such a manner as not to endanger the construction or other structures, utilities, existing piping, or property. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools especially adapted to that purpose, by watering or otherwise as may be directed.
- D. The right of the ENGINEER to order sheeting and bracing left in place shall not be construed as creating any obligation on his part to issue such orders, and his failure to exercise his right to do so shall not relieve the CONTRACTOR from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the CONTRACTOR to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

1.04 JOB CONDITIONS

- A. The CONTRACTOR shall examine the site and review the available test borings or undertake his own soil borings prior to submitting his bid, taking into consideration all conditions that may affect his work. The OWNER and ENGINEER will not assume responsibility for variations of sub-soil quality or conditions at locations other than places shown at the time the investigation was made.
- B. Existing Utilities: Locate existing underground utilities in the areas of work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.
 - 1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult the ENGINEER and the OWNER of such piping or utility immediately for directions.
 - 2. Cooperate with OWNER and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility OWNER.

SECTION 02221

TRENCHING, BEDDING, BACKFILL FOR PIPES, AND SITE EARTHWORK

3. Demolish and completely remove from site existing underground utilities indicated on the Drawings to be removed.
- C. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights. Operate warning lights as recommended by authorities having jurisdiction.
 1. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

1.05 SUBMITTALS

- A. If requested by the ENGINEER, the CONTRACTOR shall furnish a representative sample of fill material obtained from onsite or offsite sources weighing approximately 50 pounds for approval, at least ten calendar days prior to the date of anticipated use of such material. For each material obtained from other than onsite sources, the CONTRACTOR shall notify the ENGINEER of the source of the material.
- B. All temporary shoring and bracing shall be designed by a specialty ENGINEER and system design/details shall be submitted to the ENGINEER of record for review and approval; submittals shall be signed and sealed by a registered ENGINEER licensed in the state of Florida. Submit in accordance with Section 01300.

1.06 REFERENCED STANDARDS

- A. American Society for Testing and Materials (ASTM)
 1. ASTM D75 – Standard Practice for Sampling Aggregates
 2. ASTM D698 – Test Method for Laboratory Compaction Characteristics of Soils Using Standard Efforts.
 3. ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
 4. ASTM D2167 – Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
 5. ASTM D1557 - Test Method for Laboratory Compaction Characteristics of Soils Using Modified Effort (56,000 ft-lbf/cu ft (2,700kN-m/cu m)).
 6. ASTM D2487 – Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 7. ASTM D2922 – Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods
- B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

SECTION 02221

TRENCHING, BEDDING, BACKFILL FOR PIPES, AND SITE EARTHWORK

PART 2 – GENERAL

2.01 SOIL MATERIALS

A. General

1. Materials for use as base fill and backfill shall be as described below.
 - a. Satisfactory soil materials are defined as those complying with American Association of State Highway and Transportation Officials (AASHTO) M-145, soil classification Groups A-1, A-2-4, A-2-5 and A-3.
 - b. Unsatisfactory soil materials are those defined in AASHTO M-145 soil classification Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 along with peat and other highly organic soils.

B. Structural Fill

1. Structural fill material shall be satisfactory soil material consisting of a minimum of 60 percent clean medium to fine grain sized quartz sand, free of organic, deleterious and/or compressible material, having less than 10 percent material passing the No. 200 mesh sieve and containing less than 4 percent organic material. Rock in excess of 2-1/2 inches in diameter shall not be used in the fill material. Structural fill shall not contain hardpan, stones, rocks, cobbles or other similar materials.

C. Common Fill

1. Common fill material shall be satisfactory soil material containing no more than 20 percent by weight finer than No. 200 mesh sieve. It shall be free from organic matter, muck, marl, and rock exceeding 2-1/2 inches in diameter. Common fill shall not contain broken concrete, masonry, rubble or other similar materials.
2. Material falling within the above specification, encountered during the excavation, may be stored in segregated stockpiles for reuse. All material which, in the opinion of the ENGINEER, is not suitable for reuse shall be spoiled as specified herein for disposal of unsuitable materials.

D. Rock Bedding

1. Rock bedding shall be 3/8-inch to 3/4-inch washed and graded limerock. This rock shall be graded so that 99 percent will pass a 3/4-inch screen and 80 percent will be retained on a No. 8 screen.

PART 3 – EXECUTION

3.01 GENERAL

- A. All excavation, backfill and grading necessary to complete the work shall be made by the CONTRACTOR and the cost thereof shall be included in the contract price.
- B. Material shall be furnished as required from offsite sources and hauled to the site.

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- C. The CONTRACTOR shall take all the necessary precautions to maintain the work area in a safe and workable condition.
- D. The CONTRACTOR shall protect his work always by flagging, marking, lighting and barricading. It shall also be the CONTRACTOR's responsibility to preserve and protect all above and underground structures, pipe lines, conduits, cables, drains or utilities which are existing at the time he encounters them. Failure of the Drawings to show the existence of these obstructions shall not relieve the CONTRACTOR from this responsibility. The cost of repair of any damage which occurs to these obstructions during or because of construction shall be borne by the CONTRACTOR without additional cost to the OWNER.

3.02 TRENCH EXCAVATION

- A. All trench excavations shall be protected in accordance with Occupational Safety and Health Standards - Excavation, 29 CFR Part 1928, dated October 29, 1989 and the Florida Trench Safety Act.
- B. Excavation for all trenches required for the installation of pipes and electrical ducts shall be made to the depths indicated on the Drawings. Excavate trench to provide a minimum of 30-inch clear cover over the pipe bell unless otherwise noted on the Drawings. Excavate in such manner and to such widths as will give suitable room for laying the pipe or installing the ducts within the trenches, for bracing and supporting and for pumping and drainage facilities. The trench width at the top of the pipe shall not exceed the allowable as determined by the depth of cut and indicated on the Drawings.
- C. Rock shall be removed to a minimum 8-inches clearance around the bottom and sides of all the pipe or ducts being laid.
- D. Where pipe or ducts are to be laid in limerock bedding or encased in concrete the trench may be excavated by machinery to or just below the designated subgrade provided that the material remaining in the bottom of the trench is no more than slightly disturbed.
- E. Where the pipes or ducts are to be laid directly on the trench bottom the lower part of the trenches shall not be excavated to the trench bottom by machinery. The last of the material being excavated shall be done manually in such a manner that will give a flat bottom true to grade so that pipe or duct can be evenly and uniformly supported along its entire length on undisturbed material or bedding rock. Bell holes shall be made as required manually so that there is no bearing surface on the bells and pipes are supported along the barrel only.
- F. The bottom of the excavations shall be firm and dry and in all respects acceptable to the ENGINEER. Excavate any organic soil material from the bottom of the trench and replace with rock bedding, at least 6 inches thick.

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TRENCHING, BEDDING, BACKFILL FOR PIPES, AND SITE EARTHWORK

3.03 PIPE INTERFERENCES AND ENCASEMENT

- A. In no case shall there be less than 0.5 feet between any two pipe lines or between pipe lines and structures.
- B. Wherever there is more than 0.5 foot but less than 1.0-foot clearance between any two pipes, or between pipes and structures, then a concrete encasement shall be provided in accordance with the typical detail as shown on the Drawings.
- C. Provide concrete encasement of piping under structures as per the detail on the Drawings.
- D. The ENGINEER shall have full authority to direct the placement of the various pipes and structures to facilitate construction, expedite completion and to avoid conflicts.

3.04 BACKFILLING

- A. Backfilling over pipes shall begin as soon as practicable after the pipe has been laid, jointed, and inspected and the trench filled with suitable compacted material to the mid-diameter of the pipe.
- B. Backfilling over ducts shall begin not less than three days after placing concrete encasement.
- C. All backfilling shall be prosecuted expeditiously and as detailed on the Drawings.
- D. Any space remaining between the pipe and sides of the trench shall be packed full by hand shovel with selected earth, free from stones having a diameter greater than 2-inches and thoroughly compacted with a tamper as fast as placed, up to a level of one foot above the top of the pipe. Compact to 95 percent maximum density (ASTM D1557) in layers not to exceed 4 inches up to the centerline of the pipe from the trench bottom and in layers not to exceed 6 inches from the pipe centerline to 12 inches above the pipe.
- E. The filling shall be carried up evenly on both sides with at least one man tamping for each man shoveling material into the trench.
- F. The remainder of the trench above the compacted backfill, as just described above, shall be filled and thoroughly compacted with common fill by rolling, ramming, or puddling, as the ENGINEER may direct. Compact common fill in 6-inch layers to 95 percent maximum density (ASTM D1557).
- G. The bedding rock in muck areas shall consist of at least 6 inches of washed and graded limerock placed in the trench to the proposed elevation of the centerline of the pipe prior to any pipe laying. This bedding shall not be used under any circumstances as a drain for ground water. The CONTRACTOR shall take all precautions necessary to maintain the bedding in a compacted state and to prevent washing, erosion or loosening of this bed.

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- H. In locations where pipes pass through building walls, the CONTRACTOR shall take the following precautions to consolidate the refill up to an elevation of at least 1 foot above the bottom of the pipes:
 - 1. Place structural fill in such areas for a distance of not less than 3 feet either side of the center line of the pipe in level layers not exceeding 6-inches in depth.
 - 2. Wet each layer to the extent directed and thoroughly compact each layer with a power tamper to the satisfaction of the ENGINEER.

3.05 GRADING

- A. Grading shall be performed at such places as are indicated on the Drawings, to the lines, grades, and elevations shown or as directed by the ENGINEER and shall be made in such a manner that the requirements for formation of embankments can be followed. All unacceptable material encountered, of whatever nature within the limits indicated, shall be removed and disposed of as directed. During the process of excavation, the grade shall be maintained in such condition that it will be well drained at all times. When directed, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the prosecution or condition of the work.
- B. Shape the surface of earthwork to conform to lines, grades and cross sections that existed prior to beginning work or as shown on the drawings, within 1/10 of a foot. Round tops of banks to circular curves to not less than a 6-foot radius. Neatly and smoothly trim rounded surfaces. Do not overexcavate and backfill to achieve the proper grade.
- C. Overall area grading for which no grades area indicated shall be addressed as follows: Within the limits of construction and outer limits of clearing and grubbing, all holes and other depressions shall be filled, all mounds and ridges cut down, and the area brought to sufficiently uniform control so that the OWNER'S subsequent mowing operation will not be hindered by irregular terrain. This work shall be done regardless of whether the irregularities were the result of the CONTRACTOR'S operations or originally existed.
- D. If at the time of excavation, it is not possible to place any material in its proper section of the permanent structure, it shall be stockpiled in approved areas for later use. No extras will be considered for the stockpiling or double handing of excavated material.
- E. The right is reserved to make minute adjustments or revisions in lines or grades if found necessary as the work progresses, due to discrepancies on the Drawings or to obtain satisfactory construction.
- F. Stones or rock fragments larger than 2-1/2-inches in their greatest dimensions will not be permitted in the top 6-inches of the subgrade line of all dikes, fills or embankments.
- G. All fill slopes shall be uniformly dressed to the slope, cross-section and alignment shown on the Drawings, or as directed by the ENGINEER.

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- H. In cuts, all loose or protruding rocks on the back slopes shall be barred loose or otherwise removed to line or finished grade of slope. All cut and fill slopes shall be uniformly dressed to the slope, cross-section and alignment shown on the Drawings or as directed by the ENGINEER.
- I. No grading is to be done in areas where there are existing pipe lines that may be uncovered or damaged until such lines which must be maintained are relocated, or where lines are to be abandoned, all required valves are closed and drains plugged at manholes.
- J. The CONTRACTOR shall replace all pavement cut or otherwise damaged during the progress of the work as specified elsewhere herein.

3.06 COMPACTION

- A. Unless otherwise specified or shown on the drawings, areas outside pipe trenches must meet the following compaction requirements.
 - 1. Subgrade Underfill or Backfill: 95% relative density to a depth of 12 inches.
 - 2. Backfill or Fill Under Pavement: 98% relative density in 12-inch maximum layers.
 - 3. All Other Areas: 95% relative density in 12-inch maximum layers.
- B. Compact by using methods acceptable to the Engineer (powered tampers, vibrators, etc.). Flooding or puddling with water to consolidate backfill is not acceptable, except where sand is encountered and the specified density can be obtained using this method.
- C. During the compacting operations, maintain material within $\pm 2\%$ of optimum moisture. Aerate material containing excessive moisture by blading, discing, or harrowing to hasten the drying process.
- D. If any field density tests are below the specified relative density, recompact or re-excavate, rebackfill and recompact the area until the specific density is obtained. Make a minimum of two field density tests per recompact and/or re-excavated area.

3.07 DISPOSAL OF UNSUITABLE AND SURPLUS MATERIAL

- A. All surplus and/or unsuitable excavated material shall be disposed of in one of the following ways as directed by the ENGINEER.
 - 1. Transport to soil storage area on OWNER's property and stockpile or spread as directed by the ENGINEER.
 - 2. Transport from OWNER's property and legally dispose of. Any permit required for the hauling and disposing of this material beyond OWNER's property shall be obtained prior to commencing hauling operations.

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3. Suitable excavated material may be used for fill if it meets the specifications for common fill and is approved by the ENGINEER. Excavated material so approved may be neatly stockpiled at the site where designated by the ENGINEER provided there is an area available where it will not interfere with the operation of the facility nor inconvenience traffic or adjoining property OWNERS.

END OF SECTION 02221

SECTION 02400

GRADED AGGREGATE BASE

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and other Specification Sections, apply to the work of this section.

1.02 DESCRIPTION OF WORK

- A. This item shall consist of a base course of graded aggregate for all asphaltic roadways and concrete constructed on a subgrade prepared in accordance with the specifications and in conformity with the line, grades, and typical cross-section as shown on the Drawings.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Use graded aggregate material which yields a satisfactory mixture meeting all the requirements of these Specifications after it has been crushed and processed as a part of the mining operations.
- B. The CONTRACTOR may furnish the material in two sizes of such gradation that, when combined in a central mix plant pugmill, the resultant mixture meets the required specifications.
- C. Use graded aggregate base material of uniform quality throughout, substantially free from organic matter, shale, lumps and clay balls, and having a limerock bearing ratio (LBR) value of not less than 100. Use material retained on the No. 10 sieve composed of aggregate meeting the following requirements:

Soundness Loss, Sodium, Sulfate: AASHTO T104

15 Percent Wear: AASHTO T 96 (Grading A)

Group 1 Aggregates: 45 Percent

Group 2 Aggregates: 65 Percent

Group 1: This group of aggregates is composed of limestone, marble, or dolomite.

Group 2: This group of aggregates is composed of granite, gneiss, or quartzite. Use graded aggregate base material meeting the following gradation:

Sieve Size	Percent by Weight Passing
2 inch	100
1 1/2 inch	95 to 100
3/4 inch	65 to 90
3/8 inch	45 to 75
No. 4	35 to 60

SECTION 02400

GRADED AGGREGATE BASE

No. 10	25 to 45
No. 50	5 to 25
No. 200	0 to 10

1. For Group 1 aggregates, ensure that the fraction passing the No. 40 sieve has a Plasticity Index (AASHTO T90) of not more than 4.0 and a Liquid Limit (AASHTO T89) of not more than 25, and contains not more than 67 percent of the weight passing the No. 200 sieve.
2. For Group 2 aggregates, ensure that the material passing the No. 10 sieve has a sand equivalent (AASHTO T 176) value of not less than 28.
3. The CONTRACTOR may use graded aggregate of either Group 1 or Group 2, but only use one group on this project. (Graded aggregate may be referred to hereinafter as "aggregate".)

PART 3 - EXECUTION

3.01 TRANSPORTING GRADED AGGREGATE

- A. The graded aggregate shall be transported to the point where it is to be used, over aggregate previously placed if practical, and dumped on the end of the preceding spread.

3.02 SPREADING GRADED AGGREGATE

- A. Method of Spreading: The graded aggregate shall be spread uniformly. All segregated areas of fine or coarse aggregate shall be removed and replaced with properly graded aggregate. The aggregate shall be spread by mechanical rock spreaders, equipped with a device which strikes off the aggregate uniformly to laying thickness, and capable of producing an even distribution of the aggregate. For crossovers, intersections and ramp areas; for roadway widths of 20 feet or less; for the main roadway area when forms are used and for any other areas where the use of a mechanical spreader is not practicable; spreading may be done by bulldozers or blade graders. All equipment for proper construction of this project shall be in first- class working condition.
- B. Number of Courses: When the specified compacted thickness of the base is greater than six inches, the base shall be constructed in two courses. The thickness of the first course shall be approximately one-half the total thickness of the finished base, or enough additional material added to bear the weight of the construction equipment without disturbing the Subgrade. When compacted thickness is six inches or less, graded aggregate shall be placed in one lift.

3.03 COMPACTING AND FINISHING BASE

- A. Single-Course Base: For single-course base, after the spreading is completed, the entire surface shall be scarified and then shaped so as to produce the required grade and cross-section, free of scabs and laminations, after compaction.

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GRADED AGGREGATE BASE

- B. **Multiple-Course Base:** For multiple-course base, the first course shall be cleaned of foreign material and bladed and brought to a surface cross-section approximately parallel to that of the finished base. Prior to the spreading of any material for the upper course, the density tests for the lower course shall be made, and the ENGINEER shall have proof that the required compaction has been obtained.
After the spreading of the material for the second course is completed, its surface shall be finished and shaped so as to produce the required grade and cross-section after compaction, and free of scabs and laminations.
- C. **Moisture Content:** When the material does not have the proper moisture content to ensure the required density, wetting or drying will be required. When water is added, it shall be uniformly mixed-in by disking to the full depth of the course which is being compacted. Water shall be added before beginning compaction operations. Wetting or drying operations shall involve manipulation, as a unit, of the entire width and depth of the course which is being compacted. This shall be performed utilizing the speedy moisture meter.

3.04 DENSITY REQUIREMENTS

- A. As soon as proper conditions of moisture are attained, the material shall be compacted to a density of not less than 100 percent of the modified proctor maximum density as determined by AASHTO T-180 (Modified Proctor).

3.05 TESTING SURFACE, PROTECTION, AND MAINTENANCE

- A. **Density Tests:** A minimum of at least one field density test on each course of compacted base shall be performed for every 500 square yards, or every 300 linear feet of road pavement, or as directed by the ENGINEER. Additional tests may be made if deemed necessary by the ENGINEER and/or OWNER.
- B. During final compacting operations, if blading of any areas is necessary to obtain the true grade and cross-section, the compacting operations for such areas shall be completed prior to making the density tests on the finished base.
- C. **Correction of Defects: Contamination of Base Material:** If, at any time, the subgrade material should become mixed with the base course materials, the CONTRACTOR shall, without additional compensation, dig out and remove the mixture, reshape, and compact the subgrade and replace the materials removed with clean base material, which shall be shaped and compacted as specified above.
- D. **Cracks and Checks:** If cracks or checks appear in the base, either before or after priming, which in the opinion of the ENGINEER, would impair the structural efficiency of the base, the CONTRACTOR shall remove the cracks or checks by re-scarifying, reshaping, adding base material where necessary, and re-compacting, without additional compensation.
- E. **Compaction of Widening Strips:** Where base construction consists of widening

SECTION 02400

GRADED AGGREGATE BASE

strips and the trench width is not sufficient to permit use of standard base compaction equipment, compactors, trench rollers, mechanical plate tampers, or other special equipment which will achieve the density requirements specified herein. When multiple-course base construction is required by the plans or specifications, the required compaction shall be achieved in each course prior to spreading material for the overlaying course.

- F. **Testing Surface:** The finished surface of the base course shall be checked from the required crown and ensure longitudinally a smooth, consistent surface for the placement of the asphalt course(s). All irregularities, greater than 1/4 inch per 15-foot straight edge test, shall be corrected, after which the entire area shall be re-compacted and tested as specified herein before. In the testing of the surface, the measurements will not be taken in small holes caused by individual pieces of rock having been pulled out by the grader.
- G. **Priming and Maintaining:**
 - 1. **Priming:** The prime coat shall be applied only when the base meets the specified density requirements and the moisture content in the top half of the base does not exceed 90 percent of the optimum moisture of the base material. At the time of priming, the base shall be firm, unyielding and in such condition that no undue distortion will occur.
 - 2. **Maintaining:** The CONTRACTOR will be responsible for assuring that the true crown and template are maintained, with no rutting or other distortions, and that the base meets all the requirements, at the time the surface course is applied.
- H. **Thickness Requirements:**
 - 1. **Measurements:** Thickness of the base shall be measured at intervals in such a manner that each test represents 500 square yards, or every 300 linear feet of road pavement, or as otherwise directed by the ENGINEER. Measurements shall be taken at various points on the cross-section, through holes not less than three inches in diameter.
 - 2. **Areas Requiring Correction:** Where the compacted base is deficient by more than 1/2 inch from the thickness called for in the plans, the CONTRACTOR shall correct such areas. The affected areas shall then be brought to the required state of compaction and to the required thickness and cross- section.

END OF SECTION 02400

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SUPERPAVE ASPHALT CONCRETE

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. Construct a Type SP asphalt pavement using the type of mixture specified in the Contract and identified on the Drawings.

1.02 LAYER THICKNESSES

- A. Use only fine graded Type SP asphalt mixes. Fine graded mixes are defined as having a gradation that passes above the restricted zone when plotted on an FHWA 0.45 power gradation chart.
- B. Fine Mixes: The allowable structural layer thicknesses for fine Type SP asphalt Concrete mixtures are as follows:
 - Type SP 12.5 1 ½ - 2 ½ inches
 - 1. In addition to the minimum and maximum thickness requirements, the following restrictions are placed on fine mixes when used as a structural course:
 - 2. Type SP 12.5 - May not be used in the first layer of courses over 3-1/2 inches thick, nor in the first layer of courses over 2-3/4 inches thick on limited access facilities.
 - 3. The thickness of the new pavement may be checked by core samples, as determined by the ENGINEER. The CONTRACTOR shall be required to correct any deficiency either by replacing the full thickness; or overlaying the area as directed by the ENGINEER. An inspection shall be performed and all base failures shall be corrected prior to asphalt installation.
- C. Additional Requirements: The following requirements also apply to fine Type SP asphalt concrete mixtures:
 - 1. When construction includes the paving of adjacent shoulders (5 feet wide or less), the layer thickness for the upper pavement layer and shoulder shall be the same and paved in a single pass, unless shown differently in the plans.
 - 2. Use the minimum and maximum layer thicknesses as specified in 1.02 B above unless shown differently in the plans. On variable thickness overbuild layers, the minimum allowable thickness may be reduced by 1/2 inch, and the maximum allowable thickness may be increased 1/2 inch, unless shown differently in the plans.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Meet the material requirements specified in FDOT Standard Specifications Division III. Specific references are as follows:
 - 1. Superpave PG Asphalt Binder or Recycling Agent – Sections 916-1, 916-2 Coarse Aggregate, Stone, Slag or Crushed Gravel – Section 901
 - 2. Fine Aggregate – Section 902

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SUPERPAVE ASPHALT CONCRETE

3. Aggregates utilized must be in accordance with FDOT qualified products list

2.02 GRADATION REQUIREMENTS

- A. Combine the coarse and fine aggregate in proportions that will produce an asphalt mixture meeting all of the requirements defined in this Specification and conform to the gradation requirements at design as defined in **Table 1** below. Aggregates from various sources may be combined.

Table 1 - Aggregate Gradation Control Points (Gradation Design)		
	Type SP Asphalt Mixture (Percent Passing)	
	SP 12.5	
Sieve Size	Min.	Max.
1 inch	-	-
3/4 inch	100	-
1/2 inch	90	100
3/8 inch	-	90
No. 4	-	-
No. 8	28	58
No. 200	2	10

2.03 RESTRICTED ZONE

- A. The gradation identified in 2.02 shall pass above the restricted zone specified in **Table 2** below.

Table 2 – Aggregate Gradation Restricted Zone (Design Only)		
Sieve Size within Restricted Zone	Boundaries of Restricted Zone Type SP Asphalt Mixture (percent Passing)	
	SP 12.5	
	Min.	Max.
No. 4	-	-
No. 8	39.1	39.1
No. 16	25.6	31.6
No. 30	19.1	23.1

2.04 AGGREGATE CONSENSUS PROPERTIES

- A. Meet the following consensus properties at design for the aggregate blend:
 1. Coarse aggregate angularity: When tested in accordance with ASTM D 5821, meet the coarse aggregate angularity requirement defined in **Table 3** below.

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SUPERPAVE ASPHALT CONCRETE

Table 3 - Coarse Aggregate Angularity Criteria (Minimum Percent Fractured Faces)				
	Depth of Top of Pavement Layer From Surface			
	<4 inches		>4 inches	
	1 or More Fractured Faces (%)	2 or More Fractured Faces (%)	1 or More Fractured Faces (%)	2 or More Fractured Faces (%)
	85	80	60	-
For additional information, refer to AASHTO M-323-04, Table 5				

2. Fine Aggregate Angularity: When tested in accordance with AASHTO T - 304, meet the fine aggregate angularity requirement defined in **Table 4** below.

Table 4 - Fine Aggregate Angularity Criteria		
	Depth of Top of Pavement Layer From Surface	
	<4 inches	>4 inches
	Minimum Uncompacted Void Content (%)	Minimum Uncompacted Void Content (%)
	45	40
For additional information, refer to AASHTO M-323-04, Table 5		

3. Flat and Elongated Particles: When tested in accordance with ASTM D 4791, use a ratio of maximum to minimum dimensions of 5:1 and do not exceed 10 percent as the maximum amount of flat and elongated particles.

2.05 USE OF RECLAIMED (MILLED) ASPHALT PAVEMENT

- A. General Requirements: Reclaimed asphalt pavement (RAP) may be used as a component material of the asphalt mixture subject to the following:
1. The CONTRACTOR assumes responsibility for the design of asphalt mixes which incorporate RAP as a component material.
 2. For design purposes, the CONTRACTOR assumes responsibility for establishing accurate specific gravity values for the RAP material. This may be accomplished by one of the following methods:
 - a. Calculation of the bulk specific gravity value based upon the effective specific gravity of the RAP, determined on the basis of the asphalt binder content and maximum specific gravity. The ENGINEER will approve the estimated asphalt binder absorption value used in the calculation.
 - b. Testing of the extracted aggregate obtained through a vacuum extraction or ignition oven extraction.
 3. The amount of RAP material used in the mix is not to exceed 50 percent by weight of total aggregate.

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4. Use a grizzly or grid over the RAP cold bin, in-line roller crusher, screen, or other suitable means to prevent oversized RAP material from showing up in the completed recycled mixture. If oversized RAP material appears in the completed recycled mix, take the appropriate corrective action immediately. If the appropriate corrective actions are not taken immediately, plant operations should be stopped.
 5. Provide stockpiled RAP material that is reasonably consistent in characteristics and contains no aggregate particles that are soft or conglomerates of fines.
 6. Provide RAP, having minimum average asphalt content of 4.0 percent by weight of total mix. The ENGINEER may sample the stockpile to verify that this requirement is met.
- B. Binder for Mixes with RAP: Select the appropriate binder based on **Table 5** below. The ENGINEER reserves the right to change binder type and grade at design based on the characteristics of the RAP binder, and reserves the right to make changes during production. Maintain the viscosity of the recycled mixture within the range of 4,000 to 12,000 poises. Obtain a sample of the mixture for the ENGINEER within the first 1,000 tons and at a frequency of approximately one per 4,000 tons of mix.

Table 5 - Binder Grade for Mixes Containing RAP	
% RAP	Asphalt Binder Grade
< 20	PG 67-22
20-29	PG 64-22
> 30	Recycling Agent
Note: When a PG 76-22 Asphalt Binder is called for in the Contract, limit the amount of RAP material used in the mix to a maximum of 15 percent.	

PART 3 - GENERAL COMPOSITION OF MIXTURE

3.01 GENERAL

- A. Compose the asphalt mixture using a combination of aggregate (coarse, fine or mixtures hereof), mineral filler, if required, and asphalt binder material. Size, grade and combine the aggregate fractions to meet the grading and physical properties of the approved mix design. Aggregates from various sources may be combined.

3.02 MIX DESIGN

- A. Design the Type SP asphalt mixture in accordance with AASHTO PP-28, except as noted herein, to meet the requirements of this Specification. Use only previously approved designs. Prior to the production of any Type SP asphalt mixture, submit the proposed mix design with supporting test data indicating compliance with all Type SP asphalt mix design criteria.
- B. The ENGINEER and/or OWNER will consider any marked variations from

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original test data for a mix design or any evidence of inadequate field performance of a mix design as sufficient evidence that the properties of the mix design have changed, and the ENGINEER and/or OWNER will no longer allow the use of the mix design.

1. Grading Requirements: Meet Gradation Design Ranges in PART 2.
2. Gyratory Compaction: Compact the design mixture in accordance with AASHTO TP-4. Use the number of gyrations as defined in **Table 6** below.

Table 6- Type SP Design Gyratory Compactive Effort			
	Ninitial	Ndesign	Nmaximum
SP Mixes	7	75	115

3. Volumetric Criteria: Use an air void content of the mixture at design of 4.0 percent at the design number of gyrations (Ndesign). Meet the requirements of **Table 7** below.

Table 7 - Mixture Densification Criteria			
	% Gmm		
	Ninitial	Ndesign	Nmaximum
SP Mixes	> 89.0	96.0	< 98.0

4. VMA Criteria: Meet the requirements of Table 8 below for Voids in the Mineral Aggregate (VMA) of the mixture at the design number of gyrations.

Table 8 - VMA Criteria	
Type Mix	Minimum VMA (%)
SP 12.5	14.0

5. VFA Criteria: Meet the requirements of Table 9 below for voids filled with asphalt (VFA) of the mixture at the design number of gyrations.

Table 9 - VFA Criteria	
	Design VFA (%)
SP Mixes	65 - 75

6. Dust Proportion: Use an effective dust-to-binder ratio as defined in FDOT Section 334-3.2.5.
7. Moisture Susceptibility: Provide a mixture (4 inch specimens) having a retained tensile strength ratio of at least 0.80 and a minimum tensile strength (dry and unconditioned) of 100 psi.
8. Additional Information: In addition to the requirements listed above, provide the following information with each proposed mix design submitted for use:
 - a. The design number of gyrations (Ndesign).
 - b. The source and description of the materials to be used.

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- c. The FDOT source number product code of the aggregate components furnished from an FDOT approved source.
- d. The gradation and proportions of the raw materials as intended to be combined in the paving mixture. The gradation of the component materials shall be representative of the material at the time of use. Compensate for any change in aggregate gradation in handling and processing as necessary.
- e. A single percentage of the combined mineral aggregate passing each specified sieve. Degradation of the aggregate due to processing (particularly -No. 200 [-75 μ m]) should be accounted for and identified for the applicable sieves.
- f. The bulk specific gravity value for each individual aggregate (and RAP) component as identified in the FDOT aggregate control program.
- g. A single percentage of asphalt binder by weight of total mix intended to be incorporated in the completed mixture, shown to the nearest 0.1 percent.
- h. A target temperature at which the mixture is to be discharged from the plant and a target roadway temperature (per 306.3). Do not exceed a target temperature of 340°F for modified asphalts and 315°F for unmodified asphalts.
- i. Evidence that the completed mixture conforms to all specified physical requirements.

3.03 REVISION OF MIX DESIGN

- A. During production, the CONTRACTOR may request a target value revision to a mix design, subject to: (1) the target change falls within the limits defined in **Table 10**, (2) appropriate data exists demonstrating that the mix complies with production air voids specification criteria, and (3) the mixture gradation meets the basic gradation requirements defined in 2.02 and 2.03.

Table 10 - Limits for Potential Adjustments to Mix Design Target	
Characteristic	Limit from Original Mix Design
No. 8 sieve and Coarser	± 5.0%
No. 16 sieve	± 4.0%
No. 30 sieve	± 4.0%
No. 50 sieve	± 3.0%
No. 100 sieve	± 3.0%
No. 200 sieve	± 1.0%
Asphalt Binder Content (1)	± 0.3%
(1) Reductions to the asphalt binder content will not be permitted if the VMA during production is lower than 1.0 percent below the design criteria.	

- B. Submit all requests for revisions to mix designs, along with supporting documentation, to the ENGINEER. In order to expedite the revision process, the

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request for revision or discussions on the possibility of a revision may be made verbally, but must be followed up by a written request. The initial mix design will remain in effect until a change is authorized by the ENGINEER and/or OWNER. In no case may the effective date of the revision be established earlier than the date of the first communication between the CONTRACTOR and the ENGINEER regarding the revision.

- C. A new design mix will be required for any substitution of an aggregate product with a different aggregate code, unless approved by the ENGINEER and/or OWNER.

3.04 PAVING EQUIPMENT

- A. Mechanical Spreading and Screeding Equipment:
 - 1. General: Provide mechanical spreading and screeding equipment of an approved type that is self-propelled and can be steered. Equip it with a receiving and distribution hopper and a mechanical screed. Use a mechanical screed capable of adjustment to regulate the depth of material spread and to produce the desired cross-section.
 - 2. Automatic Screed Control: For all asphalt courses, placed with mechanical spreading and finishing equipment, equip the paving machine with automatic longitudinal screed controls of either the skid type, traveling stringline type, or non-contact averaging ski type. Ensure that the length of the skid, traveling stringline, or non-contact averaging ski is at least 25 feet. On the final layer of base, overbuild, structural, and friction courses, use the joint matcher in lieu of the skid, traveling stringline, or non-contact averaging ski on all passes after the initial pass. Furnish a paving machine equipped with electronic transverse screed controls when required by the Contract Documents.
 - 3. Inflation of Tires: When using paving machines equipped with pneumatic tires, the ENGINEER may require that the tires be ballasted.
 - 4. Screed Width: Provide paving machines on full width lanes that have a screed width greater than 8 feet. Does not use extendable screed strike-off devices that do not provide preliminary compaction of the mat in place of fixed screed extensions. The CONTRACTOR may use a strike-off device on irregular areas that would normally be done by hand and on shoulders 4 feet or less in width. When using the strike-off device on shoulders in lieu of an adjustable screed extension, the CONTRACTOR must demonstrate the ability to obtain an acceptable texture, density, and thickness. When using an extendable screed device to extend the screed's width on the full width lane or shoulder by 24 inches or greater, an auger extension, paddle, or kicker device is required unless the CONTRACTOR provides written documentation from the manufacturer that these are not necessary.
 - 5. Motor Graders: Provide two motor graders for spreading widening courses with prior approval from the ENGINEER only. Use motor graders that are rated at not less than 6 tons and are self-propelled and power-controlled. Mount them on smooth tread or rib-type tires (no lug types allowed) with a wheel base of at least 15 feet. Equip the front motor grader

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with a spreader box capable of spreading the mix at the required rate.

6. Rollers:

- a. Steel-Wheeled Rollers: Provide compaction equipment capable of meeting the density requirements described in these Specifications. Provide a tandem steel-wheeled roller weighing a minimum of 8 tons for seal rolling, and for the final rolling, use a separate roller with a minimum weight of 8 tons. Variations from these requirements shall be approved by the ENGINEER.
 - b. Traffic Rollers: Provide compaction equipment capable of meeting the density requirements described in these specifications. Provide a self-propelled, pneumatic-tired traffic roller equipped with at least seven smooth-tread, low pressure tires, equipped with pads or scrapers on each tire. Maintain the tire pressure between 50 and 55 psi or as specified by the manufacturer. Use rollers with a minimum weight of 6 tons. Do not use wobble-wheeled rollers. Variations from these requirements shall be approved by the ENGINEER.
 - c. Prevention of Adhesion: Do not allow the mixture to adhere to the wheels of any rollers. Do not use fuel oil or other petroleum distillates to prevent adhesion. Do not use any method which results in water being sprinkled directly onto the mixture.
7. Trucks: Transport the mix in trucks of tight construction, which prevents the loss of material and the excessive loss of heat. Provide each truck with a tarpaulin or other waterproof cover mounted in such a manner that it can cover the entire load when required. When in place, overlap the waterproof cover on all sides so that it can be tied down.
8. Coring Equipment: Furnish a suitable saw or drill for obtaining the required density cores.
9. Hand Tools: Provide the necessary hand tools such as rakes, shovels, etc., and a suitable means for keeping them clean.

END OF SECTION 02500

SECTION 02610

SITE DRAINAGE

PART 1 – GENERAL

1.01 SCOPE

- A. The Work under this section includes the furnishing of all labor material and equipment required to provide proper drainage of the site.

1.02 GENERAL REQUIREMENTS:

- A. Pipe sizes shown on the drawings are based on concrete pipe with a coefficient of roughness based on Florida Department of Transportation Standards.
- B. All workmanship, materials, equipment and installation shall be in accordance with the applicable portions of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition, and referred to hereinafter as Standard Specification. The specific sections of the above-mentioned specifications which are applicable are listed below.

1.03 SUBMITTALS

- A. Provide in accordance with Section 01300 the following:
 - 1. Product and dimensional data for all structures
 - 2. Product data for all piping
 - 3. Storm drainage schedule showing all structures, piping into and out, and elevations

PART 2 - MATERIALS

2.01 CONCRETE PIPE

- A. Pipe: Concrete pipe shall conform to Section 449 of the Standard Specifications. All pipe shall be Class III unless otherwise noted on the Drawings.
- B. Sealing Joints: The joints of new pipe shall be sealed by use of round rubber gaskets meeting the requirements of Section 942 and as provided in Paragraph 430-7 of the Standard Specifications. All joints to be wrapped with non-woven filter fabric.

2.02 DRAINAGE STRUCTURES

- A. Structures, including mitered end sections, shall be used where shown on the drawings and constructed in accordance with the details shown.
- B. Concrete shall be in accordance with Section 346, of the FDOT Standard Specification for Road and Bridge Construction, Latest Edition.

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SITE DRAINAGE

2.03 POLYETHYLENE CORRUGATED PIPE

- A. Drainage pipe may be high density polyethylene corrugated exterior/smooth interior pipe in sizes 4 inches through 10 inches and conforming with AASHTO M254, Type S. Material shall be high-density polyethylene conforming with the minimum requirements of cell classification 424420C for 4- through 10-inch diameters, as defined and described in the latest version of ASTM D3350, except that carbon black content should not exceed 4 percent. Minimum conveyance factor shall be a Manning "n" value of 0.012. Acceptable manufacturer shall be Hi-Q, as manufactured by Hancor, Inc., N-12 polyethylene pipe, as manufactured by Advanced Drainage Systems, Inc., or ENGINEER approved equal.
- B. Couplings and Fittings: Coupling bands shall cover at least one full corrugation on each section of pipe. When gasketed coupling bands are required, the gasket shall be made of closed-cell synthetic expanded rubber meeting the requirements of ASTM D 1056, Type 2. Gaskets shall be installed on the coupling band by the pipe manufacturer. All coupling bands shall meet or exceed the soil-tightness requirement of the AASHTO Standard Specification for Highway Bridges, Section 23, Paragraph 23.3.1.5.4(e). Pipe fittings shall conform to AASHTO M294.

2.04 POLYPROPYLENE CORRUGATED PIPE

- A. Drainage pipe may be polypropylene smooth interior with annular exterior corrugations in sizes 12 inches through 60 inches. Polypropylene compound for pipe and fitting production shall be impact modified copolymer meeting the material requirements of ASTM F2881, Section 5 and AASHTO M330, Section 6.1. Minimum conveyance factor shall be a Manning "n" value of 0.012. Acceptable products shall be HP Storm, as manufactured by Advanced Drainage Systems, Inc., or ENGINEER approved equal.
- B. Fittings: Fittings shall conform to ASTM F2881 or AASHTO M330. Bell and spigot connections shall utilize a welded or integral bell and valley or inline gaskets meeting the watertight joint performance requirements of ASTM D3212.

2.05 MANHOLES

- A. Precast Concrete Manholes: ASTM C 478, precast reinforced concrete, of depth indicated with provision for rubber gasket joints.
- B. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having a separate base slab or base section with integral floor.
 - 1. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
 - 2. Top Section: Eccentric cone type, unless concentric cone or flat-slab-top type is indicated. Top of cone to match grade rings.
 - 3. Grade Rings: Provide 2 or 3 reinforced concrete rings, of 6 to 9 inches total thickness and match 24-inch diameter frame and cover.
 - 4. Gaskets: ASTM C 443, rubber.

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SITE DRAINAGE

5. Steps: Cast into base, riser, and top sections sidewall at 12-to 16-inch intervals.
 6. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
 7. Channel and Bench: Concrete.
- C. Cast-in-Place Manholes: Reinforced concrete of dimensions and with appurtenances indicated.
1. Bottom, Walls, and Top: Reinforced concrete.
 2. Channel and Bench: Concrete.
 3. Steps: Cast into sidewall at 12- to 16-inch intervals.
- D. Manhole Steps: Wide enough for an adult to place both feet on one step and designed to prevent lateral slippage off the step.
1. Material: Steel-reinforced plastic.
- E. Manhole Frames and Covers: ASTM A 536, Grade 60-40-18, heavy-duty, ductile iron, 24-inch inside diameter by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch-diameter cover, indented top design, with lettering "STORM SEWER" cast into cover.

2.06 CATCH BASINS

- A. Precast Concrete Catch Basins: ASTM C 478 or ASTM C 858, precast reinforced concrete, of depth indicated. Sections shall have provision for rubber gasket joints. Base section slab shall have minimum thickness of 6 inches.
1. Base Section: Base riser section and separate base slab, or base riser section with integral floor.
 2. Riser Sections: Sections shall be of lengths to provide depth indicated.
 3. Top Section: Type to match FDOT configuration detailed.
 4. Grade Rings: Provide 2 or 3 reinforced concrete rings, of 6 to 9 inches total thickness, as necessary.
 5. Gaskets: ASTM C 443, rubber.
 6. Steps: Cast into riser sidewall at 12- to 16-inch intervals.
 7. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
 8. Channel and Bench: Concrete.
- B. Cast-in-Place Catch Basins: Reinforced concrete of dimensions and with appurtenances indicated.
1. Bottom, Walls, and Top: Reinforced concrete.
 2. Channel and Bench: Concrete.
- C. Catch Basin Steps: Wide enough for an adult to place both feet on one step and designed to prevent lateral slippage off the step.
1. Material: Steel-reinforced plastic.
- D. Catch Basin Frames and Grates: Per FDOT Standard Frame and Grates.

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SITE DRAINAGE

2.07 OUTFALLS

- A. General: Construct of reinforced concrete pipe, mitered end section, toewalls, and rip rap, as indicated.

2.08 CONCRETE AND REINFORCEMENT

- A. Concrete: Portland cement mix, 3,000 psi
 1. Cement: ASTM C 150, Type II
 2. Fine Aggregate: ASTM C 33, sand
 3. Coarse Aggregate: ASTM C 33, crushed gravel
 4. Water: Potable
- B. Reinforcement: Steel conforming to the following:
 1. Fabric: ASTM A 185, welded wire fabric, plain
 2. Reinforcement Bars: ASTM A 615, Grade 60, deformed
- C. Forms:
 1. Form Materials: Plywood, metal, metal-framed plywood, or other acceptable panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces without distortion or defects. Material shall be of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal.
 2. Form Release Agent: Provide commercial formulation form-release agent with a maximum of 350 mg/l volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces. Release agent to be within allowable volatile limits according to applicable local, state and federal codes.

2.09 MASONRY

- A. Bricks for accessories shall be hard common clay brick. Mortar shall be one part Portland cement and three parts masonry sand to which shall be added lime putty in the amount of 50 percent of the volume of cement. Special commercial mortar mixes may be used if approved by the ENGINEER. All masonry materials shall conform to the latest applicable ASTM specifications. Set all masonry units in full beds of mortar, with full joints and strike all joints flush. Masonry reinforcements shall be galvanized Dur-O-Wal, or approved equal, and shall be installed at every other bed joint.

2.10 CURING MATERIALS

- A. Conform to TT-C-800, with 30-percent minimum solids content.
- B. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yard, complying with AASHTO M-182, Class 2.

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SITE DRAINAGE

- C. Moisture-Retaining Cover: One of the following, complying with ASTM C-171.
 - 1. Waterproof paper
 - 2. Polyethylene film
 - 3. White burlap-polyethylene sheet
- D. Clear Solvent-Borne Liquid Membrane-Forming Curing Compound: This is a solvent-borne membrane-forming curing compound. Revise to Type II and verify manufacturer's products when a white pigmented curing compound is required. Do not use if waterborne low-VOC emissions compounds are required. ASTM C-309, Type I, Class A or B, wax free.
- E. Clear Waterborne Membrane-Forming Curing Compound:
 - 1. This is a waterborne membrane-forming curing compound. Use when low VOC emissions are required. ASTM C-309, Type I, Class B.
 - 2. Provide material that has a maximum volatile organic compound (VOC) rating of 350 mg per liter.
- F. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete surfaces for temporary protection from rapid moisture loss.

PART 3 - EXECUTION

3.01 PREPARATION OF FOUNDATION FOR BURIED STORMWATER SYSTEMS

- A. Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation, throughout the length of the pipe.
- B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid, and backfill with clean sand or pea gravel to indicated level.
- C. Shape bottom of trench to fit bottom of pipe. Fill unevenness with tamped sand backfill. Dig bell holes at each pipe joint to relieve the bells of all loads and to ensure continuous bearing of the pipe barrel on the foundation.

3.02 INSTALLATION, GENERAL

- A. General Locations and Arrangements: Drawings (plans and details) indicate the general location and arrangement of the underground stormwater system piping. Location and arrangement of piping layout take into account many design considerations. Install the piping as indicated, to the extent practical.
- B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert, unless approved otherwise by the ENGINEER. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed. The pipe shall be carefully examined for defects and the inside cleaned. After placing pipe in the ditch, the ends shall be wiped free from all dirt, sand and foreign material.

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SITE DRAINAGE

All pipe and joints shall be made, handled, and installed in strict accordance with the manufacturer's recommendations and instructions. A copy of the installation manual shall be furnished to the ENGINEER prior to placing pipe on the job site.

1. Install concrete pipe in accordance with applicable provisions of American Concrete Pipe Association "Concrete Pipe Field Manual", unless otherwise indicated.
 2. Place concrete pipe with elliptical reinforcing so that the reference lines indicating top of pipe are not more than 5 degrees from vertical plane through longitudinal axis of pipe.
 3. Install polyethylene pipe in accordance with ASTM D2321 and ADS recommended installation guidelines, with the exception that minimum cover in trafficked areas for 4- through 48-inch (100 to 1200 mm) diameters shall be one foot. (0.3 m) and for 60-inch (1500 mm) diameter the minimum cover shall be 2 ft. (0.6 m) in single run applications. Backfill for minimum cover situations shall consist of Class 1 (compacted), Class 2 (minimum 90% SPD) or Class 3 (minimum 95%SPD) material.
 4. Install polypropylene pipe in accordance with ASTM D2321 and ADS recommended installation guidelines, with the exception that minimum cover in traffic areas for 12- through 48-inch (300 to 1200 mm) diameters shall be one foot (0.3 m) and for 60-inch (1500 mm) diameter the minimum cover shall be 2 ft. (0.6 m) in single run applications. Backfill for minimum cover situations shall consist of Class 1 (compacted), Class 2 (minimum 90% SPD), or Class 3 (minimum 95% SPD) material.
- C. Use manholes or catch basins for changes in direction, except where a fitting is indicated. Use fittings for branch connections, except where direct tap into existing sewer is indicated. The ENGINEER shall be notified at least 24 hours before the pouring of any concrete is to be started, and such pouring shall not be started until the reinforcement has been approved as placed.
- D. Use proper size increasers, reducers, and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.
- E. Install piping pitched down in direction of flow, at minimum slope per plans.
- F. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed, by tunneling, jacking, or a combination of both.

3.03 MANHOLES

- A. General: Install manholes complete with accessories as indicated. Form continuous concrete or split pipe section channel and benches between inlets and outlet. Set tops of frames and covers flush with finish surface where manholes occur in pavements. Elsewhere, set tops 3 inches above finished grade, unless otherwise indicated.
- B. Place precast concrete manhole sections as indicated, and install in accordance with ASTM C 891.

SECTION 02610

SITE DRAINAGE

- C. Construct cast-in-place manholes as indicated.
- D. Provide rubber joint gasket complying with ASTM C 443 at joints of sections.
- E. Apply bituminous mastic coating at joints of sections.

3.04 CATCH BASINS

- A. Construct catch basins to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.

3.05 OUTFALLS

- A. Construct outfalls of reinforced concrete which will attain 28-day compressive strength of not less than 3000 psi.

3.06 TAP CONNECTIONS

- A. Make connections to existing piping and underground structures so that finished work will conform as nearly as practicable to the requirements specified for new work.
- B. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap, with not less than 6 inches of 3,000-psi, 28-day compressive-strength concrete.
- C. Make branch connections from side into existing 15 to 18-inch piping by removing section of existing pipe and installing wye fitting into existing piping. Encase entire wye with not less than 6 inches of 3,000-psi, 28-day compressive-strength concrete.
- D. Make branch connections from side into existing 24-inch or larger piping or to underground structures by cutting opening into existing unit sufficiently large to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall, unless otherwise indicated. On outside of pipe or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
 - 1. Provide concrete that will attain minimum 28-day compressive strength of 3,000 psi, unless otherwise indicated.
 - 2. Use epoxy bonding compound as interface between new and existing concrete and piping materials.
- E. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris, concrete, or other extraneous material that may accumulate.

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SITE DRAINAGE

3.07 CLOSING ABANDONED STORMWATER SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping that is indicated to remain in place. Provide sufficiently strong closures to withstand hydrostatic or earth pressure that may result after ends of abandoned utilities have been closed.
 - 1. Close open ends of concrete pipe or structures with not less than 8-inch-thick brick masonry bulkheads.
 - 2. Close open ends of other piping with plastic plugs, or other acceptable methods suitable for size and type of material being closed. Wood plugs are not acceptable.
- B. Abandoned Structures: Remove structure and close open ends of the remaining piping or remove top of structure down to not less than 3 feet below final grade; fill structure with stone, rubble, gravel, or compacted dirt, to within 1 foot of top of structure remaining, and fill with concrete.

3.08 FIELD QUALITY CONTROL

- A. Testing: Perform testing of completed piping in accordance with local authorities having jurisdiction. All sampling and testing shall be conducted by a testing laboratory under the direction of a Professional ENGINEER, licensed in the State of Florida, at the CONTRACTOR's expense. Submit test results directly to the ENGINEER. The following tests shall be taken:
 - 1. 28-day compressive test of concrete, minimum of three test cylinders per 50 cubic yards of concrete poured.
 - 2. Air content, minimum one test for each day's pour.
 - 3. Slump test, minimum one test for each day's pour.
 - 4. CONTRACTOR shall replace materials removed for testing purposes.
 - 5. Should any work or materials fail to meet the requirements set forth in the plans and specifications, CONTRACTOR shall pay for retesting of same.
- B. Cleaning: Clear interior of piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.
 - 1. In large, accessible piping, brushes and brooms may be used for cleaning.
 - 2. Place plugs in ends of uncompleted pipe at end of day or whenever work stops.
 - 3. Flush piping between manholes, to remove collected debris.
- C. Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.
- D. Make inspections after pipe between manholes has been installed, cleaned and approximately 2 feet of backfill is in place, and again at completion of project. Each section of pipe between structures is to show from either end on examination, a full circle of light. Each appurtenance to the system shall be of the specified size and form, to neatly and substantially constructed, with the top set permanently to exact position and grade.

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SITE DRAINAGE

If inspection indicates poor alignment, debris, displaced pipe, infiltration, or other defects, correct such defects and reinspect. All repairs shown necessary by the inspections are to be made, broken or cracked pipe replaced, all deposits removed and the pipe left true to line and grade as herein specified, or shown on the plans, entirely clean and free from abnormalities and ready for use.

- E. Limits of Infiltration and Methods of Testing: The allowable limit of groundwater infiltration for the entire system of new stormwater systems or any one trunk, or interceptor shall be in complete accordance with ASTM C425-71T and shall not exceed a limit of infiltration equal to 0.2 gal/inch diameter/hour/100 linear feet of pipe.
1. The test will be made by measuring the infiltrated flow of water over a measuring weir set up in the invert of the sewer, or by an alternate method approved by the ENGINEER, a known distance from a temporary bulkhead or other limiting point of infiltration. After the sewer have been pumped out, and normal conditions prevail, tests shall be started.
 2. Tests shall be run continuously for a period of not less than three(3) hours, with weir readings taken at 20 minute intervals. The tests shall be made by the CONTRACTOR. The ENGINEER shall be notified 24 hours in advance. Where infiltration occurs in excess of the specified amount, the defective pipe or joints shall be located and repaired at the expense of the CONTRACTOR. If the defective portions cannot be located, the CONTRACTOR, at his own expense, shall remove and reconstruct as much of the original work as necessary to obtain a sewer within allowable infiltration limits upon such retesting as necessary.
- F. Clean-up: Before final inspection and acceptance, the CONTRACTOR shall clean ditches, shape shoulders and restore all disturbed areas, including street crossings, grass plots, to as good as condition as existed before work started. All trenches shall be leveled and loose material removed from pavement gutters, sidewalks, pipe lines, and inlet sediment traps, employing hand labor, if necessary.

END OF SECTION 02610

SECTION 02910

SODDING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. This Work consists of sodding areas cleared during construction and not paved or as otherwise shown on the Drawings.
- B. All disturbed areas within the plant shall be sodded upon completion.

1.02 SUBMITTALS

- A. Provide technical data as per Section 01300 for all materials and installation procedures required under this Section.
- B. Submit certifications for all sodding supplied on the project.

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver sod on pallets.
- B. Protect roots from exposure to wind or sun. Protect sod against dehydration, contamination and heat during transportation and delivery.
- C. Sod shall be delivered and installed within a 24-hour period.
- D. Keep sod stored in the shade or covered with moistened burlap.
- E. After installation provide water to establish and maintain the sod.

1.04 WARRANTY

- A. Guarantee sod for a period of 90 days after date of final completion by the CONTRACTOR.

PART 2 – PRODUCTS

2.01 MATERIAL

- A. Sod shall be Argentine Bahia. The sod shall be live, fresh, and uninjured at the time of planting and shall have a thick mat of roots with enough adhering soil to assure growth. Apply sod within 48 hours of cutting or stack and keep moist. Do not plant dormant sod or if ground is frozen.

PART 3 – EXECUTION

3.01 PLACEMENT

- A. Prepare the ground by loosening the soil. Place sod on the prepared soil to form

SECTION 02910

SODDING

a solid mass with tightly fitted joints. Butt ends and sides of sod strips; do not overlap. Stagger strips to avoid a continuous downhill seam. Tamp or roll lightly to ensure contact with subgrade. Tamp the outer edges of the sodded area to produce a smooth contour. Work sifted soil into minor cracks between pieces of sod; remove excess to avoid smothering of adjacent grass. Water sod thoroughly with a fine spray immediately after planting.

3.02 WATERING

- A. Keep sod continuously moist to a depth below the root zone for three weeks after placement. If there is not water available to the site, the CONTRACTOR shall provide the water for the sod.

3.02 MAINTENANCE

- A. Maintain sod by watering, fertilizing, weeding, mowing, trimming and other operations such as rolling, re-grading, and re-planting as required to establish a lawn free of eroded or bare areas and acceptable to the ENGINEER. Where inspected work and materials do not comply with requirements, replace rejected work and continue maintenance until re-inspected by ENGINEER and found to be acceptable. Remove rejected materials promptly from the project site.

END OF SECTION 02910

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1- GENERAL

1.01 SCOPE OF WORK

- A. Description of scope and intent
 1. CONTRACTOR shall provide all material, labor, and tools required to complete the installation of specified system.
 2. Any omission of reference to items required to complete the full operational and functional system specified in the section does not relieve the CONTRACTOR of the obligation to provide same.
 3. To provide installation of all items, including delivery, dispersing to the proper locations within the building, and affixing in place.
 4. Installation shall be accomplished by workers skilled in their craft that will perform their work in a professional manner and will leave the premises safe, orderly and clean.
 5. Drawings and general provisions of Contract, including General and Supplemental Conditions and Division 1 Specification Sections, apply to this Section.
 6. CONTRACTOR is responsible for coordination of work included in this specification with all other specification sections related to furnishing of all materials, labor, permits, fees and services necessary for completion of work in this section.
- B. Section Includes:
 1. Formwork for cast in place concrete, with shoring, bracing, and anchorage.
 2. Formwork accessories.
 3. Form stripping.
 4. Reinforcing steel for cast in place concrete.
 5. Grout.
 6. Cast in place concrete, including concrete for the following:
 - a. Foundations, footings.
 - b. Slabs on grade.
 - c. Supported slabs.
 - d. Foundation and structural walls.
 - e. Equipment pads and bases.
 7. Concrete curing.
 8. Shoring and reshoring.

1.02 REFERENCES

All referenced standards refer to the edition in force at the time these plans and Specifications are issued for bidding.

- A. AASHTO M 182 Standard Specification for Burlap Cloth Made from Jute or Kenaf; American Association of State Highway and Transportation Officials.
- B. ACI 117 Standard Tolerances for Concrete Construction and Materials; American Concrete Institute.

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CAST-IN-PLACE CONCRETE

- C. ACI 201.2R Guide to Durable Concrete; American Concrete Institute.
- D. ACI 211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute.
- E. ACI 214 Recommended Practice for Evaluation of Compression Test Results of Field Concrete.
- F. ACI 301 Specifications for Structural Concrete for Buildings; American Concrete Institute.
- G. ACI 302.1R Guide for Concrete Floor and Slab Construction; American Concrete Institute.
- H. ACI 304R Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute.
- I. ACI 305R Hot Weather Concreting; American Concrete Institute.
- J. ACI 306R Cold Weather Concreting; American Concrete Institute.
- K. ACI 318 Building Code Requirements for Reinforced Concrete; American Concrete Institute.
- L. ACI 347R Guide to Formwork for Concrete; American Concrete Institute.
- M. ACI 350 Code Requirements for Environmental Engineering Concrete Structures.
- N. ACI 350.1 Specification for Tightness Testing of Environmental Engineering Concrete Containment Structures & Commentary
- O. ACI 372 Guide to Design and Construction of Circular Wire-and-Strand-Wrapped Prestressed Concrete Structures
- P. ACI SP 66 ACI Detailing Manual; American Concrete Institute.
- Q. ASTM A 185 Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
- R. ASTM A 615 Standard Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
- S. ASTM C 31 Standard Practice for Making and Curing Concrete Test Specimens in the Field.
- T. ASTM C 33 Standard Specification for Concrete Aggregates.

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- U. ASTM C 39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- V. ASTM C 42 Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
- W. ASTM C 94 Standard Specification for Ready Mixed Concrete.
- X. ASTM C 143 Standard Test Method for Slump of Hydraulic Cement Concrete.
- Y. ASTM C 150 Standard Specification for Portland Cement.
- Z. ASTM C 171 Standard Specifications for Sheet Materials for Curing Concrete.
- AA. ASTM C 172 Standard Practice for Sampling Freshly Mixed Concrete.
- BB. ASTM C 173 Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
- CC. ASTM C 231 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
- DD. ASTM C 260 Standard Specifications for Air Entraining Admixtures for Concrete.
- EE. ASTM C 494 Standard Specifications for Chemical Admixtures for Concrete.
- FF. ASTM C 618 Standard Specifications for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
- GG. ASTM C 685 Standard Specifications for Concrete Made by Volumetric Batching and Continuous Mixing.
- HH. ASTM C 881 Standard Specification for Epoxy Resin Base Bonding Systems for Concrete.
- II. ASTM C 1059 Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.
- JJ. ASTM C 1107 Standard Specification for Packaged Dry, Hydraulic Cement Grout (Nonshrink).
- KK. ASTM D 1751 Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- LL. ASTM D 1752 Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

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MM. ASTM E 154 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth under Concrete Slabs, on Walls, or as Ground Cover.

NN. ASTM E 329 Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.

OO. CRSI Manual of Standard Practice; Concrete Reinforcing Steel Institute.

PP. Florida Building Code – FBC

1.03 DEFINITIONS

- A. Unexposed Finish: A general use finish, with no appearance criteria, applicable to all formed concrete concealed from view after completion of construction.
- B. Exposed Finish: A general use finish applicable to all formed concrete exposed to view except those indicated to receive textured finish and including surfaces which may receive a paint coating (if any).

1.04 SUBMITTALS

- A. All submittals shall be submitted in accordance with Section 01300.
- B. Product Data: Submit manufacturer's product data for the following:
 - 1. Formwork accessories.
 - 2. Form liners.
 - 3. Concrete admixtures.
 - 4. Grout.
 - 5. Bonding compound.
 - 6. Epoxy bonding system
- C. Aggregates: Submit test reports showing compliance with specified quality and gradation.
- D. Shop Drawings: Submit shop drawings for fabrication and placement of the following:
 - 1. Reinforcement: Comply with ACI SP 66. Include bar schedules, diagrams of bent bars, arrangement of concrete reinforcement, and splices.
 - a. Show construction joints.
 - b. Include details of reinforcement at openings through concrete structures.
 - c. Include elevations of reinforcement in walls.
 - d. Show stirrup spacing.
 - e. Concrete embedment's.
 - 2. Shoring and reshoring for elevated concrete placement shall include:
 - a. Location, size, and type of all shoring members.
 - b. Location, size, and type of all reshoring members.
 - c. Location, size, and type of all mud sills, blocking, temporary lateral bracing and other accessories necessary to safely support and brace the structure during construction.

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- d. Prepare shop drawings under seal of professional structural ENGINEER registered in the state of Florida.
- E. Quality Control Submittals
 1. Submit the following information related to quality assurance requirements specified:
 2. Design data: Submit proposed mix designs and test data before concrete operations begin. Identify for each mix submitted the method by which proportions have been selected.
 - a. For mix designs based on trial mixtures, include trial mix proportions, test results, and graphical analysis and show required average compressive strength f_{cr} .
 - b. Indicate quantity of each ingredient per cubic yard of concrete.
 - c. Indicate type and quantity of admixtures proposed or required.
 3. Test reports: Submit laboratory test reports for all testing specified.
 4. Certifications: Submit affidavits from an independent testing agency certifying that all materials furnished under this section conform to specifications.
 5. Certifications: Provide certification from manufacturers of concrete admixtures that chloride content complies with specified requirements.
 6. Certifications: Submit mill test certificates for all reinforcing steel furnished under this section, showing physical and chemical analysis.
 7. Placement schedule: Submit concrete placement schedule prior to start of any concrete placement operations. Include location of all joints indicated on drawings, plus anticipated construction joints.
 8. Submit batch tickets complying with ASTM C 685 or delivery tickets complying with ASTM C 94, as applicable, for each load of concrete used in the work.
 - a. Include on the tickets the additional information specified in the ASTM document.
 9. Cold weather concreting: Submit description of planned protective measures.
 10. Hot weather concreting: Submit description of planned protective measures.
 11. Mass Concrete: Submit description of planned protective measures.

1.05 QUALITY ASSURANCE

- A. Codes and Standards: Comply with the following documents, except where requirements of the contract documents or of governing codes and governing authorities are more stringent:
 1. ACI 301
 2. ACI 318
 3. ACI 350
 4. CRSI Manual of Standard Practice.
- B. Testing Agency Services:
 1. Employ, at CONTRACTOR's expense, an independent testing agency acceptable to the ENGINEER to perform specified tests and other services required for quality assurance.
 - a. Testing agency shall meet ASTM E 329 requirements.

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- C. Source of Materials: Obtain materials of each type from same source for the entire project.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver reinforcement to project site bundled and tagged with metal tags indicating bar size, lengths, and other data corresponding to information shown on placement drawings.
 - 1. Concrete reinforcement materials stored on the site shall be kept on concrete blocks and supported off the ground to prevent damage and accumulation of water, dirt, or rust.
- B. Store cementitious materials in a dry, weather tight location. Maintain accurate records of shipment and use.
- C. Store aggregates to permit free drainage and to avoid contamination with deleterious matter or other aggregates. When stockpiled on ground, discard bottom 6 inches of pile.
- D. Handle aggregates to avoid segregation.

1.07 PROJECT CONDITIONS

- A. Cold Weather Concreting: Comply fully with the recommendations of ACI 306.
 - 1. Well in advance of proposed concreting operations, advise the ENGINEER of planned protective measures including but not limited to heating of materials, heated enclosures, and insulating blankets.
- B. Hot Weather Concreting: Comply fully with the recommendations of ACI 05R.
 - 1. Well in advance of proposed concreting operations, advise the ENGINEER of planned protective measures including but not limited to cooling of materials before or during mixing, placement during evening to dawn hours, fogging during finishing and curing, shading, and windbreaks.
- C. Mass Concrete: Comply fully with the recommendations of ACI 207.1R.
 - 1. Well in advance of proposed concreting operations, advise the ENGINEER of planned protective measures including but not limited to cooling of materials before or during mixing, placement, curing, forms, height of lifts (max 8ft), and monitoring.

PART 2- PRODUCTS

2.01 FORMWORK

- A. Facing Materials:
 - 1. Unexposed finish concrete: Any standard form materials that produce structurally sound concrete.
 - 2. Exposed finish concrete: Materials selected to offer optimum smooth, stain free final appearance and minimum number of joints. Provide materials with sufficient strength to resist hydrostatic head without bow or deflection in excess of allowable tolerances.

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3. Textured finish concrete: Materials or linings as indicated on the drawings, or as required to match ENGINEER's control sample.
- B. Formwork Accessories:
 1. Form coating: Form release agent that will not adversely affect concrete surfaces or prevent subsequent application of concrete coatings.
 2. Metal ties: Commercially manufactured types; cone snap ties, taper removable bolt, or other type which will leave no metal closer than 1-1/2 inches from surface of concrete when forms are removed, leaving not more than a 1 inch diameter hole in concrete surface.
 3. Fillets: Wood or plastic fillets for chamfered corners, in maximum lengths possible.

2.02 REINFORCING MATERIALS

- A. Reinforcing Bars: Provide deformed bars complying with the following, except where otherwise indicated:
 1. ASTM A 615, Grade 60.
- B. Welded Wire Fabric: ASTM A 185, cold drawn steel, plain.
- C. Reinforcing Accessories:
 1. Tie wire: Black annealed type, 16-1/2 gage or heavier.
 2. Supports: Bar supports conforming to specifications of CRSI "Manual of Standard Practice."
 - a. Class 1 (plastic protected) at all formed surfaces which will be exposed to weather.
 - b. Class 1 (plastic protected) or Class 2 (stainless steel protected) at all formed surfaces which will be exposed to view but not to weather.
 - c. Precast concrete blocks of strength equal to or greater than specified strength of concrete or Class 3 supports equipped with sand plates, where concrete will be cast against earth. Concrete masonry units will not be accepted.

2.03 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, and as follows:
 1. Type I, except where other type is specifically permitted or required.
 2. Type II shall be used for moderate sulfate resistance conditions, retaining walls and exposed concrete not included in Type V below and when hot weather concreting is required.
 3. Type III shall be used for high early strength and when cold weather concreting is required.
 4. Type IV shall be used for low heat of hydration when mass concreting is required.
 5. Type V shall be used for high sulfate resistance conditions, all environmental and all water or wastewater liquid retaining structures (includes all wet well surfaces). (An alternate Type V cement mixture shall be a Type I/II. The CONTRACTOR shall submit the Type I/II cement for review, concrete mix

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design where the Type I/II was utilized and 30 concrete break test results of where the Type I/II cement was implemented).

- B. Fly Ash: ASTM C 618, Type C or F.
- C. Water: Potable.
- D. Aggregates:
 - 1. Normal weight concrete: ASTM C 33.
 - a. Class 5M.
 - b. Gradation as specified below under mix design.
- E. Admixtures General: Admixtures which result in more than 0.1 percent of soluble chloride ions by weight of cement are prohibited.
- F. Air Entraining Admixture: ASTM C 260 and certified by manufacturer for compatibility with other mix components.
 - 1. Products: The following products, provided they comply with requirements of the contract documents, will be among those considered acceptable:
 - a. "Air Mix"; The Euclid Chemical Company.
 - b. "Sika Aer"; Sika Corporation.
 - c. "Micro Air"; Master Builders, Inc.
 - d. "Darex AEA"; W. R. Grace & Co.
- G. Water Reducing, Retarding Admixture: ASTM C 494, Type D.
 - 1. Products: The following products, provided they comply with requirements of the contract documents, will be among those considered acceptable:
 - a. "Pozzolith Retarder"; Master Builders, Inc.
 - b. "Eucon Retarder 75"; The Euclid Chemical Company.
 - c. "Daratard 17"; W. R. Grace & Co.
 - d. "PSI R Plus"; Cormix Construction Chemicals.
 - e. "Plastiment"; Sika Corporation.
 - f. "Protard"; Master Builders, Inc. (former Conchem product).
- H. Water Reducing and Accelerating Admixtures: ASTM C 494, Type E.
 - 1. Products: The following products, provided they comply with requirements of the contract documents, will be among those considered acceptable:
 - a. "Accelguard 80"; The Euclid Chemical Company.
 - b. "Pozzutec 20"; Master Builders, Inc.
 - c. "Gilco Accelerator"; Cormix Construction Chemicals.
- I. High Range Water Reducing Admixture (Superplasticizer): ASTM C 494, Type F or G.
 - 1. Products: The following products, provided they comply with requirements of the contract documents, will be among those considered acceptable:
 - a. "WRDA 19" or "Daracem 100"; W. R. Grace & Co.
 - b. "PSP Superplasticizer"; Master Builders, Inc. (former Conchem product).
 - c. "Sikament 300"; Sika Corporation.
 - d. "Eucon 37"; The Euclid Chemical Company.

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- e. "PSI Super"; Cormix Construction Chemicals.
- f. "Rheobuild"; Master Builders, Inc.

2.04 MISCELLANEOUS MATERIALS AND ACCESSORIES

- A. Vapor Retarder: Membrane for installation beneath building slabs on grade, resistant to decay when tested in accordance with ASTM E 154, and as follows:
 - 1. Polyethylene sheet, not less than 8 mils thick.
- B. Nonshrink Grout: ASTM C 1107.
 - 1. Minimum 4000 psi grout compressive strength
 - 2. Type: Provide nonmetallic type only.
 - 3. Products: The following products, provided they comply with requirements of the contract documents, will be among those considered acceptable:
 - a. Nonmetallic type:
 - 1) "Masterflow 928"; Master Builders, Inc.
 - 2) "SonogROUT 14k"; Sonneborn Building Products Division ChemRex, Inc.
 - 3) "Euco N S Grout"; The Euclid Chemical Company.
 - 4) "Supreme"; Cormix Construction Chemicals.
 - 5) "Five Star Grout"; Five Star Products, Inc.
- C. Burlap: AASHTO M 182, Class 2 jute or kenaf cloth.
- D. Moisture Retaining Cover: ASTM C 171, and as follows:
 - 1. Curing paper.
 - 2. Polyethylene film.
 - 3. White burlap polyethylene sheeting.
- E. Bonding Compound: Non redispersable acrylic bonding admixture, ASTM C 1059, Type II.
 - 1. Products: The following products, provided they comply with requirements of the contract documents, will be among those considered acceptable:
 - a. "Everbond"; L & M Construction Chemicals, Inc.
 - b. "Flex Con"; The Euclid Chemical Company.
- F. Epoxy Bonding Systems: Epoxy adhesive for bonding fresh concrete to hardened concrete and for grouting wall pipes, bolts and reinforcing dowels. ASTM C 881; type, grade, and class as required for project conditions.
 - 1. Products: The following products, provided they comply with requirements of the contract documents, will be among those considered acceptable:
 - a. "Concresive LPL"; Master Builders, Inc.
 - b. "Sikadur 32 Hi Mod"; Sika Corporation.
 - c. "Euco #452 Epoxy System"; The Euclid Chemical Company.
 - d. "Sikastix 390".
 - e. "EucoEpoxy 461".
 - f. "Five Star Epoxy Grout".
 - g. "Sikstix 370".
 - h. "EucoEpocY 463".

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G. Expansion Joint Filler

1. Expansion Joint Filler shall be performed non-extruding and resilient type meeting the Specifications of ASTM D1751, or D1752, unless otherwise specified.
2. All expansion joints in base slabs on grade other than hydraulic structures shall be fiber expansion joints of required slab depth meeting the requirement of ASTM D1751, Type I and AASHTO M213. Exposed joints shall be sealed as specified below.
3. All expansion joints in hydraulic structures shall be $\frac{3}{4}$ inch sponge rubber expansion joints of required wall thickness meeting the requirements of ASTM D1752, Type I and AASHTO M153, Type I. Joints shall be sealed on both sides as specified below.
 - a. Nonextruding bituminous type: ASTM D 1751.
 - b. Sponge rubber type: ASTM D 1752, Type I.

H. Expansion Joint Sealer

1. Joint sealants for hydraulic structures shall be one of the following, or approved equal:
 - a. "CM-60" two-part gray tone, as manufactured by W. R. Meadows, Inc., applied over a backer rod sized for the joint. Underwater primer shall be used on all joints subject to immersion. Standard "CM-60" primer shall be applied to all other joints. Sealant depth shall be one-half the width of the joint.
 - b. The sealant shall be a two-part, polyurethane sealant "Eucolastic I" by the Euclid Chemical Company or "Sikaflex 1a" by Sika Chemical Company. Joint width should be 4 times the expected joint movement, but not less than $\frac{1}{4}$ inch. All joints shall be primed with "Eucolastic Primer" by the Euclid Chemical Company or "Sikaflex 429" by Sika Chemical Company.

I. PVC Waterstops

Waterstops: Made of Polyvinyl Chloride (PVC) and of subzero grade, Plastigrip, Type W-6 as manufactured by Progress Unlimited, Inc. or approved equivalent.

1. Minimum 4" x $\frac{3}{16}$ " or as specified on the drawings.
2. Produced from a compound, the base resin of which shall be virgin PVC.
3. Minimum Properties:
 - a. 2000 psi minimum tensile strength, ASTM D412-51T
 - b. 350% minimum elongation, ASTM D412-51T
 - c. -35 degrees F minimum low temperature brittleness, ASTM D746-57T
 - d. 65-75 shore 'A' durometer hardness, ASTM D676-59T
 - e. 0.15 maximum water absorption, ASTM D570-59T
4. Field Splicing:
 - a. Butt splices shall be fused welded using a thermostatically controlled Teflon PVC Waterstop iron at the Manufacturer's recommended temperature
 - b. Lapping, gluing or use of adhesives shall not be permitted.
 - c. Provide factory made waterstop fabrications for all changes of directions, intersections, and transitions leaving only butt joint splicing for the field.
5. Center waterstop in the joint and secure in correct position.

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6. Use ribbed center bulb for all moving joints. Use dumbbell for all non-movement joints.
7. Always place the center bulb in the center of the expansion joint. Do not embed the center bulb in concrete.
8. Vibrate concrete around waterstops thoroughly to prevent honeycombing and to ensure contact between concrete and waterstop.

2.05 CONCRETE MIX DESIGN

- A. Review: Do not begin concrete operations until proposed mix has been reviewed by the ENGINEER.
- B. Proportioning of Normal Weight Concrete: Comply with recommendations of ACI 211.1.
- C. Required Average Strength: Establish the required average strength f_{cr} of the design mix on the basis of trial mixtures as specified in ACI 301, and proportion mixes accordingly. Employ an independent testing agency acceptable to the ENGINEER for preparing and reporting proposed mix design.
- D. Proportion normal-weight concrete mix to produce an average strength at 28 day as follows unless otherwise indicated on the drawings:
 1. Columns, beams, walls, footings and slabs: 4000 psi
 2. Masonry Filled Grout: 3000 psi
 3. Prestressed Elements: 5000 psi
- E. Fly Ash:
 1. The CONTRACTOR may elect to replace a portion of the Portland cement with fly ash up to a maximum of 25 percent by weight of cement plus fly ash.
- F. Admixtures:
 1. Air entraining admixture: Add at rate to achieve specified air content.
 - a. Do not use in slabs on grade scheduled to receive topping, unless manufacturer of topping recommends use over air entrained concrete.
 2. Water reducing and retarding admixture: Add as required in concrete mixes to be placed at ambient temperatures above 90 degrees F.
 3. Water reducing and accelerating admixture: Add as required in concrete mixes to be placed at ambient temperatures below 50 degrees F.
 4. High range water reducing admixture (superplasticizer): Add as required for placement and workability.
 5. Do not use admixtures not specified or approved.
- G. Design mix to meet or exceed each requirement specified. Where more than one criterion is specified, the most stringent shall apply. For example, a minimum cement content or maximum water cement ratio might result in strengths greater than the minimum specified; likewise, a greater cement content or lower water cement ratio may be required in order to achieve the required strength.
 1. Specified compressive strength $f'(c)$ (ASTM C 39): As noted
 2. Maximum water cement ratio by weight:
 - a. 0.4 for concrete toppings subject to traffic

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- b. 0.45 for all other concrete
- 3. Maximum slump: As recommended in ACI 211.1. and ACI 350 as applicable.
- 4. Gradation of coarse aggregate: ASTM C 33 standard gradation with maximum nominal size of 3/4 inches.
- 5. Total air content (ASTM C 173 or ASTM C 231): 5 percent.
- H. Mix Adjustments: Provided that no additional expense to OWNER is involved, CONTRACTOR may submit for ENGINEER's approval requests for adjustment to approved concrete mixes when circumstances such as changed project conditions, weather, or unfavorable test results occur. Include laboratory test data substantiating specified properties with mix adjustment requests.

2.06 CONTROL OF MIX IN THE FIELD

- A. Slump: A tolerance of up to 1 inch above that specified will be permitted for 1 batch in 5 consecutive batches tested. Concrete of lower slump than that specified may be used, provided proper placing and consolidation is obtained.
 - 1. If slump upon arrival at the site is lower than 1 inch below the value specified, one addition of water in accordance with ASTM C 94 will be permitted to bring slump within tolerance, provided that:
 - a. A positive means is available to measure the amount of water added at the site.
 - b. The specified (or approved) maximum water cement ratio is not exceeded.
 - c. Not more than 45 minutes have elapsed since batching.
- B. Total Air Content: A tolerance of plus or minus 1 1/2 percent of that specified will be allowed for field measurements.
- C. Do not use batches that exceed tolerances.

2.07 CONCRETE MIXING

- A. On Site Equipment: Mix concrete materials in appropriate drum type batch machine mixer, in compliance with ASTM C 685. Mix each batch minimum of 1 1/2 minutes and maximum of 5 minutes before discharging concrete. Clean thoroughly at end of day and before changing concrete type.
- B. Transit Mixers: Mix concrete materials in transit mixers, complying with requirements of ASTM C 94.
 - 1. At ambient temperatures of 85 to 90 degrees F, reduce mixing and delivery time to 75 minutes.
 - 2. At ambient temperatures above 90 degrees F, reduce mixing and delivery time to 60 minutes.

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PART 3- EXECUTION

3.01 CONCRETE FORM PREPARATION

- A. General: Comply with requirements of ACI 301 for formwork, and as herein specified. The CONTRACTOR is responsible for design, ENGINEER, and construction of formwork, and for its timely removal.
- B. Earth Forms: Hand trim bottoms and sides of earth forms to profiles indicated on the drawings. Remove loose dirt before placing concrete.
- C. Design: Design and fabricate forms for easy removal, without impact, shock, or damage to concrete surfaces or other portions of the work. Design to support all applied loads until concrete is adequately cured, within allowable tolerances and deflection limits.
- D. Construction: Construct and brace formwork to accurately achieve end results required by contract documents, with all elements properly located and free of distortion. Provide for necessary openings, inserts, anchorages, and other features shown or otherwise required.
 - 1. Joints: Minimize form joints and make watertight to prevent leakage of concrete.
 - a. Align joints symmetrically at exposed conditions.
 - 2. Chamfers: Provide chamfered edges and corners at exposed locations, unless specifically indicated otherwise on the drawings.
 - 3. Permanent openings: Provide openings to accommodate work of other trades, sized and located accurately. Securely support items built into forms; provide additional bracing at openings and discontinuities in formwork.
 - 4. Temporary openings: Provide temporary openings for cleaning and inspection in most inconspicuous locations at base of forms, closed with tight fitting panels designed to minimize appearance of joints in finished concrete work.
- E. Tolerances for Formed Surfaces: Comply with minimum tolerances established in ACI 117, unless more stringent requirements are indicated on the drawings.
- F. Release Agent: Provide either form materials with factory applied non-absorptive liner or field applied form coating. If field applied coating is employed, thoroughly clean and recondition formwork and reapply coating before each use. Rust on form surfaces is unacceptable.

3.02 VAPOR RETARDER INSTALLATION

- A. General: Place vapor retarder sheet over prepared base material, aligning longer dimension parallel to direction of pour and lapped 6 inches. Seal joints with appropriate tape.

3.03 PLACING REINFORCEMENT

- A. General: Comply with requirements of ACI 301 and as herein specified.

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- B. Preparation: Clean reinforcement of loose rust and mill scale, soil, and other materials which adversely affect bond with concrete.
- C. Placement: Place reinforcement to achieve not less than minimum concrete coverages required for protection. Accurately position, support, and secure reinforcement against displacement. Provide Class C tension lap splices complying with ACI 318 unless otherwise indicated. Do not field bend partially embedded bars unless otherwise indicated or approved.
 - 1. Use approved bar supports and tie wire, as required. Set wire ties to avoid contact with or penetration of exposed concrete surfaces. Tack welding of reinforcing is not permitted.
 - 2. Wire fabric: Install in maximum lengths possible, lapping adjoining pieces not less than one full mesh. Offset end laps to prevent continuous laps in either direction, and splice laps with tie wire.
- D. Welding: Welding of reinforcement is not permitted.

3.04 JOINT CONSTRUCTION

- A. Construction Joints: Locate and install construction joints as indicated on drawings. If construction joints are not indicated, locate in manner which will not impair strength and will have least impact on appearance, as acceptable to the ENGINEER. Construction joints in retaining walls and walls of concrete tanks or structures subject to hydrostatic pressure shall be intentionally roughened to a full amplitude of approximately $\frac{1}{4}$ inch.
 - 1. Keyways: Provide keyways not less than 1 1/2 inches deep.
 - 2. Reinforcement: Continue reinforcement across and perpendicular to construction joints, unless details specifically indicate otherwise.
- B. Isolation Joints: Construct isolation joints in slabs poured on grade at points of contact with vertical components, such as foundation walls and column pedestals. Install expansion joint filler to full concrete depth. Recess top edge of filler 1/8 inch where joints are unsealed.
- C. Expansion Joints: Construct expansion joints where indicated. Install expansion joint filler to full depth of concrete. Recess edge of filler to depth indicated to receive joint sealant and backer rod as specified herein and detailed on drawings.
- D. Control Joints: Construct contraction joints in building slabs poured on grade to form panels of sizes indicated on drawings, but not more than 20 feet apart in either direction.
 - 1. Saw cuts: Form control joints by means of saw cuts one fourth the depth of the slab, performed as soon as possible after slab finishing without dislodging aggregate.

3.05 INSTALLATION OF EMBEDDED ITEMS

- A. General: Set anchorage devices and other items required for other work connected to or supported by cast in place concrete, using templates, setting drawings, and instructions from suppliers of items to be embedded.

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1. Edge Forms and Screeds: Set edge forms and intermediate screeds as necessary to achieve final elevations indicated for finished slab surfaces.

3.06 WATERSTOPS

- A. Waterstops shall be provided at all joints to seal off leakage of liquid from or into concrete tanks or structures subject to hydrostatic pressures. The type of waterstops used shall be as shown on the Drawings and as specified herein. The CONTRACTOR shall submit to the ENGINEER for approval the proposed procedure and schedule of concrete placing operations along with a detailed layout of the waterstop materials required showing sizes, lengths and types of joints.
- B. Where required for proper location of waterstops, whether shown on the Drawings or not, starter walls of up to 1-1/2 inches in height and monolithic with slabs shall be provided at all wall construction joints. Reinforcing steel shall not be depressed at waterstops but shall have only the amount of concrete covering shown or specified. Starter walls as specified shall be required whether shown on the Drawings or not, unless specified concrete cover over reinforcing steel is 3 inches or greater.

3.07 CONCRETE PLACEMENT

- A. Preparation: Provide materials necessary to ensure adequate protection of concrete during inclement weather before beginning installation of concrete.
- B. Inspection: Before beginning concrete placement, inspect formwork, reinforcing steel, and items to be embedded, verifying that all such work has been completed.
 1. Wood forms: Moisten immediately before placing concrete in locations where form coatings are not used.
- C. Placement General: Comply with requirements of ACI 304 and as follows:
 1. Concreting should be carried on at such a rate that the concrete is at all times plastic and flows readily into spaces between reinforcement.
 2. Schedule continuous placement of concrete to prevent the formation of cold joints.
 3. Provide construction joints if concrete for a particular element or component cannot be placed in a continuous operation.
 4. Deposit concrete as close as possible to its final location, to avoid segregation.
 5. Concrete shall be worked around reinforcement and embedded fixtures and into corners of forms.
 6. The following shall be prohibited from use:
 - a. Partially hardened concrete.
 - b. Contaminated concrete.
 - c. Re-tempered concrete.
 - d. Re-mixed concrete after initial set has occurred.
- D. Placement in Forms: Limit horizontal layers to depths which can be properly consolidated, but in no event greater than 24 inches.
 1. Consolidate concrete by means of mechanical vibrators, inserted vertically in

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freshly placed concrete in a systematic pattern at close intervals. Penetrate previously placed concrete to ensure that separate concrete layers are knitted together.

2. Vibrate concrete sufficiently to achieve consistent consolidation without segregation of coarse aggregates.
 3. Do not use vibrators to move concrete laterally.
- E. Slab Placement: Schedule continuous placement and consolidation of concrete within planned construction joints.
1. Thoroughly consolidate concrete without displacing reinforcement or embedded items, using internal vibrators, vibrating screeds, roller pipe screeds, or other means acceptable to ENGINEER.
 2. Strike off and level concrete slab surfaces, using highway straightedges, darbies, or bull floats before bleed water can collect on surface. Do not work concrete further until finishing operations are commenced.
- F. Cold Weather Placement: Comply with recommendations of ACI 306 when air temperatures are expected to drop below 40 degrees F either during concrete placement operations or before concrete has cured.
1. Do not use frozen or ice laden materials.
 2. Do not place concrete on frozen substrates.
- G. Hot Weather Placement: Comply with recommendations of ACI 305R when ambient temperature before, during, or after concrete placement is expected to exceed 90 degrees F or when combinations of high air temperature, low relative humidity, and wind speed are such that the rate of evaporation from freshly poured concrete would otherwise exceed 0.2 pounds per square foot per hour.
1. Do not add water to approved concrete mixes under hot weather conditions.
 2. Provide mixing water at lowest feasible temperature and provide adequate protection of poured concrete to reduce rate of evaporation.
 3. Use fog nozzle to cool formwork and reinforcing steel immediately prior to placing concrete.
- H. Mass Concrete Placement: Comply with recommendations of ACI 207.1R when any volume of concrete with dimensions large enough to require that measures be taken to cope with generation of heat from hydration of the cement and attendant volume change to minimize cracking.
1. When the minimum dimension of the concrete exceeds 36 inches and the ratio of volume of concrete to the surface area is greater than 12 inches, provide for mass concrete.
 2. Lifts shall not exceed 8ft.

3.08 FINISHING FORMED SURFACES

- A. Repairs, General: Repair surface defects, including tie holes, immediately after removing formwork.
1. Remove honeycombed areas and other defective concrete down to sound concrete, cutting perpendicular to surface or slightly undercutting. Dampen patch location and area immediately surrounding it prior to applying bonding compound or patching mortar.

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2. Before bonding compound has dried, apply patching mixture matching original concrete in materials and mix except for omission of coarse aggregate, and using a blend of white and normal Portland cement as necessary to achieve color match. Consolidate thoroughly and strike off slightly higher than surrounding surface.
- B. Textured Form Finish: Repair tie holes and patch defective areas to match pattern created by form construction or form liners.
- C. Unexposed Form Finish: Repair tie holes and patch defective areas. Rub down or chip off fins or other raised areas exceeding ¼-inch height.
- D. Exposed Form Finish: Repair and patch defective areas, with fins or other projections completely removed and smoothed.
 1. Smooth rubbed finish: Apply to surfaces indicated no later than 24 hours after form removal.
 - a. Wet concrete surfaces to be finished and rub with Carborundum brick or other abrasive until uniform color and texture are achieved.
 - b. Do not apply separate grout mixture.
 2. Contiguous unformed surfaces: Strike smooth and float to a similar texture tops of walls, horizontal offsets, and other unformed surfaces adjacent to or contiguous with formed surfaces. Continue final finish of formed surfaces across unformed surfaces, unless otherwise specifically indicated.

3.09 FINISHING SLABS

- A. Finishing Operations
 1. Do not directly apply water to slab surface or dust with cement.
 2. Use hand or powered equipment only as recommended in ACI 302.1R.
 3. Screeding: Strike off to required grade and within surface tolerances indicated. Verify conformance to surface tolerances. Correct deficiencies while concrete is still plastic.
 4. Bull Floating: Immediately following screeding, bull float or darby before bleed water appears to eliminate ridges, fill in voids, and embed coarse aggregate. Recheck and correct surface tolerances.
 5. Do not perform subsequent finishing until excess moisture or bleed water has disappeared and concrete will support either foot pressure with less than ¼-inch indentation or weight of power floats without damaging flatness.
 6. Final floating: Float to embed coarse aggregate, to eliminate ridges, to compact concrete, to consolidate mortar at surface, and to achieve uniform, sandy texture. Recheck and correct surface tolerances.
- B. Coordinate appearance and texture of required final finishes with the ENGINEER before application.
 1. Apply final finishes in the locations indicated on the drawings.
- C. Float Finish: As specified above.

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- D. Broomed Float Finish: After floating and when water sheen has practically disappeared, apply uniform transverse corrugations approximately 1/16-inch deep, without tearing surface.
- E. Slab Surface Tolerances:
 - 1. Achieve flat, level planes except where grades are indicated. Slope uniformly to drains.
 - 2. Floated finishes: Depressions between high spots shall not exceed 5/16 inch under a 10-foot straightedge.
- F. Repair of Slab Surfaces: Test slab surfaces for smoothness and to verify surface plane to tolerance specified. Repair defects as follows:
 - 1. High areas: Correct by grinding after concrete has cured for not less than 14 days.
 - 2. Low areas: Immediately after completion of surface finishing operations, cut out low areas and replace with fresh concrete. Finish repaired areas to blend with adjacent concrete. Proprietary patching compounds may be used when approved by the ENGINEER.
 - 3. Crazed or cracked areas: Cut out defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts. Dampen exposed concrete and apply bonding compound. Mix, place, compact, and finish patching concrete to match adjacent concrete.
 - 4. Isolated cracks and holes: Groove top of cracks and cut out holes not over 1 inch in diameter. Dampen cleaned concrete surfaces and apply bonding compound; place dry pack or proprietary repair compound acceptable to ENGINEER while bonding compound is still active:
 - a. Dry pack mix: One part Portland cement to 2-1/2 parts fine aggregate and enough water as required for handling and placing.
 - b. Install patching mixture and consolidate thoroughly, striking off level with and matching surrounding surface. Do not allow patched areas to dry out prematurely.

3.10 CONCRETE CURING AND PROTECTION

- A. General
 - 1. Prevent premature drying of freshly placed concrete and protect from excessively cold or hot temperatures until concrete has cured.
 - 2. Provide curing of concrete by one of the methods listed and as appropriate to service conditions and type of applied finish in each case.
- B. Curing Period
 - 1. Not less than 7 days for standard cements and mixes.
 - 2. Not less than 4 days for high early strength concrete using Type III cement.
- C. Curing Temperature
 - 1. Concrete shall be maintained above 50 degrees F and in moist condition during the entire curing period.

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- D. Formed Surfaces: Cure formed concrete surfaces by moist curing with forms in place for full curing period.
 - 1. Keep wooden or metal forms moist when exposed to heat of the sun.
 - 2. If forms are removed prior to completion of curing process, continue curing by one of the applicable methods specified.
- E. Surfaces Not in Contact with Forms
 - 1. Start initial curing as soon as free water has disappeared, but before surface is dry.
 - 2. Keep continuously moist for not less than 3 days by uninterrupted use of any of the following:
 - a. Water ponding.
 - b. Water saturated sand.
 - c. Water fog spray.
 - d. Saturated burlap: Provide 4-inch minimum overlap at joints.
 - 3. Begin final curing procedures immediately following initial curing and before concrete has dried.
 - a. Moisture retaining cover: Lap not less than 3-inches at edges and ends, and seal with waterproof tape or adhesive. Repair holes or tears during curing period with same tape or adhesive. Maintain covering in intimate contact with concrete surface. Secure to avoid displacement.
 - 1) Extend covering past slab edges at least twice the thickness of slab.
 - 2) Do not use plastic sheeting on surfaces which will be exposed to view when in service.
 - 3) Continue final curing to end of curing period.
- F. Avoid rapid drying at end of curing period.
- G. During and following curing period, protect concrete from temperature changes of adjacent air in excess of 5 degrees F per hour and 50 degrees F per 24 hours. Progressively adjust protective measures to provide uniform temperature changes over entire concrete surface.

3.11 SHORES AND SUPPORTS

- A. General: Comply with recommendations of ACI 347 for shoring and reshoring in multistory construction.
- B. Low Rise Construction: Extend shoring from ground to roof for structures 4 stories or less in height.
- C. Reshoring: Remove shores and reshore in a planned sequence, to avoid damage to partly cured concrete. Locate and provide adequate reshoring to safely support work without excessive stress or deflection.
- D. Provide as a package, shoring and reshoring drawings prepared by or under the direct supervision of a specialty ENGINEER registered in the State of Florida.

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3.12 REMOVAL OF FORMS AND SUPPORTS

- A. Non Load Bearing Formwork: Provided that concrete has hardened sufficiently that it will not be damaged, forms not actually supporting weight of concrete or weight of soffit forms may be removed after concrete has cured at not less than 50 degrees F for 24 hours. Maintain curing and protection operations after form removal.
- B. Load Bearing Formwork: Do not remove shoring and forms supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, until concrete has attained at least the specified compressive strength $f'(c)$ and until the CONTRACTOR has determined that the actual compressive strength attained is adequate to support the weight of the concrete and superimposed loads.
- C. Keep reshores in place a minimum of 15 days after placing upper tier, and longer if required, until concrete has attained at least the specified compressive strength $f'(c)$ and until the CONTRACTOR has determined that the actual compressive strength attained is adequate to support the weight of the concrete and superimposed loads.
- D. Keep supports in place until heavy loads due to construction operations have been removed.
- E. Test field cured specimens to determine potential compressive strength of concrete for specific locations.

3.13 MISCELLANEOUS CONCRETE ITEMS

- A. Fill in: Fill in holes and openings left in concrete structures for passage of work by other trades after such work is in place. Place such fill in concrete to blend with existing construction, using same mix and curing methods.
- B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as indicated on Drawings. Set anchor bolts at correct elevations, complying with diagrams or templates of equipment manufacturer.
 - 1. Grout base plates and foundations as indicated with non-shrink grout.
 - 2. Use nonmetallic grout for exposed conditions, unless otherwise indicated.
 - 3. Equipment bases shall be sized to provide a minimum of 1.5" between the edge of the equipment bases and the edge of the equipment being served.
 - 4. Provide conduit windows through equipment bases of electrical equipment sized no larger than the conduit windows of the equipment being served.
 - 5. Equipment bases for electrical equipment shall be a minimum of 4" thick with chamfered edges.
- C. Reinforced Masonry: Provide concrete grout for reinforced masonry where indicated on Drawings and as scheduled.

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3.14 CONCRETE REPAIRS

- A. General: Repairs due to poor workmanship shall be made by the CONTRACTOR at the CONTRACTOR's expense and shall be approved by the ENGINEER prior to repair procedure being implicated.
- B. Perform cosmetic repairs of concrete surfaces as specified under concrete application.
- C. Perform structural repairs with prior approval of the ENGINEER for method and procedure, using epoxy bonding systems. The ENGINEER's approval is required for repair methods using materials other than those specified.

3.15 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. Refer to Section 01410 for additional concrete testing requirements for the project.
- B. Composite Sampling and Making and Curing of Specimens: ASTM C 172 and ASTM C 31.
 - 1. Take samples at point of discharge.
 - 2. For pumped concrete, perform sampling and testing at the frequencies specified herein at point of delivery to pump, and perform additional sampling and testing at the same frequency at discharge from line.
 - 3. Results obtained at discharge from line shall be used for acceptance of concrete.
- C. Slump: ASTM C 143. One test per strength test and additional tests if concrete consistency changes.
 - 1. Modify sampling to comply with ASTM C 94.
- D. Air Content of Normal Weight Concrete: ASTM C 173 or ASTM C 231. One test per strength test performed on air entrained concrete.
- E. Concrete Temperature:
 - 1. Test hourly when air temperature is 40 degrees F or below.
 - 2. Test hourly when air temperature is 90 degrees F or above.
 - 3. Test each time a set of strength test specimens is made.
- F. Compressive Strength Tests: ASTM C 39.
 - 1. Compression test specimens: Mold and cure one set of 4 standard cylinders for each compressive strength test required.
 - 2. Testing for acceptance of potential strength of as delivered concrete:
 - a. Obtain samples on a statistically sound, random basis.
 - b. Minimum frequency:
 - 1) One set per 100 cubic yards or fraction thereof for each day's pour of each concrete class.
 - 2) One set per 3500 square feet of slab or wall area or fraction thereof for each day's pour of each concrete class.
 - 3) When the above testing frequency would provide fewer than 5 strength tests for a given class of concrete during the project, conduct testing from not less than 5 randomly selected batches, or

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- from each batch if fewer than 5.
- c. Test one specimen per set at 7 days for information unless an earlier age is required.
 - d. Test 2 specimens per set for acceptance of strength potential; test at 28 days unless other age is specified. The test result shall be the average of the two specimens. If one specimen shows evidence of improper sampling, molding, or testing, the test result shall be the result of the remaining specimen; if both show such evidence, discard the test result and inform the ENGINEER.
 - e. Retain one specimen from each set for later testing, if required.
 - f. Strength potential of as delivered concrete will be considered acceptable if all of the following criteria are met:
 - 1) No individual test result falls below specified compressive strength by more than 500 psi.
 - 2) Average of any 3 consecutive strength test results equals or exceeds specified compressive strength f'_c .
 - 3) Testing for evaluation of field curing:
 - a) Frequency: 1 field set of specimens per strength acceptance test.
 - b) Mold specimens from same sample used for strength acceptance tests. Field cure, and test at same age as for strength acceptance tests.
 - c) Evaluate construction and curing procedures and implement corrective action when strength results for field cured specimens are less than 85 percent of test values for companion laboratory cured specimens.
3. Removal of forms or supports: Mold additional specimens and field cure with concrete represented; test to determine strength of concrete at proposed time of form or support removal.
- G. Test Results: Testing agency shall report test results in writing to ENGINEER and CONTRACTOR within 24 hours of test.
- 1. Test reports shall contain the following data:
 - a. Project name, number, and other identification.
 - b. Name of concrete testing agency.
 - c. Date and time of sampling.
 - d. Concrete type and class.
 - e. Location of concrete batch in the completed work.
 - f. All information required by respective ASTM test methods.
 - 2. Nondestructive testing devices such as impact hammer or sonoscope may be used at ENGINEER's option for assistance in determining probable concrete strength at various locations or for selecting areas to be cored, but such tests shall not be the sole basis for acceptance or rejection.
 - 3. The testing agency shall make additional tests of in place concrete as directed by the ENGINEER when test results indicate that specified strength and other concrete characteristics have not been attained.
 - a. Testing agency may conduct tests of cored cylinders complying with ASTM C 42, or tests as directed.
 - b. Cost of additional testing shall be borne by the CONTRACTOR when unacceptable concrete has been verified.

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H. Water Tightness of Water Containing Walls

1. All basins, tanks, manholes, storm drainage structures, and wet wells are hydraulic structures and shall be watertight. Water tightness testing shall be conducted prior to any application of coatings or painting systems to the tank, basin, manhole, or wet well as per Sections 09900 and 13216. Each structure shall be filled with water, full depth (above maximum water level), prior to backfilling (unless otherwise noted) and kept full of water for 48 hours prior to starting the tightness testing. After 48-hours the level in the tank shall be measured and the testing period shall begin and conducted over a 24-hour period. The CONTRACTOR shall exercise every precaution to secure water tightness by careful mixing and placing of the concrete to obtain a homogeneous mixture at maximum density, without air pockets or voids, using the minimum practical amount of water in the mix. Extreme care shall be used to secure continuity of water stops at expansion and construction joints, to seal off holes from wall ties, and when placing concrete about wall sleeves, wall pipes and other obstructions. The CONTRACTOR shall fix all leaks.
2. The CONTRACTOR shall furnish, at his own expense, any pumps, piping, and appurtenances to provide the test water for the water tightness testing and any water post-loading operations of structures.
3. All structures shall be watertight.

END OF SECTION 03300

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PRECAST CONCRETE VAULTS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all professional services, labor, materials, equipment, and incidentals as shown, specified and required to design, furnish, load, haul, unload, hoist, set and install the precast concrete structures.
2. The work includes one precast chemical injection vault.
3. The sodium hypochlorite injection vault shall be governed by this specification. All stormwater inlet structures shall be governed by Section 02610 – Site Drainage.

B. General:

1. Structures shall conform in shape, size, dimensions, material, and other respects to the details shown or as ordered by ENGINEER. Minimum thickness sizes for slabs and walls are provided on the drawings.
2. Concrete for inverts in precast concrete structures shall be 4,000 psi and shall conform to the requirements specified under Section 03300, Cast-In-Place Concrete.

1.02 RELATED SECTIONS

- A. Section 01300 – Submittals
- B. Section 01600 – Delivery, Storage and Handling
- C. Section 02140 – Dewatering
- D. Section 02220 – Excavating, Backfilling and Grading for Structures
- E. Section 03300 – Cast-In-Place Concrete
- F. Section 05500 – Miscellaneous Metals
- G. Section 05560 – Aluminum Access Hatches
- H. Section 09900 – Painting

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1.03 QUALITY ASSURANCE

- A. Standards referenced in this Section are:
 - 1. American Association of State Highway and Transportation Officials (AASHTO).
 - 2. ASTM C 478, Standard Specification for Circular Precast Reinforced Concrete Manhole Sections.
 - 3. AWWA C 302, Reinforced Concrete Pressure Pipe, Non-Cylinder Type for Water and Other Liquids.
 - 4. Precast/Prestressed Concrete Institute (PCI) MNL-116, Manual for Quality Control for Plants and Production of Structural Precast Concrete Products.
- B. Fabrication Tolerances:
 - 1. General: Fabricate precast concrete units complying with manufacturing and testing procedures, quality control recommendations, and dimensional tolerances of PCI MNL-116, unless otherwise indicated. Keep bar sizes small, even where this will reduce the spacing of the bars.
 - 2. Units shall be true to dimensions. Unit bow, as fabricated and installed, shall not exceed 1/8-inch per unit in the short dimension and 1/4 inch per unit in the long dimension. Step in alignment face and jog in alignment shall not exceed 1/4-inch. Provide a 3/4-inch chamfer or 1 x 2-inch radius on all exposed edges and corners.
 - 3. Imperfections such as air bubbles, ripples, joint lines, warpage, stains, projections, honeycombs, uneven matrix plate, and other defects will not be acceptable.
- C. Qualifications and Responsibilities of CONTRACTOR's Design Professional:
 - 1. Professional Engineer:
 - a. Engage a registered professional engineer qualified to practice in the State of Florida and experienced in providing engineering services of the kind indicated.
 - b. Responsibilities include but are not necessarily limited to:
 - 1) Carefully reviewing precast concrete structural performance and design criteria stated in the Contract Documents.
 - 2) Preparing written requests for clarifications or interpretations of performance or design criteria for submittal to ENGINEER by CONTRACTOR.
 - 3) Preparing or supervising the preparation of design calculations and related drawings, shop drawings, testing plan development, test result interpretation and a comprehensive engineering analysis verifying compliance of the precast concrete structure with the requirements of the Contract Documents.

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PRECAST CONCRETE VAULTS

- 4) Signing and sealing all calculations and design drawings, and shop drawings.
 - 5) Certifying that:
 - i. It has performed the design of the precast concrete structure in accordance with the performance and design criteria stated in the Contract Documents, and
 - ii. The said design conforms to all applicable local, state and federal codes, rules and regulations, and to the prevailing standards of practice.
- D. Qualifications of Fabricator: A firm that complies with the following requirements and is experienced in producing structural precast concrete units similar to those indicated for this Project and with a record of successful in-service performance.
1. Participates in PCI's Plant Certification program at the time of bidding and is designated a PCI-certified plant for Group C, Category C1 – Precast Concrete Products (no pre-stressed reinforcement).
 2. Certification shall be maintained throughout the production of the precast concrete units. Production shall immediately stop if at any time the fabricator's certification is revoked, regardless of the status of completion of contracted work. Production will not be allowed to re-start until the necessary corrections are made and certification has been re-established. In the event certification(s) cannot be re-established in a timely manner, causing project delays, the fabricator, at no additional cost, will contract out the remainder of the units to be manufactured at a PCI certified plant.

1.04 SUBMITTALS

- A. All submittals shall be in accordance with Section 01300.
- B. Shop Drawings: Submit for approval the following:
1. Qualifications:
 - a. Submit qualifications data for the CONTRACTOR's Design Professional.
 2. Precast Structures:
 - a. Drawing showing design and construction of all precast concrete structures, as well as the location and details of all items that are to be embedded in the precast units.
 - b. Design calculations and shop drawings, signed and stamped with a seal of a Registered Professional Engineer licensed to practice in the State of Florida and PE certification provided in Section 01300. **Calculations must be submitted with the initial shop drawing for approval. Release and approval of the design will not be granted without the calculations being signed and sealed.**
 - c. Test result from concrete cylinder strength tests.

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PRECAST CONCRETE VAULTS

C. Shop Tests:

1. Submit description of proposed testing methods, procedures, and apparatus. Prepare and submit report for each test.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials:

1. Deliver precast concrete units to project site in such quantities and at such times to assure continuity of installation.
2. CONTRACTOR is responsible for all hauling, freight, fees, escort vehicles to deliver the concrete unit to the site. As a basis of bid for hauling the precast structures, the CONTRACTOR shall include as a minimum: wide load permits, overweight permits, tractors and trailers to haul overweight loads, wide load trailers, weight station fees, escort vehicles and coordination with FDOT and Florida Highway Patrol for route planning, as applicable.

B. Storage of Materials:

1. Store units at project site in a manner that will prevent cracking, distortion, warping, staining, or other physical damage and so that precast copings are without damage at time of installation.

C. Handling of Materials:

1. Lift and support units only at designated lifting or supporting points as shown on final Shop Drawings.

PART 2 – PRODUCTS

2.01 PRECAST CONCRETE STRUCTURES

A. Layout and details shall be as shown and specified. Design shall be adequate to withstand live loads, lateral earth pressure loading, and uplift case.

1. Design Criteria:
 - a. Top slab live load: 300 psf or AASHTO HS-20 truck wheel loads, whichever causes the greater stress.
 - b. Soil Design Parameters: Refer to the geotechnical report prepared by Meskel and Associates Engineering located in **Appendix A**.
 - c. Maximum ground water table = assume at ground surface
 - d. Vertical surcharge on soil of 300 psf.
 - e. Safety factor for uplift normal ground water > 1.5.
 - f. Safety factor for uplift 100-year storm ground water > 1.1.
2. Design shall meet the requirements of ACI 350 and the latest Florida Building Code.

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PRECAST CONCRETE VAULTS

- B. Concrete Mix: Standard-weight concrete consisting of specified Portland cement, pigments, aggregates, admixtures, and water to produce the following properties:
 - 1. Compressive Strength: 4,000 psi minimum at 28 days.
 - 2. Total Air Content: not less than 4 percent nor more than 6 percent.
- C. Where precast structures are made up of various precast components such as base sections, riser sections and top sections, the joint between sections shall be watertight and be the tongue and groove type complying with AWWA C302.
- D. Walls shall be precast with wall pipes or with pipe sleeves with water stop suitable for application or as shown on Drawings.
- E. Precast structure shall be designed and constructed to accept access hatches, aluminum grating, or castings as shown and specified.
- F. Precast structures shall be designed to support the weight of equipment lifted from the structure to the top slab as necessary.
- G. Underground precast units shall have a shop-applied exterior coating. The units shall be given two coats of bitumastic coating with a total dry film thickness of 12 mils. Each coat shall be applied at a rate not to exceed one gallon per 100 square feet. Time shall be allowed between coats to permit sufficient drying. Field application of coating is unacceptable except for coating repairs.
- H. Lifting holes, if used, shall be tapered. Tapered, solid rubber plugs shall be furnished to seal the lifting holes. The lifting holes shall be made to be sealed by plugs driven from the outside face only.
- I. Mark date of manufacture and name of trademark of manufacturer on inside of barrel.

2.02 ACCESS HATCHES, CASTINGS, OR GRATING

- A. All necessary access hatches and castings as shown and specified shall be cast into concrete as necessary, refer to the civil details, Section 05500, and/or Section 05560 for additional requirements.
- B. Where grating is shown, the manufacturer shall accommodate the support of grating. All grating shall meet the requirements as detailed on the structural general notes sheet.
- C. Where grating is shown, the manufacturer shall accommodate the support of grating. All grating shall meet the requirements as detailed on the structural general notes sheet.

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PRECAST CONCRETE VAULTS

2.03 SHOP TESTING

A. Shop Tests:

1. At a minimum, conduct the following shop test:
 - a. Conduct concrete cylinder strength tests. Cylinders shall be cured in the same manner as the precast structures. Collect a minimum of five test cylinders from every 50 cubic yards of concrete poured at a minimum.

PART 3 – EXECUTION

3.01 INSPECTION

- A. CONTRACTOR and his installer shall examine the substrate and the conditions under which Work is to be performed and notify OWNER of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to OWNER.

3.02 INSTALLATION

- A. Set units in true alignment. All joints shall be sealed with cement mortar inside and out and troweled smooth to the contour of the wall surface. Raised or rough joint finishes will not be accepted.
- B. Precast structures shall be set on structural fill or concrete foundation and in accordance with geotechnical recommendations. Precast units shall be set at the proper grade and carefully leveled and aligned.
- C. Install units in accordance with manufacturer's recommendations.
- D. Replace precast concrete units damaged for any reason or which fail to perform as specified.
- E. Each structure shall be watertightness tested and the ENGINEER shall observe each test.
1. Refer to Section 03300 for specific requirements.
 2. Lower groundwater table below bottom of the structure for the duration of the test. Plug all pipes and other openings into the structure and brace to prevent blow out. Fill structure with water to the top of the section. If the excavation has not been backfilled and no water is observed moving down the surface of the structure, the structure is satisfactorily watertight. If the test, as described above is unsatisfactory as determined by the ENGINEER, or if the structure excavation has been backfilled, continue the test. A period of time may be permitted to allow for absorption. The requirement shall be zero leakage over the time period. Uncover the rejected structure as necessary and to

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PRECAST CONCRETE VAULTS

disassemble, reconstruct or replace it as directed by the ENGINEER. Retest the structure and, if satisfactory, fill and paint the interior joints.

3. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorptions, etc. It will be assumed that all loss of water during the test is a result of leaks through the joints or through the concrete.
4. Testing shall be completed prior to any interior coating (if required) being applied.

END OF SECTION 03411

SECTION 03520

LIGHTWEIGHT CONCRETE ROOF INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes cast-in-place lightweight concrete roof insulation, incorporation vermiculite aggregate and embedded polystyrene rigid insulation board.
- B. Related Sections:
 - 1. Section 07552; SBS Modified Bituminous Membrane Roofing: contains requirements for roof membrane systems to be installed on top of lightweight concrete roof insulation.

1.03 REFERENCE

- A. American Society for Testing and Materials (ASTM)
100 Barr Harbor Drive, West Conshohocken, PA 19428.
(601) 832-9500
 - 1. ASTM C 495; Standard Test Method for Compressive Strength of Lightweight Insulation Concrete.
 - 2. ASTM C 332; Standard Specification for Lightweight Aggregates for Insulation Concrete.
 - 3. ASTM C 578; Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
 - 4. ASTM C 150; Standard Specification for Portland Cement Types I, II, III.
 - 5. ASTM C 177; Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot Plate Apparatus.
- B. Underwriters Laboratories, Inc. (UL)
333 Pfingsten Road, Northbrook, IL 60062-2096.
(847) 272-8800
 - 1. Fire Resistance Directory (Latest Edition)
- C. Factory Mutual Research Corporation
1151 Boston-Providence Turnpike
Norwood, MA 02062
(781) 255-4681

1.04 SUBMITTALS

- A. Provide submittals in accordance with Section 01300.

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LIGHTWEIGHT CONCRETE ROOF INSULATION

- B. Product Data: For lightweight concrete insulation system and individual system components. Include manufacturer's instructions for mixing and placement of lightweight concrete insulation systems.
- C. Shop Drawings: Include roof plans, sections, and details showing roof slopes, lightweight insulating concrete thicknesses at all high and low points, embedded insulation board, roof penetrations, roof perimeter terminations and curbs, control and expansion joints, and roof drains.
- D. Material Safety Data Sheets (MSDS): For Portland cement, vermiculite aggregate and rigid insulation board.
- E. Design Mixtures: Lightweight insulating concrete mix design.
- F. Laboratory Test Results: From an independent laboratory, submit test results for the following performance criteria:
 - 1. Thermal insulation value per ASTM C 177
 - 2. Mix design compressive strength per ASTM C 495
 - 3. Mix design wet and dry density range per ASTM C 495
 - 4. Expanded polystyrene density per ASTM C 578
- G. Sample Warranty/Guarantee: Submit sample document, including addendum as required, indicating compliance with all specified requirements.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An installer who employs and retains, throughout the project, supervisors who are trained and approved by manufacturer.
 - 1. A firm that has been evaluated by UL and found to comply with requirements of the National Roof Deck Contractors Association Lightweight Insulating Concrete Roof Deck Contractors (LWIC) Accreditation Program.
- B. FM Approvals Listing: Provide lightweight concrete roof insulation evaluated by FM Approvals as part of a roof assembly and listed in FM Approvals' "RoofNav" as part of an approved roof assembly which includes all other assembly materials specified for this project. The lightweight concrete insulation must be part of an approved FM assembly with the minimum classifications specified for this project.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original undamaged packages or acceptable bulk containers, fully identified as to manufacturer, brand or other identifying data bearing the proper Underwriters Laboratories (UL) and/or Factory Mutual (FM) labels.
- B. Store packaged materials to protect them from elements or physical damage, in a dry location.
- C. Do not use cement that shows indications of moisture damage, caking, or other deterioration.

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- D. Familiarize every member of the application crew with the manufacturer's material safety data sheets and with all fire and safety regulations required by governing codes and regulations.

1.07 PROJECT CONDITIONS

- A. Do not place lightweight insulating concrete unless ambient temperature and roof surface temperature is at least 40 deg F and rising and predicted to remain above 40 deg F for at least the first twenty-four (24) hours after placement.
- B. Do not place lightweight insulating concrete during rain or snow or on surfaces covered with standing water, snow, or ice.
- C. Do not place lightweight concrete roof insulation when precipitation is predicted within the first twenty-four (24) hours after placement or before the concrete is expected to sufficiently harden/ cure to prevent damage from precipitation, whichever is longer.

1.08 WARRANTY/GUARANTEE

- A. Upon successful completion of the project, and after all post installation procedures have been completed, furnish the OWNER with a letter that certifies that the installation of the roof system including the lightweight insulating concrete system and the roof membrane/flashing system. The roof system guarantee shall include both the roofing and flashing membrane, and the specified new lightweight insulating concrete system consisting of aggregate fill, patented-pre-formed polystyrene panels, base sheet, and base sheet fasteners. All repair or replacement costs covered under the guarantee shall be borne by the roof membrane/flashing manufacturer. The guarantee shall be for a 20-year term, without deductibles or limitations on coverage amount, and be issued at no additional cost to the OWNER. Refer to Section 07552; SBS Modified Bituminous Membrane Roofing and Section 01740; Warranties.
- B. In addition to coverage specified above, specific lightweight concrete insulation items covered during the terms of the warranty/guarantee shall include:
 - 1. The actual resistance to heat flow through the roof insulation will be at least 80 percent of the design thermal resistance, provided the roof membrane is free of leaks.
 - 2. The roof insulation system will remain as a re-roofable condition, capable of retaining fasteners similar to and with pull-out resistance equal to or exceeding the original installation, excluding damage to the insulation caused by removal of the original roof membrane.
 - 3. The roof insulation system will not cause structural damage to the building as a result of expansion from thermal or chemical reaction.
 - 4. The roof insulation will remain in place even if the roof membrane sustains wind damage covered by the guarantee.
 - 5. The roof system guarantee will not limit, by geographic location, the OWNER's rights for claims, actions, and/or proceedings.

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PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design Manufacturer: Subject to compliance with requirements, provide products by the following:
 - 1. Siplast, Inc., Suite 1600 N, 222 West Ls Colinas Blvd., Irving, TX 75039, (972) 869-0070
 - a. Acceptable System: "The NVS System"

2.02 MATERIALS

- A. Cementitious Material: Portland cement, ASTM C 150, Type I, Type II or Type III.
- B. Lightweight Mineral Aggregate: ASTM C 332, Group I, vermiculite and containing no detectable asbestos as determined by the method specified in 40 CFR 763, Subpart E, Appendix E, Section 1, "Polarized Light Microscopy".
 - 1. "NVS Concrete Aggregate" by Siplast, Inc.
- C. Water: Potable that is clean and free of deleterious amounts of acid, alkali and organic compounds.
- D. Molded-Polystyrene Insulation Board: Expanded polystyrene (EPS) insulation board, ASTM C 578, Type I, having a minimum nominal density of 1.0-lb/cu. ft. and containing approximately three percent (3 percent) open area.
 - 1. "Insulperm Insulation Board" by Siplast, Inc.
 - a. Insulation boards shall be provided in one inch (1 inch) increment thickness only. Half-inch (1/2 inch) increment thickness boards are not acceptable.
- E. The R value for the insulation and lightweight topping at the edge shall be R=7.8. This shall be achieved by 1.5 inches expanded polystyrene insulation plus a minimum 1.5 inches lightweight topping concrete over the insulation. The R value at midspan of the roof shall be R=25.8. This shall be achieved by 6 inches of polystyrene insulation plus a minimum of 1.5 inches of lightweight concrete over the insulation.

2.03 DESIGN MIXTURES

- A. Prepare design mixtures for lightweight concrete roof insulation by laboratory trial batch method. Use a qualified independent testing agency for preparing and reporting proposed mix designs.
- B. Limit water-soluble chloride ions to the maximum percentage by weight of cement or cementitious material permitted by ACI 301
- C. Design mix to product lightweight concrete roof insulation with the following minimum physical properties using the minimum amount of water necessary to product a workable mix.

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1. As-Cast Unit Weight: 60 to 68 lb/cu. ft. at point of placement, when tested according to ASTM C 138.
2. Oven-Dry Unit Weight: 35 to 41 lb/cu. ft. when tested according to ASTM C 495.
3. Compressive Strength: Minimum of 300 psi, when tested according to ASTM C 495.
4. Cement-to-Aggregate Ratio, by Volume 1:3.5.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Inspect, clean and prepare the surface of the waterproof vapor barrier as required to ensure that the surface to receive lightweight concrete is free of oil, grease, paints/primers, dirt, water or any other materials that would interfere with bonding of the lightweight concrete to the waterproof vapor barrier.
- B. Inspect and repair the surface of the waterproof vapor barrier as required to ensure that the membrane, flashing and flashing terminations are completely watertight.

3.02 MIXING AND PLACING

- A. The initial flow of lightweight insulating concrete shall be into a waste container until it is flowing properly and free of excess water.
- B. Mix and place lightweight insulating concrete according to manufacturer's written instructions, using equipment and procedures to avoid segregation of mixture and loss of air content.
- C. Place a one eighth inch (1/8 inch) minimum slurry coat of lightweight concrete over top of the waterproof vapor barrier.
- D. Place polystyrene board insulation in wet, lightweight concrete slurry within thirty (30) minutes of pouring the slurry. Ensure full contact of board insulation with slurry, stagger joints, and tightly butt insulation boards.
 1. Install insulation boards in thickness shown on the approved shop drawings.
 2. The difference in thickness of adjacent boards at insulation steps shall be no greater than one inch (1 inch) and shall be no less than one inch (1 inch).
- E. Within four (4) hours of placing insulation boards in the slurry coat, fill all holes/slots in the insulation board with lightweight concrete and pour a one-inch (1.5-inch) minimum lightweight topping over insulation boards.
 1. Deposit and screed lightweight concrete roof insulation in a continuous operation until an entire panel or section of roof area is completed. Do not vibrate or work mix except for screeding or floating. Place to depths and slopes indicated.
 2. Finish top surface smooth, free of ridges and depressions, and maintain surface condition to receive subsequent roofing system.

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- a. There shall be no ponding water or "birdbaths", retaining water longer than twenty-four (24) hours after precipitation, on the finished surface of the lightweight concrete insulation or subsequent finished roof system.
- F. Begin curing operations immediately after placement, and air cure for not less than three days, according to manufacturer's written instructions, before application of roofing.
 1. If ambient temperature falls below 32 deg F, protect lightweight concrete roof insulation from freezing and maintain temperature recommended by manufacturer for seventy-two (72) hours after placement.
 2. If precipitation occurs within the three days (min.) curing period, allow an additional three days (min.) from the end of each period of precipitation before application of roofing.
 3. Avoid roof-top traffic over the lightweight concrete insulation until one can walk over the surface without creating surface damage.

3.03 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to sample materials, perform field tests and inspections, and prepare test reports evaluating lightweight concrete roof insulation according to requirements specified in this Article.
- B. Testing agency shall take samples of lightweight insulating concrete according to ASTM C 172, except as modified by ASTM C 495, and shall be performed according to the following requirements:
 1. Determine as-cast unit weight during each hour of placement, according to ASTM C 138.
 2. Determine oven-dry unit weight and compressive strength according to ASTM C 495. Make a set of at least six molds for each day's placement, but not less than one set of molds for each 5000 sq. ft. of roof area.
 3. Perform additional tests when test results indicate that as-cast unit weight, oven-dry unit weight, compressive strength, or other requirements have not been met.
 - a. Retest cast-in-place lightweight concrete roof insulation according to ASTM C 513 for oven-dry unit weight and compressive strength.

3.04 DEFECTIVE WORK

- A. Remove and replace lightweight concrete roof insulation if surfaces are excessively scales or too rough to receive roofing, according to roofing membrane manufacturer's written requirements.
- B. Remove and replace lightweight concrete roof insulation that fails to comply with oven-dry unit weight, compressive strength requirements.
- C. Remove and replace lightweight concrete roof insulation that fails to demonstrate adequate fastener pull-out resistance.

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LIGHTWEIGHT CONCRETE ROOF INSULATION

- D. Remove and replace lightweight concrete roof insulation in areas that pond water on the surface lightweight concrete insulation or subsequent finished roof membrane system longer than twenty-four (24) hours after precipitation, including adjacent areas required to ensure proper drainage across the affected area and eliminate ponding water.
- E. Remove and replace lightweight concrete roof insulation in all areas where insulation board was not placed in slurry and/or was not covered with concrete within the time limits specified.
- F. Repair Procedures: Perform all patching and repairing of lightweight concrete insulation, using the same materials listed in this specification, as follows:
 - 1. Mark the outline of the area of the lightweight concrete to be removed.
 - 2. Make a vertical saw-cut in the concrete to a minimum depth of one inch (1 inch) around the marked area.
 - 3. Remove the lightweight concrete assembly down to the waterproof vapor barrier. Clean surface of waterproof vapor barrier before installing new lightweight concrete system.
 - a. If project conditions permit, as determined by and with written approval of the owner, excessively scaled or rough surfaces may be covered with an additional over-pour of lightweight concrete.
 - 1) Over-pour shall not result in less than 8 inch minimum flashing heights.
 - 2) Over-pour shall not result in altered drainage patterns or areas of ponding water.
 - 3) Thickness of over-pour must be not less than 1 inch.
 - 4) Feathering of over-pour edges to meet surface of existing concrete is not permitted.
 - a) Saw-cut existing concrete 24 inch beyond over-pour area, remove concrete down to top of insulation board and replace concrete as continuation of over-pour.

END OF SECTION 03520

SECTION 04230

REINFORCED UNIT MASONRY

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes unit masonry assemblies that shall be provided as necessary to construct the new buildings as part of this project. Items included in this section are:
 - 1. Decorative concrete masonry units (Split faced and smooth faced, colored CMU)
 - 2. Mortar and grout
 - 3. Reinforcing steel
 - 4. Masonry joint reinforcement
 - 5. Ties and anchors
 - 6. Miscellaneous masonry accessories
- B. Products furnished, but not installed, under this Section include the following:
 - 1. Anchor sections of adjustable masonry anchors for connecting to structural frame, installed under Division 5 Section "Structural Steel."
- C. Products installed, but not furnished, under this Section include the following:
 - 1. Steel lintels and shelf angles for unit masonry, furnished under Division 5 Section "Metal Fabrications."

1.03 DEFINITIONS

- A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.04 SUBMITTALS

- A. Provide submittals in accordance with Section 01300.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: For the following:
 - 1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
- D. Samples for Initial Selection: For the following:
 - 1. Decorative concrete masonry units, in the form of small-scale units.
 - 2. Colored mortar.
 - 3. Weep holes/vents.
- E. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot

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numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- F. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:
1. Masonry units.
 - a. Include material test reports substantiating compliance with requirements.
 2. Cementitious materials. Include brand, type, and name of manufacturer.
 3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 4. Grout mixes. Include description of type and proportions of ingredients.
 5. Reinforcing bars.
 6. Joint reinforcement.
 7. Anchors, ties, and metal accessories.
- G. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports, per ASTM C 780, for mortar mixes required to comply with property specification.
 2. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- H. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1093 for testing indicated, as documented according to ASTM E 548.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.
- D. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

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- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Build full mockup of typical wall area as shown on Drawings.
 2. Build mockups for typical exterior wall in sizes approximately 48 inches wide and 60 inches high by full thickness, including face and backup wythes and accessories.
 - a. Include a sealant-filled joint at least 16 inches long in each exterior wall mockup.
 - b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.
 - c. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
 3. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
 4. Protect accepted mockups from the elements with weather-resistant membrane.
 5. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
 - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
 - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
 - c. Mock ups must be approved the the Architect and OWNER prior to beginning construction of any building.
- F. Preinstallation Conference: Conduct conference at Project site to discuss masonry and building construction requirements. Pay special attention to anchoring of door and window frames, providing necessary blocking, and the use of the correct anchor attachments that are provided with all opening frames including but not limited to windows, doors and louvers.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry. Keeping units dry while stored as well as while being laid is very important to the prevention of efflorescence. Make every effort to keep cmu units dry at all times.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

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- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.07 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work or in the event of rain during a days work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides and anchor cover securely in place. Be advised this aspect of the construction process will be closely monitored.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
 - 5. Remove any and all stained or damaged blocks that cannot be cleaned.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

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1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.02 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.03 CONCRETE MASONRY UNITS (CMUs)

- A. Shapes: Provide shapes indicated and as follows:
 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 2. Provide square-edged units for outside corners, unless otherwise indicated.
 3. All units to be manufactured with moisture inhibitors. Design basis for moisture inhibitor is the Dry-Block System.
- B. Decorative Concrete Masonry Units: ASTM C 90.
 1. Weight Classification: Normal weight.
 2. Pattern and Texture:
 - a. Standard pattern, smooth and split face finish, integrally colored CMU with moisture inhibitors. Final block color shall be selected by OWNER, JEA.
 3. Size (Width): Manufactured to the following dimensions:
 - a. 8 inches nominal; 7-5/8 inches actual.
 - b. 12 inches nominal; 11-5/8 inches actual.
 4. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.
 - a. Where units are to be left exposed, provide color and texture matching the range represented by Architect's sample and as indicated on the drawings.
 - b. All units to be manufactured with moisture inhibitors. Design basis for moisture inhibitor is the Dry-Block System.

2.04 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.

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- C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.
- D. Colored Cement Product: Packaged blend made from portland cement and lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 - 1. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
 - a. Color for colored, split faced CMU. Refer to the Drawings for the colors.
 - 2. Pigments shall not exceed 10 percent of portland cement by weight.
 - 3. Available Products:
 - a. Colored Portland Cement-Lime Mix:
 - 1) Capital Materials Corporation; Riverton Portland Cement Lime Custom Color.
 - 2) Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
 - 3) Lafarge North America Inc.; Eaglebond.
 - 4) Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.
- E. Aggregate for Mortar: ASTM C 144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
- F. Aggregate for Grout: ASTM C 404.
- G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 - 1. Available Products:
 - a. Addiment Incorporated; Mortar Kick.
 - b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Morset.
 - c. Sonneborn, Div. of ChemRex; Trimix-NCA.
- H. Water: Potable.
- I. Mortar shall have moisture inhibitors.
- J. Mortar Joints to be concave struck. Make every effort to produce a dry joint to defeat the passage of water. Design basis for the mortar moisture inhibitor is the Dry-Block II Mortar Admixture System.

2.05 REINFORCEMENT

- A. Masonry Joint Reinforcement, General: ASTM A 951.
 - 1. Interior Walls: Hot-dip galvanized, carbon steel.
 - 2. Exterior Walls: Hot-dip galvanized, carbon steel.
 - 3. Wire Size for Side Rods: W1.7 or 0.148-inch diameter.
 - 4. Wire Size for Cross Rods: W1.7 or 0.148-inch diameter.
 - 5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.

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6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- B. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.06 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with subparagraphs below, unless otherwise indicated.
 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.

2.07 MISCELLANEOUS ANCHORS

- A. Post installed Anchors: Provide chemical or torque-controlled expansion anchors, with capability to sustain, without failure, a load equal to six times the load imposed when installed in solid or grouted unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
 1. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).
 2. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group 1 or 4) for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.

2.08 MISCELLANEOUS MASONRY ACCESSORIES

- A. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color selected from manufacturer's standard.
 1. Available Products:
 - a. Mortar Net USA, Ltd.; Mortar Net Weep Vents.
 2. Provide weeps at wall bases, opening sills, heads and other obstructions to downward movement of water. Provide thru wall flashing at each weep location. Weeps shall be at 2-ft-8-inch O.C. horizontally.

2.09 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
 1. Available Manufacturers:
 - a. Diedrich Technologies, Inc.

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- b. EaCo Chem, Inc.
- c. ProSoCo, Inc.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. The intent of the drawings is to build to masonry dimensions without cutting. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
 - 1. Mix units from several pallets or cubes as they are placed.
- F. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
 - 1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.

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3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.
7. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.03 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond and bond pattern indicated on Drawings; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet CMU if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- H. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.

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REINFORCED UNIT MASONRY

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c., unless otherwise indicated.
3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 7 Section "Fire-Resistive Joint Systems" as applicable.

3.04 MORTAR BEDDING AND JOINTING

- A. Lay concrete masonry units as follows:
 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.05 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 1. Space reinforcement not more than 16 inches o.c.
 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.
 - a. Reinforcement above is in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

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- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.06 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry as follows:
 - 1. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
- C. Install expansion or control joints maximum of 24-ft-0-inch O.C. in exterior CMU.

3.07 LINTELS

- A. Install steel lintels where indicated.
- B. Provide minimum bearing of 16 inches at each jamb, unless otherwise indicated.

3.08 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
- B. Install flashing as follows, unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - 2. At all exterior masonry walls, use "Blockflash" pan with connection bridge single wythe flashing weep system.
 - 3. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
 - 4. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

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- D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
 - 1. Use specified weep/vent products to form weep holes.
 - 2. Space weep holes 32 inches o.c., unless otherwise indicated.

3.09 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - 1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - 2. Limit height of vertical grout pours to not more than 60 inches.

3.10 FIELD QUALITY CONTROL

- A. Inspectors: OWNER will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.
 - 1. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.

3.11 PARGING

- A. Parge exterior faces of below-grade masonry walls, where indicated, in 2 uniform coats to a total thickness of 3/4 inch. Dampen wall before applying first coat and scarify first coat to ensure full bond to subsequent coat.
- B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.
- C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.12 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match

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adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 - 6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.13 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Crush masonry waste to less than 4 inches in each dimension.
 - 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 2 Section "Earthwork."
 - 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off OWNER's property.

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REINFORCED UNIT MASONRY

3.14 CONCRETE MASONRY UNIT SCHEDULE

- A. Reference architectural drawings for locations of CMU types and elevations; match exposed face of lintel CMUs with CMU of wall. CMU shall be as manufactured by "Best Block LLC." Final integrally colored CMU shall be selected by the OWNER, JEA.
- B. Interior walls of CMU shall be standard grey stretcher in widths indicated on floor plans.

END OF SECTION 04230

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STRUCTURAL STEEL

PART 1- GENERAL

1.01 SUMMARY

- A. Description of scope and intent:
 - 1. CONTRACTOR shall provide all material, labor, and tools required to complete the installation of specified system.
 - 2. Any omission of reference to items required to complete the full operational and functional system specified in the section does not relieve the CONTRACTOR of the obligation to provide same.
 - 3. To provide installation of all items, including delivery, dispersing to the proper locations within the building, and affixing in place.
 - 4. Installation shall be accomplished by workers skilled in their craft who will perform their work in a professional manner and will leave the premises safe, orderly and clean.
 - 5. Drawings and general provisions of Contract, including General and Supplemental Conditions and Division 1 Specification Sections, apply to this Section.
 - 6. CONTRACTOR is responsible for coordination of work included in this specification with all other specification sections related to furnishing of all materials, labor, permits, fees and services necessary for completion of work in this Section.
 - 7. In the event of a conflict between the Design Drawings, referenced standards and these Specifications, the more stringent shall govern unless directed otherwise by the ENGINEER. CONTRACTOR shall strictly adhere to OSHA requirements and local codes or those of any regulatory agency or body with jurisdiction.
- B. Section Includes:
 - 1. Fabrication and erection of structural steel framing members, as defined in AISC Code and as indicated on the drawings.
 - 2. Fabrication and erection of architecturally exposed structural steel (AESS).
 - 3. Welding.
 - 4. Shop painting.
- C. Products furnished but not installed under this section:
 - 1. Steel anchorages cast in concrete.
 - 2. Steel anchorages embedded in masonry.

1.02 REFERENCES

Comply with the following documents, except where requirements of the Contract Documents or of governing codes and governing authorities are more stringent. All referenced standards refer to the edition in force at the time these plans and specifications are issued.

- A. ASTM A 36 -- Standard Specification for Structural Steel
- B. ASTM A 6 -- General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use

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- C. ASTM A 123 -- Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- D. ASTM A 307-- Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
- E. ASTM A 325-- Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
- F. ASTM A 500-- Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
- G. ASTM A 786 – Rolled Steel Floor Plates
- H. ASTM A 992 – Specification for Structural Steel Shapes
- I. ASTM C 1107-- Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
- J. ASTM E 94 -- Standard Guide for Radiographic Testing
- K. ASTM E 142-- Standard Method for Controlling Quality of Radiographic Testing
- L. ASTM E 164-- Standard Practice for Ultrasonic Contact Examination of Weldments
- M. ASTM E 165-- Standard Test Method for Liquid Penetrant Examination
- N. ASTM E 709-- Standard Guide for Magnetic Particle Examination
- O. ASTM F 959-- Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners
- P. AWS D1.1-- Structural Welding Code - Steel; American Welding Society
- Q. Code of Standard Practice for Steel Buildings and Bridges; American Institute of Steel Construction, Inc. (AISC)
- R. Specification for Structural Steel Buildings -- Allowable Stress Design and Plastic Design; American Institute of Steel Construction, Inc. (AISC)
- S. Specification for Structural Joints Using ASTM A325 or A490 Bolts; Research Council on Structural Connections; American Institute of Steel Construction, Inc. (AISC)
- T. Steel Structures Painting Manual, Volume 2, Systems and Specifications; Steel Structures Painting Council (SSPC)

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STRUCTURAL STEEL

1.03 DEFINITIONS

- A. Structural Steel: Items as listed in 2.1 of AISC "Code of Standard Practice for Steel Buildings and Bridges," and excluding steel, iron, or other metal items not listed, even if attached to the structural framing.

1.04 SYSTEM DESCRIPTION

- A. General: Unless otherwise specifically approved in writing, furnish exact sections, weights, and kinds of material specified, using details and dimensions shown.
 - 1. Not all connections are detailed; similar details apply to similar conditions, unless otherwise indicated. Contact the Architect promptly to verify design of members or connections in any situation where design requirements are unclear.

1.05 SUBMITTALS

- A. Provide submittals in accordance with Section 01300.
- B. Product Data: Producer's or manufacturer's information for products as follows, including sufficient data to show compliance with specified requirements:
 - 1. Mill test reports for each type of structural steel furnished.
 - 2. Test reports for high-strength bolts, nuts, and washers, including chemical analysis, tensile strength tests, and hardness tests.
 - 3. Test reports for direct tension indicators.
 - 4. Specifications for primer paint, including manufacturer's data on chemical composition, adhesion of spray fireproofing, and dry film thickness per applied coat.
 - 5. Specifications for non-shrink grout.
- C. Shop Drawings: Complete drawings for structural steel, including information on location, type, and size of all connections, distinguishing between those made in the shop and those made in the field.
 - 1. Indicate weld lengths and sizes, using standard American Welding Society (AWS) welding symbols.
 - 2. Include setting drawings and templates for anchorages to be installed by others.
 - 3. Prepare shop drawings under the seal of a professional structural ENGINEER registered in the state of Florida.
 - 4. The fabricator is specifically responsible for the adequacy of any connections designed by the fabricator to performance standards established in the contract documents. Approval by the ENGINEER of shop drawings shall not relieve the fabricator of this responsibility, despite wording to the contrary in paragraph 4.2.1 of the AISC Code.
- D. Test Reports: Submit test reports for all specified tests of connections.
- E. Welder Qualifications: Evidence that welders employed in the work are currently certified under American Welding Society (AWS) qualification procedures.
- F. Surveys: Certified copies of specified surveys, showing locations of all critical

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elements and deviations from data shown on Contract documents.

1.06 QUALITY ASSURANCE

- A. Welding Procedures: Establish that joint welding procedures are prequalified or test in accordance with American Welding Society (AWS) qualification procedures.
- B. Regulatory Requirements: Unless other requirements of governing authorities or particular requirements of this specification are more stringent, comply with provisions of the following:
 - 1. AISC "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. AISC "Specification for Structural Steel Buildings -- Allowable Stress Design and Plastic Design," with Commentary and Supplements.
 - 3. AWS D1.1, "Structural Welding Code - Steel."
- C. Testing and Inspection Agency: Engage an independent testing and inspection agency acceptable to the OWNER to perform testing, inspect and evaluate connections, and prepare test reports.
 - 1. Correct deficiencies in the structural steel work identified by the testing and inspection agency at no additional expense to the OWNER. Subsequent tests to confirm the adequacy of corrected work will be at the CONTRACTOR's expense.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Shipping: Deliver steel in timely fashion, to permit the most efficient and economical flow of work. Deliver steel members properly marked for field assembly and erection.
 - 1. Deliver anchor bolts, washers, and other anchorage devices to be built into other work in time to avoid delays and permit their proper installation.
- B. Storage: Protect steel and other materials of this section from damage and corrosion. If temporary storage at the project site is required, keep steel members off the ground, using platforms or pallets, in location easily accessible for inspection.

PART 2- PRODUCTS

2.01 STEEL MATERIALS

- A. AESS Materials - General: For members which will be exposed in the finished work and have been identified as AESS on the drawings, provide only materials which are free of surface blemishes such as pitting, roller marks, rolled trade names, and surface roughness.
- B. Structural Steel Members (refer to plans for locations indicated):
 - 1. Wide flanges and WT sections: ASTM A992, Fy=50 ksi
 - 2. Channels, angles, plates, and miscellaneous steel: ASTM A36, Fy=36 ksi
 - 3. 316 Stainless Steel: ASTM A484, ASTM A276, Fy=30 ksi
 - 4. Structural Tubing, Cold-Formed: ASTM A500, Fy=46 ksi
 - 5. Steel Pipe: ASTM A53, Type E or S, Grade B, Fy=35 ksi
- C. Anchor Bolts: ASTM F1554, Carbon steel, Grade 36; ASTM A 36 steel plate washers.

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- D. Bolts and Nuts:
 - 1. Carbon Steel: ASTM A307, Grade A
 - 2. High Strength Steel: ASTM A325, Type 1, plain (medium carbon steel)
 - 3. Stainless Steel: ASTM F593, ASTM F594
 - 4. AESS: Provide hexagonal bolt heads and nuts at all exposed connections.
- E. Hardened Washers: ASTM F436, ASTM A240 (for stainless)
 - 1. Dimensional requirements shall meet ANSI B18.22.1, Type A plain.
- F. Direct Tension Indicators: At CONTRACTOR's option, provide either load indicator washers complying with ASTM F 959 or snap-off high-strength bolts certified to provide the minimum fastener tension in accordance with AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts" at all connections requiring high-strength bolts.
- G. Shear Connectors: ASTM A108, Grades 1010 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B. Minimum Yield Strength = 50 ksi. Test Shear connectors in accordance with AWS. All studs shall be a minimum $\frac{3}{4}$ " diameter unless otherwise noted.

2.02 MISCELLANEOUS MATERIALS

- A. Welding Electrodes and Fluxes: AWS D1.1, Types as follows:
 - 1. E70XX.
- B. Nonshrink Grout: Prepackaged material requiring only the addition of water and complying with ASTM C 1107, and as follows:
 - 1. Natural aggregate (nonmetallic) type.
 - 2. Products: The following products, provided they comply with requirements of the contract documents, will be among those considered acceptable:
 - a. "Masterflow 928"; Master Builders, Inc.
 - b. "SonogROUT 14k"; Sonneborn Building Products Division/ChemRex, Inc.
 - c. "Euco N-S Grout"; The Euclid Chemical Company.
 - d. "Supreme"; Cormix Construction Chemicals.
 - e. "Five Star Grout"; Five Star Products, Inc.
- C. Shop Primer: Fabricator's standard primer.

2.03 FABRICATION

- A. Shop Assembly - General: Comply with requirements of AISC Specifications. Shop fabricate and assemble to maximum degree possible.
 - 1. AESS: Comply with requirements of AISC Code for architecturally exposed structural steel.
 - a. Appearance: Cut, fit, and assemble units with exposed surfaces smooth, square, and free from cutting marks, shear distortion, burrs, and nicks.
 - b. Tolerances: As specified in AISC Code for AESS, unless more stringent requirements are indicated on the drawings.

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- B. Thermal Cutting: Perform all thermal cutting by machine.
 - 1. Plane thermally cut edges which are to be welded.
- C. Connections
 - 1. Shop connections: As indicated on the drawings.
 - 2. Field connections: As indicated on the drawings.
 - 3. Bolts: High-strength steel bolts, except as otherwise indicated.
 - a. Bolting: Comply with requirements of AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
 - 4. Welds: Comply with requirements of AWS Code for welding procedures and quality of welds, including appearance.
 - a. Built-up sections: Assemble components and weld using procedures which will maintain proper alignment of finished section.
 - b. AESS: Verify that weld sizes, fabrication sequence, and equipment to be employed will limit distortions to allowable tolerances. Surface bleed of back-side welding on exposed surfaces will not be acceptable.
 - 1) Grind smooth exposed fillet welds 1/2 inch and larger.
 - 2) Grind flush butt welds.
 - 3) Dress all exposed welds.
- D. Finishing: Accurately mill ends of columns and other members which must transmit loads in bearing.
- E. Holes in Steel Members: Make all holes by means of cutting, drilling, or punching at right angles to surface of metal. Do not make or enlarge holes by burning.
 - 1. Provide holes in steel members as required to permit connection of work by others.

2.04 SHOP COATING – GALVANIZING

- A. Galvanize the following items:
 - 1. All structural steel exposed to weather and as indicated on drawings.
- B. Preparation: Thoroughly clean members to be galvanized, removing loose rust and mill scale.
- C. Galvanizing: Perform galvanizing after fabrication in accordance with requirements of ASTM A 123, except galvanize all fastener assemblies in accordance with ASTM A153, use galvanizing methods which provide surface suitable for painting with min class A slip coefficient (0.33).

2.05 SHOP COATING – PAINT

- A. Shop prime all steel members, except:
 - 1. Galvanized steel members.
 - 2. Steel members embedded in concrete or mortar.
 - 3. Do not paint the following surfaces:
 - a. Machined or milled surfaces.
 - b. Surfaces adjacent to field welds.
 - c. Faying surfaces of bolted connections.

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- d. Portions of member that receive a special coating. Refer to Section 09900.
- B. Preparation: Thoroughly clean steel surfaces to be shop primed, removing loose rust, loose mill scale, dirt, oil, and grease. Clean steel in accordance with SSPC procedures as follows:
 - 1. Power tool or blast cleaning: SSPC SP-3, -5, -6, or -10.
- C. Painting: As soon as possible after cleaning, apply specified paint coating, refer to Section 09900 for coatings. Apply coatings in accordance with instructions of paint manufacturer. Apply coatings at a rate sufficient to provide a finished thickness to meet the requirements of Section 09900.

2.06 SHOP QUALITY CONTROL

- A. Testing and Inspection:
 - 1. General: Provide access to testing and inspection agency so that specified testing and inspection can be safely accomplished.
 - 2. Shop bolted connections: Comply with testing and verification procedures in AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts," except test not less than the following number of bolts in each bolted connection:
All slip critical connections as noted SC on drawings.
 - 3. Shop welded connections: Inspect and test shop-fabricated welds as follows:
 - a. Visually inspect all welds.
 - b. Inspect 100. percent of full penetration welds, using test method as follows:
 - 1) Radiographic testing (ASTM E 94 and ASTM E 142).
 - c. Inspect 20 percent of fillet welds, using one of the following test methods:
 - 1) Radiographic Testing (ASTM E 94 and ASTM E 142).
 - 2) Magnetic Particle Inspection (ASTM E 709).
 - 3) Ultrasonic Testing (ASTM E 164).
 - 4) Liquid Penetrant Inspection (ASTM E 165).

PART 3- EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine areas and conditions for erection of structural steel and verify that the work may properly proceed. Do not commence erection of structural steel until unsatisfactory conditions have been corrected or fabricated steel components have been adjusted with the architect's agreement.
 - 1. Surveys: Conduct verification surveys by a professional ENGINEER or land surveyor registered in the state of Florida.

3.02 PREPARATION

- A. Temporary Support: Provide temporary guys, braces, falsework, cribbing, or other elements required to secure the steel framing against loads equal in intensity to design loads. Remove such temporary support only when permanent connections have been made and the steel framing is fully capable of supporting design loads, including any temporary construction loads.

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3.03 ERECTION

- A. General: Erect structural steel in compliance with AISC Code of Standard Practice and Specifications.
 - 1. AESS: Comply with erection requirements of AISC Code dealing with architecturally exposed structural steel.
- B. Assembly:
 - 1. Set structural members accurately to locations and elevations indicated, within tolerances established in AISC Code, before making final connections.
 - 2. Do not use thermal cutting to correct fabrication errors on any major structural member.
 - a. Thermal cutting of secondary members may be permitted by the architect upon request, but only when members involved are not loaded.
- C. Columns and Bearing Surfaces:
 - 1. Clean bearing and contact surfaces before assembly. Slightly roughen concrete and masonry surfaces to improve bond.
 - 2. Set base and bearing plates accurately, using metal wedges, shims, or setting nuts as required.
 - 3. After tightening anchor bolts and ensuring that structure is plumb, grout solidly between plates and bearing surfaces.
 - a. Comply with manufacturer's instructions for nonshrink grout.
- D. Bolting:
 - 1. Carbon steel bolts: Use only for temporary bracing during erection, unless otherwise specifically permitted by contract documents.
 - 2. High-strength bolts: Comply with requirements of AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
- E. Welding:
 - 1. Do not perform field welding when ambient temperature is at 0 degrees F or below, or when surfaces are wet, exposed to rain, snow, or high wind.
 - 2. Perform field welding in accordance with AWS "Structural Welding Code - Steel."
 - 3. Tighten and leave in place erection bolts used in field-welded construction.
 - a. AESS: Verify that weld sizes, erection sequence, and equipment to be employed will limit distortions to allowable tolerances. Surface bleed of back-side welding on exposed surfaces is not acceptable.
 - 1) Grind smooth exposed fillet welds 1/2 inch and larger.
 - 2) Grind flush butt welds.
 - 3) Dress all exposed welds.
 - 4) Remove erection bolts, plug-weld bolt holes, and grind smooth.
- F. Touch-up Painting: As soon as possible after erection of primed structural steel, clean painted areas which have been abraded or otherwise damaged by welding, bolting, or other field operations. Apply touch-up paint matching shop coating by brush or spray to all damaged paint areas, achieving a minimum final thickness of 1.5 mils.

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STRUCTURAL STEEL

3.04 FIELD QUALITY CONTROL

A. Testing and Inspection:

1. General: Provide access to testing and inspection agency so that specified testing and inspection can be safely accomplished.
2. Field-bolted connections: Comply with testing and verification procedures in AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts," except test not less than the following number of bolts in each bolted connection:
All slip critical connections as noted "SC" on the drawings.
3. Field-welded connections: Inspect and test field-fabricated welds as follows:
 - a. Visually inspect all field welds.

END OF SECTION 05120

SECTION 05210

STEEL JOISTS

PART 1- GENERAL

1.01 SUMMARY

- A. Description of scope and intent:
 - 1. CONTRACTOR shall provide all material, labor, and tools required to complete the installation of specified system.
 - 2. Any omission of reference to items required to complete the full operational and functional system specified in the section does not relieve the CONTRACTOR of the obligation to provide same.
 - 3. To provide installation of all items, including delivery, dispersing to the proper locations within the building, and affixing in place.
 - 4. Installation shall be accomplished by workers skilled in their craft who will perform their work in a professional manner and will leave the premises safe, orderly and clean.
 - 5. Drawings and general provisions of Contract, including General and Supplemental Conditions and Division 1 Specification Sections, apply to this Section.
 - 6. CONTRACTOR is responsible for coordination of work included in this specification with all other specification sections related to furnishing of all materials, labor, permits, fees and services necessary for completion of work in this Section.
 - 7. In the event of a conflict between the Design Drawings, referenced standards and these Specifications, the more stringent shall govern unless directed otherwise by the ENGINEER. CONTRACTOR shall strictly adhere to OSHA requirements and local codes or those of any regulatory agency or body with jurisdiction.
- B. Section Includes:
 - 1. K-series open web steel joists.
 - 2. LH-series open web steel joists
 - 3. Bracing.
- C. Products Furnished but Not Installed under This Section:
 - 1. Bearing plates.
 - 2. Anchor bolts.
- D. Related Sections:
 - 1. Structural steel: Elsewhere in Division 5.
 - 2. Metal decking: Elsewhere in Division 5.

1.02 REFERENCES

- A. AWS D1.1-92 -- Structural Welding Code--Steel; American Welding Society; 1992.
- B. SJI Technical Digest No. 9 -- Handling and Erection of Steel Joists and Joist Girders; Steel Joist Institute; July 1987.
- C. Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders; Steel Joist Institute (SJI); 1992.

SECTION 05210

STEEL JOISTS

1.03 SYSTEM DESCRIPTION

- A. Provide joist system which is designed and fabricated to comply with requirements of the contract documents and which strictly conforms to material, manufacturing, and erection requirements of the Steel Joist Institute's (SJI) "Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders" (referred to hereinafter as SJI "Specifications").
 - 1. Wind Uplift and Shear: Design joists, joist to joist connections, and joist to structure connections to comply with wind criteria requirements indicated in the structural drawings

1.04 SUBMITTALS

- A. Provide submittals in accordance with Section 01300.
- B. Product Data: Submit for each distinct type of joist required and for accessories.
- C. Shop Drawings: Drawings for fabrication and erection of joists; include plans, elevations, and large scale details of typical sections, special connections, joining, and accessories.
 - 1. Show location and spacing of joists; indicate mark number and type.
 - 2. Prepare shop drawings under the seal of a professional structural engineer registered in the state of Florida.
 - 3. Show bridging.
 - 4. Provide design calculations prepared by a professional structural engineer registered in the state of Florida.
- D. Quality Control Submittals: Submit the following:
 - 1. SJI certification of joist characteristics.
 - 2. Manufacturers' certification of joist characteristics.
 - 3. Manufacturer's installation instructions, including specific installation sequence.

1.05 QUALITY ASSURANCE

- A. Field Welder Qualification: Qualify welding procedures and each welder in accordance with the American Welding Society's "Structural Welding Code -- Steel (AWS D1.1)."
- B. Testing: Engage an independent testing agency acceptable to the owner to perform specified quality control procedures and to prepare reports.
 - 1. Only AWS-certified welding inspectors shall inspect and evaluate welds.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Strictly conform to requirements of SJI Technical Digest No. 9.

1.07 COORDINATION

- A. Coordination Data: Prepare and distribute to affected installers, drawings or templates

SECTION 05210

STEEL JOISTS

detailing placement of bearing plates and anchor bolts.

PART 2- PRODUCTS

2.01 MATERIALS

- A. Steel: Conform to requirements of SJI "Specifications."
- B. Steel Primer for K-Series and LH-Series Joists: Conform to requirements of SJI "Specifications."
- C. Accessories: Provide accessories required for erection of steel joists, complying with SJI "Specifications" and with contract documents.

2.02 JOIST FABRICATION

- A. General: All materials shall be clean and straight.
- B. Bridging is schematically shown on drawings. Detail and fabricate bridging in complete accordance with SJI requirements.
- C. Joists:
 - 1. Top chord extensions: Provide extensions where indicated. Extension members shall be designed as cantilever beams, with their reactions carried back at least to the first panel point of the joists.
 - 2. Bottom chords: Form bottom chord members of joists using angles.
 - 3. Bottom chord extensions: Where indicated, provide extended bottom chords or separate extension units properly designed to support ceilings attached directly to joist bottom chords. Maximum clearance between wall finish and end of extension: 1/2 inch, unless indicated otherwise.
 - 4. Special end connections: Provide special end connections where joists bear less than 2-1/2 inches over steel supports. Connections shall provide positive attachment to the support.
 - 5. Camber: Comply with recommendations of SJI "Specifications."
 - 6. Surface preparation for shop priming: Clean steel in accordance with requirements in Section 09900.
 - 7. Shop priming and painting shall be per Section 09900 Paragraph 2.05.C.
 - 8. Bearing plates: Furnish bearing plates fabricated from same grade of steel as joists, with welded stud anchors or anchor bolts, or as otherwise shown on drawings.

2.03 SHOP QUALITY CONTROL

- A. Inspection:
 - 1. Provide access to independent testing and inspection agency so that inspection can be accomplished safely.
 - 2. Independent testing and inspection agency shall visually inspect shop welds to verify compliance with the American Welding Society's "Structural Welding Code -- Steel (AWS D1.1)."

SECTION 05210

STEEL JOISTS

PART 3- EXECUTION

3.01 ERECTION

- A. Do not begin joist erection until structural support components have been installed and are in suitable condition to receive joists.
- B. Do not overload or exceed carrying capacity of any joist during construction period.
- C. Accurately position and space joists before permanent attachment to structural supports.
- D. Provide safe, stable structure throughout construction period. Do not remove bridging after construction is completed, unless specifically authorized to do so by the ENGINEER.
 - 1. Install bridging in accordance with SJI requirements.
 - 2. Bridging installation shall proceed concurrently with joist erection and shall be completed before joists are subjected to construction loads.
- E. K-Series and LH Series Joist Anchorage:
 - 1. Weld joists to structural support members as required by SJI "Specifications."
- F. Touch-up Painting: Immediately after erection, solvent clean and hand- or power-tool clean (SSPC-SP 2 or SSPC-SP 3) completed field connections and damaged surfaces of shop-primed joists and adjoining structural steel. Apply corrosion-resistant touch-up paint compatible with coating illustrated in Section 09900 Paragraph 2.05.C.

3.02 FIELD QUALITY CONTROL

- A. General: Provide access for independent testing agency so that inspection can be accomplished safely.
- B. The CONTRACTOR shall engage a qualified independent testing agency to perform field quality controlled testing as indicated below:
 - 1. Verify location, sizing, and spacing of joists.
 - 2. Perform visual inspection of all connections.
 - 3. Performance Test for K-series and LH-Series Joists: If directed by the ENGINEER, conduct load test in accordance with the Steel Joist Institute's (SJI) "Recommended Code of Standard Practice for Steel Joist and Joist Girders." Joists shall have bridging and top deck applied. Test panel shall sustain for one hour a test load of 1.65 times the design live load. After test load is removed, the permanent deflection shall not exceed 20 percent of the deflection under full test loading.

END OF SECTION 05210

SECTION 05310

STEEL DECK

PART 1- GENERAL

1.01 SUMMARY

- A. Description of scope and intent:
 - 1. CONTRACTOR shall provide all material, labor, and tools required to complete the installation of specified system.
 - 2. Any omission of reference to items required to complete the full operational and functional system specified in the section does not relieve the CONTRACTOR of the obligation to provide same.
 - 3. To provide installation of all items, including delivery, dispersing to the proper locations within the building, and affixing in place.
 - 4. Installation shall be accomplished by workers skilled in their craft who will perform their work in a professional manner and will leave the premises safe, orderly and clean.
 - 5. Drawings and general provisions of Contract, including General and Supplemental Conditions and Division 1 Specification Sections, apply to this Section.
 - 6. CONTRACTOR is responsible for coordination of work included in this Specification with all other Specification sections related to furnishing of all materials, labor, permits, fees and services necessary for completion of work in this Section.
 - 7. In the event of a conflict between the Design Drawings, referenced standards and these Specifications, the more stringent shall govern unless directed otherwise by the ENGINEER. CONTRACTOR shall strictly adhere to OSHA requirements and local codes or those of any regulatory agency or body with jurisdiction.
- B. Section Includes:
 - 1. Roof Deck
- C. Related Sections:
 - 1. Cast-in-place concrete: Elsewhere in Division 3
 - 2. Structural steel: Elsewhere in Division 5
 - 3. Steel joists: Elsewhere in Division 5
 - 4. Roofing: Division 7

1.02 REFERENCES

- A. ASTM A 36/A 36M-93a -- Standard Specification for Structural Steel; 1993.
- B. ASTM A 446/A 446M-93 -- Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality; 1993.
- C. ASTM A 653/A 653M-01a -- Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process; 2001.
- D. AWS D1.1-92 -- Structural Welding Code--Steel; American Welding Society; 1992.

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STEEL DECK

- E. AWS D1.3-89 -- Structural Welding Code--Sheet Steel; American Welding Society; 1989.
- F. MIL P-21035B(NAVY) -- Paint, High Zinc Dust Content, Galvanizing Repair (Metric); U.S. Department of Defense; 1991.
- G. Fire Resistance Directory; Underwriters Laboratories Inc. (UL); 1994.
- H. FM P7825 -- Approval Guide 1992; Factory Mutual System; 1992 (with supplement 1).
- I. SDI Publication No. 28 -- Steel Deck Institute Design Manual for Composite Decks, Form Decks, Roof Decks, Corner Decks and Cellular Metal Floor Deck with Electrical Distribution; Steel Deck Institute, Inc.; 1992.
- J. Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute (AISI); 1986 (with 1989 Addendum and 1990 Errata).

1.03 SYSTEM DESCRIPTION

- A. Provide deck system which is designed and fabricated to comply with requirements of the contract documents and which strictly conforms to material, manufacturing, and erection requirements of the Steel Deck Institute's (SDI) "Standard Specifications Load Tables and Weight Tables for Steel Roof and Floor Decks" (referred to hereinafter as SDI "Specifications").
 - 1. Wind uplift and shear: Design deck and connections to comply with wind requirements indicated on structural drawings.

1.04 SUBMITTALS

- A. Provide submittals in accordance with Section 01300.
- B. Product Data: Submit deck MANUFACTURER's specifications and product information, indicating compliance with specified requirements.
 - 1. Include Steel Deck Institute certification of MANUFACTURER's deck characteristics.
 - 2. Include MANUFACTURER's certification of deck characteristics.
 - 3. Submit MANUFACTURER's installation instructions, including specific installation sequence.
 - 4. Submit MANUFACTURER's data on mechanical fasteners.
- C. Shop Drawings: Submit detailed Drawings indicating deck types and plan layout; support locations and anchorages; projections; openings and reinforcement; and pertinent details and accessories.
- D. Calculations: Submit MANUFACTURER's documentation of deck design loads, allowable spans, and section properties.
 - 1. Prepare calculations under seal of a professional structural ENGINEER registered in Florida.

SECTION 05310

STEEL DECK

- E. Welder Qualifications: Submit evidence that welders employed in the work are currently certified under AWS qualification procedures.

1.05 QUALITY ASSURANCE

- A. Codes and Standards: Comply with requirements of the following, except where exceeded by the contract documents or requirements of governing authorities:
 - 1. AISI "Specification for the Design of Cold-Formed Steel Structural Members."
 - 2. AWS D1.3 "Structural Welding Code--Sheet Steel."
 - 3. "Steel Deck Institute Design Manual for Composite Decks, Form Decks, Roof Decks, and Cellular Metal Floor Deck with Electrical Distribution."
- B. Qualifications: Qualify welding processes and welding operators per procedures specified in AWS D1.1.
- C. Installer: A company specializing in this type of work and with 5 years of documented experience.
- D. Testing: Welded decking in place is subject to inspection and testing by an independent agency paid by the owner. If testing indicates that welds do not comply with requirements, remove defective work, and replace at no additional expense to the owner.
- E. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those steel deck units tested for fire resistance per ASTM E 119 by a testing and inspection agency acceptable to authorities having jurisdiction.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
 - 2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.
- F. FM Listing: Provide roof deck units listed in Factory Mutual System's "Approval Guide" for Class I Fire-Rated and Class 1-90 windstorm construction.

1.06 STORAGE AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Storage: Separate sheets and store units on dry wood sleepers, sloped to promote drainage. Cover with waterproof material ventilated to avoid condensation.
- C. Marking: Unless deck units are all the same gage and yield strength for the project, mark each unit clearly to identify differences.

SECTION 05310

STEEL DECK

PART 2- PRODUCTS

2.01 MANUFACTURERS

- A. Products of the following MANUFACTURERS, provided they comply with requirements of the contract documents, will be among those considered acceptable:
 - 1. Bowman Metal Deck/Empire Detroit Steel Division/Armco, Inc.
 - 2. Epic Metals Corporation.
 - 3. Robertson, a United Dominion Company.
 - 4. United Steel Deck, Inc.
 - 5. Vulcraft Division/Nucor Corporation.
 - 6. Wheeling Corrugating Company Division/Wheeling-Pittsburgh Steel Corporation.

2.02 MATERIALS

- A. Steel for Galvanized Metal Deck Units: ASTM A 446.
- B. Bearing Plates and Angles: ASTM A 36.
- C. Miscellaneous Steel: ASTM A 36.
- D. Sheet Metal Accessories: ASTM A 526, galvanized.
- E. Galvanizing: ASTM A 653, G90 coating where indicated.
- F. Galvanizing Repair Paint: Comply with requirements of Military Specification MIL P-21035B, Type I or II.

2.03 FABRICATION

- A. Roof Deck Units - General: Provide deck complying with SDI specifications for properties indicated.
- B. Standard Roof Deck Units: Comply with the following:
 - 1. Profile type: Intermediate-rib deck (Type IR).
 - 2. Material: G90 galvanized steel.
 - a. Minimum yield strength: 33,000 psi.
 - b. Minimum metal thickness: 0.052 inch.
 - 3. Spanning configuration: Multiple span.
 - 4. Sheet coverage width: 36 inches.
 - 5. Side joints: Lapped.
 - 6. Flute sides: Plain vertical faces.
- C. Eaves Plates: Fabricate of same material and gage as deck units, with flange for attachment, and with dimensions as indicated on drawings.
- D. Ridge/Valley Plates: Fabricate of same material and gage as deck units, in slope to match roof slope, not less than 4-1/2 inches wide.
- E. Fasteners: Stainless steel, self-tapping.

SECTION 05310

STEEL DECK

PART 3- EXECUTION

3.01 EXAMINATION

- A. Examine field conditions and substrates to receive metal decking and verify that existing conditions are acceptable before commencing installation.

3.02 INSTALLATION

- A. General: Install deck units and accessories in compliance with Steel Deck Institute specifications, MANUFACTURER's recommendations, and requirements of this specification section. Fasten deck units to supports promptly after placement and alignment. Do not leave placed sheets unattached at end of working day.
 - 1. Shop drawings: Comply with final shop drawings.
 - 2. Bearing: Follow the MANUFACTURER's minimum recommended bearing lengths with a minimum of 6 inches at nonsteel supports and 1-1/2-inch at steel supports; align and level deck units.
 - 3. Placement: Place deck units flat and square, without excessive warp or deflection.
 - 4. End laps: Lap ends of deck units over supports and make laps not less than 2 inches.
 - 5. Precautions: Coordinate location of decking bundles to prevent overloading of structure.
- B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.
- C. Fastening:
 - 1. Fasten roof deck units to steel supporting members as indicated on drawings.
 - 2. Fasten roof deck units to nonsteel supporting members as indicated on drawings.
 - 3. Side laps: Fasten side laps of adjacent deck units as indicated on drawings.
 - 4. If not indicated on the drawings, fasten metal deck as follows:
 - a. Fasten metal deck panels to supporting members with a #12 TEK screw or equivalent at a spacing of 6" on center.
 - b. Fasten side laps and perimeter edges of panels between supports with a #10 TEK screw or equivalent at intervals not exceeding the lesser of 1/3 of the span or 36 inches.
- D. Openings:
 - 1. Cut deck units and accessories to fit snugly around other work penetrating decks.
 - 2. At openings up to 18 inches in either dimension, provide reinforcement and closure strips as shown or as required for strength and rigidity.
- E. Metal Accessories: Fasten metal accessories securely to deck units, using welding or mechanical fasteners as appropriate to conditions.
 - 1. Install metal cant strips at roof edges and as otherwise detailed.
 - 2. Fasten or weld metal sump pans to top deck surface at openings provided, spacing fasteners or welds at 12 inches on center maximum and with fastener or

SECTION 05310

STEEL DECK

weld in each corner. Neatly cut opening for drain size indicated.

3. Install other metal accessories as indicated.
- F. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure per SDI recommendations, unless otherwise indicated.
- G. Floor Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, per SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of decking. Weld cover plates at changes in direction of floor deck panels, unless otherwise indicated.
- H. Install piercing hanger tabs not more than 14 inches apart in both directions, within 9 inches of walls at ends, and not more than 12 inches from walls at sides, unless otherwise indicated.
- I. Touch-up Painting: After installation of deck units and accessories, wire-brush burned and abraded areas and rust spots and apply touch-up paint.
 1. Apply galvanizing repair paint to galvanized surfaces, complying with MANUFACTURER's instructions.

3.03 CLEANING

- A. Upon completion of work, remove all rubbish, debris, and excess materials from project site.

END OF SECTION 05310

SECTION 05400

COLD-FORMED METAL FRAMING

PART 1 – GENERAL

1.01 SUMMARY

- A. Description of scope and intent:
 - 1. CONTRACTOR shall provide all material, labor, and tools required to complete the installation of specified system.
 - 2. Any omissions of reference to items required to complete the full operational and functional system specified in the section does not relieve the CONTRACTOR of the obligation to provide same.
 - 3. To provide installation of all items, including delivery, dispersing to the proper locations within the building, and affixing in place.
 - 4. Installation shall be accomplished by workers skilled in their craft that will perform their work in a professional manner and will leave the premises safe, orderly and clean.
 - 5. Drawings and general provisions of Contract, including JEA General and Supplementary Conditions and Division 1 Specifications Sections, apply to this section.
 - 6. CONTRACTOR is responsible for coordination of work included in this specification with all other specification sections related to furnishing of all materials, labor, permits, fees and services necessary for completion of Work in this section.
- B. Section Includes:
 - 1. Exterior wall framing.
 - 2. Interior load-bearing wall framing.
 - 3. Roof rafter framing.
 - 4. Roof equipment support framing.
- C. Related Sections include the following:
 - 1. Division 5 Section "Metal Fabrications" for masonry shelf angles and connections.
 - 2. Division 6 Section "Rough Carpentry" for sub-flooring, wall sheathing, or roof sheathing using wood-based structural-use panels, particleboard, fibrous-felted board, and foam-plastic sheathing.
 - 3. Division 9 Section "Gypsum Board Assemblies" for interior non-load-bearing metal-stud framing and ceiling-suspension assemblies.
 - 4. Division 9 Section "Gypsum Board Shaft-Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies.

1.02 DEFINITIONS

- A. Minimum Uncoated Steel Thickness: Minimum uncoated thickness of cold-formed framing delivered to the Project site shall be not less than 95 percent of the thickness used in the cold-formed framing design. Lesser thickness shall be permitted at bends due to cold forming.
- B. Producer: Entity that produces steel sheet coil fabricated into cold-formed members.

SECTION 05400

COLD-FORMED METAL FRAMING

1.03 REFERENCES

Comply with the following documents, except where requirements of the Contract Documents or of governing codes and governing authorities are more stringent. All referenced standards refer to the edition in force at the time these Drawings and Specifications are issued.

- A. ASTM A 90 -- Standard Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
- B. ASTM A 446-- Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality
- C. ASTM A 570-- Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality.
- D. ASTM A 611-- Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Structural Quality.
- E. ASTM C 1007-- Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.
- F. ASTM A 653—Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.04 SUBMITTALS

- A. Provide submittals in accordance with Section 01300.
- B. Product Data: For each type of cold-formed metal framing product and accessory indicated.
- C. Shop Drawings: Show layout, spacing, sizes, thickness, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining Work.
- D. Mill certificates signed by steel sheet producer indicating steel sheet complies with requirements.
- E. Welding Certificates: Copies of certificates for welding procedures and personnel.
- F. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and OWNERS, and other information specified.

SECTION 05400

COLD-FORMED METAL FRAMING

- G. Product Test Reports: From a qualified testing agency indicating that each of the following complies with requirements, based on comprehensive testing of current products:
 - 1. Mechanical fasteners.
 - 2. Miscellaneous structural clips and accessories.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer with minimum of five (5) years experience and who has completed cold-formed metal framing similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Mill certificates signed by steel sheet producer indicating steel sheet complies with requirements, including uncoated steel thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and galvanized-coating thickness.
- C. Testing Agency Qualifications: Employ, at CONTRACTOR's expense, an independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
- D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- E. Fire-Test-Response Characteristics: Refer to Architectural specifications for all fire ratings.
- F. AISI Specifications: Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members" for calculating structural characteristics of cold-formed metal framing:
 - 1. CCFSS Technical Bulletin: "AISI Specification Provisions for Screw Connections."

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling. Follow all MANUFACTURER's written instruction unless otherwise noted herein.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation. Follow all MANUFACTURER's written instruction unless otherwise noted herein.

SECTION 05400

COLD-FORMED METAL FRAMING

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Available manufacturers: Subject to compliance with requirements, MANUFACTURERS offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Dietrich Industries, Inc.

2.02 MATERIALS

- A. Steel Sheet: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
 - 1. Grade: As indicated on drawings.
 - 2. Coating: G90.

2.03 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories of the same material and finish used for framing members, with a minimum yield strength of 45,000 psi.
- B. Provide accessories of MANUFACTURER's standard thickness and configuration, unless otherwise indicated, as follows:
 - 1. Supplementary framing.
 - 2. Bracing, bridging, and solid blocking.
 - 3. Web stiffeners.
 - 4. End clips.

2.04 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36, zinc coated by hot-dip process according to ASTM A 123.
- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Mechanical Fasteners: Corrosion-resistant-coated, self-drilling, self-threading steel drill screws as indicated on drawings.
- D. Welding Electrodes: Comply with AWS standards.

2.05 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, ASTM A 780.

SECTION 05400

COLD-FORMED METAL FRAMING

2.06 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to MANUFACTURER's written recommendations and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed metal framing members as indicated on the drawings. Wire tying of framing members is not permitted.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Grout bearing surfaces uniform and level to ensure full contact of bearing flanges or track webs on supporting concrete.

3.02 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to ASTM C 1007, unless more stringent requirements are indicated.
- C. Install cold-formed framing and securely anchor to supporting structure.
 - 1. Bolt wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

SECTION 05400

COLD-FORMED METAL FRAMING

- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to MANUFACTURER's written recommendations and requirements in this Section.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed metal framing members by screw fastening, as standard with fabricator and indicated on drawings. Wire tying of framing members is not permitted.
- E. Install framing members in one-piece lengths, unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- H. Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work. Refer to architectural for insulation requirements
- I. Fasten hole-reinforcing plate over web penetrations that exceed size of MANUFACTURER's standard punched openings.
- J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.03 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and MANUFACTURER's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to MANUFACTURER and Installer, that ensure cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05400

SECTION 05500

METAL FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

- A. Description of scope and intent:
 - 1. CONTRACTOR shall provide all material, labor, and tools required to complete the installation of specified system.
 - 2. Any omission of reference to items required to complete the full operational and functional system specified in the section does not relieve the CONTRACTOR of the obligation to provide same.
 - 3. To provide installation of all items, including delivery, dispersing to the proper locations within the building, and affixing in place.
 - 4. Installation shall be accomplished by workers skilled in their craft that will perform their work in a professional manner and will leave the premises safe, orderly and clean.
 - 5. Drawings and general provisions of Contract, including JEA Conditions and Division 1 Specification Sections, apply to this Section
 - 6. CONTRACTOR is responsible for coordination of work included in this specification with all other specification sections related to furnishing of all materials, labor, permits, fees and services necessary for completion of work in this section.
 - 7. In the event of a conflict between the design drawings, referenced standards and these Specifications, the more stringent shall govern unless directed otherwise by the Architect. CONTRACTOR shall strictly adhere to OSHA requirements and local codes or those of any regulatory agency or body with jurisdiction
- B. This Section includes the following:
 - 1. Steel framing and supports for applications where framing and supports are not specified in other Specification Sections or on the Structural Drawings.

1.02 SUBMITTALS

- A. Provide submittals in accordance with Section 01300.
- B. Shop Drawings: Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
 - 1. Provide templates for anchors and bolts specified for installation under other Sections.
- C. Welding Certificates: Copies of certificates for welding procedures and personnel.

1.03 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

SECTION 05500

METAL FABRICATIONS

- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.3, "Structural Welding Code--Sheet Steel."
 - 3. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.04 PROJECT CONDITIONS

- A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

1.05 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.01 METALS, GENERAL

- A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

2.02 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Malleable-Iron Castings: ASTM A 47, Grade 32510.
- C. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.03 PAINT

- A. Shop Primer for Ferrous Metal: Fast-curing, lead and chromate free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664;

SECTION 05500

METAL FABRICATIONS

selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

- B. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds in steel, complying with SSPC-Paint 20.

2.04 FASTENERS

- A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Anchor Bolts: ASTM F 1554, Grade 36.
- C. Machine Screws: ASME B18.6.3.
- D. Lag Bolts: ASME B18.2.1.
- E. Wood Screws: Flat head, carbon steel, ASME B18.6.1.
- F. Plain Washers: Round, carbon steel, ASME B18.22.1.
- G. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1.
- H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Material: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
- I. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.

2.05 GROUT

- A. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.

2.06 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

SECTION 05500

METAL FABRICATIONS

- B. Shear and punch metals cleanly and accurately. Remove burrs.
- C. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- G. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.
- H. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
- I. Remove sharp or rough areas on exposed traffic surfaces.
- J. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

2.07 STEEL ANGLES

- A. Fabricate angles from steel angles of sizes required or indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete. Align expansion joints in angles with indicated control and expansion joints.
- C. Galvanize steel angles to be installed in all walls. All exposed exterior angles shall also be painted.

SECTION 05500

METAL FABRICATIONS

2.08 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports that are not a part of structural-steel framework as necessary to complete the Work.
- B. Fabricate units from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 - 1. Fabricate units from slotted channel framing where indicated.
- C. Galvanize all miscellaneous framing and supports.

2.09 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

2.10 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 - 1. ASTM A 123, for galvanizing steel and iron products.
 - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:
 - 1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include

SECTION 05500

METAL FABRICATIONS

threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.

- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- E. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- G. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.02 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings, if any.

3.03 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with

SECTION 05500

METAL FABRICATIONS

the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 Section "Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05500

SECTION 05560

ALUMINUM ACCESS HATCHES

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install access hatches.
- B. The Work includes new access hatch frame(s) with new lid(s) and accessories included herein.
- C. Review installation procedures under this and other Sections and coordinate the installation of items to be installed with or before the access hatches.

1.02 QUALITY ASSURANCE

- A. MANUFACTURER shall have not less than five years' experience producing products substantially like those specified and, upon ENGINEER's request, shall submit documentation of not less than five satisfactory installations in place for not less than five years each.
- B. Obtain all products included in this Section regardless of the component MANUFACTURER from a single access hatch MANUFACTURER. Furnishing hatches from more than one MANUFACTURER is not acceptable.
- C. The access hatch MANUFACTURER shall prepare, or shall review and approve, all shop drawings and other submittals for all components furnished under this Section.
- D. Components shall be suitable for specified service conditions and shall be integrated into the overall assembly by the access hatch MANUFACTURER.

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01300
 - 1. Detailed plans and other drawings showing location of products and direction of door swing; access hatch schedules indicating cover location, material, type, loading capacity, and other information; and fabrication details for the access hatch covers Work, including materials, thickness of metals, finishes, latching or locking provisions, type of anchorages, and accessory items.
 - 2. Copies of MANUFACTURER's literature and specifications for each type of access hatch incorporated in the Work.
 - 3. Installation data, including setting drawings and templates.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Packing and Shipping:
 - 1. Protect mill finish and other finish during shipping and installation by an attached, adhesive-backed vinyl material that is removable during and after

SECTION 05560

ALUMINUM ACCESS HATCHES

installation of the access hatch.

- B. Storage and Protection:
 - 1. Protect aluminum members and packaged materials from corrosion and deterioration.
 - 2. Refer to Section 01600 for additional information.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Provide MANUFACTURER's standard fabricated access hatch units, modified when necessary to comply with the Contract Documents. Where standard units are not available for the sizes and types required, provide custom-fabricated units of the same quality as MANUFACTURER's similar standard-sized units.
- B. Fabricate each access hatch unit in the shop, complete with anchors, gaskets, hardware, and accessory items, as required.
- C. Galvanizing Repair Paint: For repairing damaged galvanized surfaces, provide high zinc-dust content paint complying with MIL-P-21035B.
- D. Provide access hatches in accordance with Table 05560-A, Access Hatch Schedule:

TABLE 05560-A ACCESS HATCH SCHEDULE

Hatch No.	Size		Material	Leaf Type	Frame Type	Location
	Width (nominal) inches	Length (nominal) inches				
1	42"	42"	Aluminum	Single	See 2.02A	Chemical Injection Vault

2.02 ANGLE-FRAME TYPE ACCESS HATCH

- A. Aluminum Access Hatch
 - 1. Design Live Load: 300 pounds per square foot.
 - 2. Products and MANUFACTURERS:
 - a. Single-Leaf Door Aluminum Access Hatch Cover
 - i. Model S1S by Halliday Products
 - ii. Model APS 300 by USF Fabrication
 - iii. ENGINEER approved equal
 - b. Double-Leaf Door Aluminum Access Hatch Cover
 - i. Model S2S by Halliday Products
 - ii. Model APD 300 by USF Fabrication
 - iii. ENGINEER approved equal

SECTION 05560

ALUMINUM ACCESS HATCHES

3. Cover: 1/4-inch thick, aluminum diamond-pattern plate reinforced for 300 psf live load. Cover shall be equipped with a lifting handle and 316 stainless steel hold-open arm with red vinyl grip that automatically locks the cover in the 90-degree open position.
4. Frame: The exact frame sizes, materials, and dimensions shall be determined by the CONTRACTOR prior to ordering replacement lids and accessories.
5. Gasket: A U-shaped EPDM gasket mechanically attached or riveted to the lid shall be provided.
6. Hinges: Type 316 stainless steel, heavy-duty butt hinges with Type 316 stainless steel pin fastened to door with Type 316 stainless steel tamper-resistant bolts.
7. Latch: Latches shall be 316 stainless steel pressure locks with exterior staple for padlock.
8. Lift Assistance: Compression spring operators enclosed in telescopic tubes. Automatic hold-open arm with release handle automatically locks cover(s) in the open position.
9. Finish: Mill finish aluminum with SS hardware.
10. Bituminous coating shall be applied to surfaces in contact with concrete.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Examine areas and conditions under which roof access hatch cover Work will be performed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

- A. Install access hatches in accordance with approved shop drawings and other approved submittals, the Contract Documents, and MANUFACTURER's instructions.
- B. Set each access hatch level and true to line or grade, without warp or rack.
- C. Protection of aluminum from dissimilar materials: Coat surfaces of aluminum in contact with dissimilar materials such as concrete, masonry, steel, and other metals in accordance with Section 09900 or as described above.
- D. Galvanized covers: Where zinc coating is damaged, touch-up abraded surfaces with galvanizing repair paint applied in accordance with the paint MANUFACTURER's instructions and recommendations.

3.03 ADJUSTING AND CLEANING

- A. Adjust leaves of roof access hatch covers as necessary to provide proper

SECTION 05560

ALUMINUM ACCESS HATCHES

operations.

- B. Remove stains, concrete splatter, oils, grease, and other foreign materials necessary and provide clean, finished surfaces.

END OF SECTION 05560

SECTION 06100

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Rough carpentry for:
 - a. Miscellaneous lumber for attachment and support of other work.
 - b. Wood furring.
 - 2. Preservative treatment.
- B. Treated Wood: Treating plant's instructions for use, including storage, cutting, and finishing.
 - 1. Pressure preservative treatment: Treating plant's certification of compliance with specified standards and stating process employed and preservative retention values.
 - a. Treatment for above-ground use: Certification of kiln drying after treatment.

PART 2 - PRODUCTS

2.01 DIMENSION LUMBER

- A. Size: Provide nominal sizes indicated, complying with NIST PS 20 except where actual sizes are specifically required.
- B. Miscellaneous Lumber: Provide dimension lumber and boards necessary for the support of work specified in other sections, whether or not specifically indicated, and including but not limited to blocking, nailers, etc.
 - 1. Moisture content: 15 percent maximum (kiln-dry).
 - 2. Lumber: S4S, No. 2 or standard grade.
 - 3. Boards: Construction, 2 common, or No. 2 grade.

2.02 MISCELLANEOUS MATERIALS

- A. Fasteners: Provide as required by applicable codes and as otherwise indicated.

2.03 WOOD TREATMENT BY PRESSURE PROCESS

- A. Aboveground Lumber: AWPB LP-2 (waterborne preservatives).
 - 1. Kiln dried after treatment to 19 percent maximum moisture content.
 - 2. Treat the following:
 - a. Wood in contact with roofing, flashing, or waterproofing.
 - b. Wood in contact with masonry or concrete.
 - c. Other members indicated.
- B. Fasteners for Preservative Treated Wood: Hot-dip galvanized steel (ASTM A153).

SECTION 06100

ROUGH CARPENTRY

PART 3 - EXECUTION

3.01 INSTALLATION – GENERAL

- A. Arrange work to use full length pieces except where lengths would exceed commercially available lengths. Discard pieces with defects that would lower the required strength or appearance of the work.
- B. Cut and fit members accurately. Install plumb and true to line and level.
- C. Fasten carpentry in accordance with applicable codes and recognized standards.
- D. Where exposed, countersink nails and fill flush with suitable wood filler.

3.02 MISCELLANEOUS CARPENTRY

- A. Provide miscellaneous blocking, nailers, grounds, and framing as shown and as required for support of facing materials, fixtures, specialty items, and trim. Cut and shape to the required size. Provide in locations required by other work.
- B. Use countersunk fasteners appropriate to applied loading.

3.03 WOOD FURRING

- A. Install wood furring plumb and level; shim as necessary to bring true to plane; install closure strips at ends perpendicular to main furring direction.
 - 1. Suspended furring: Provide where shown. Include suitable hangers anchors.

END OF SECTION 06100

SECTION 07131

SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General and Supplemental Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Cold applied, self-adhering membrane used as roofing underlayment.

1.03 SUBMITTALS

- A. Provide submittals in accordance with Section 01300.
- B. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.
- C. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
- D. Samples: For the following products:
 - 1. 12-by-12-inch square of waterproofing sheet.
- E. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.
- F. Qualification Data: For Installer and manufacturer.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for waterproofing.
- H. Warranties: Special warranties specified in this Section.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum of 20-years experience in the production of sheet membrane waterproofing.
- B. Installer Qualifications: A firm that is approved or licensed by waterproofing manufacturer for installation of waterproofing required for this Project.
- C. Source Limitations: Obtain primary waterproofing materials through one source from a single manufacturer.

SECTION 07131

SELF-ADHERING SHEET WATERPROOFING

- D. Mockups: Before beginning installation, install waterproofing to 100 sq. ft. of roof to demonstrate surface preparation, crack and joint treatment, corner treatment, and execution quality.
 - 1. If Architect determines mockups do not comply with requirements, reapply waterproofing until mockups are approved.
 - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- E. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with MANUFACTURER's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.
- C. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- D. Store rolls according to manufacturer's written instructions.
- E. Protect stored materials from direct sunlight.

1.06 PROJECT CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 - 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.07 WARRANTY

- A. Special Manufacturer's Warranty: MANUFACTURER's standard form in which manufacturer agrees to replace waterproofing material that does not comply with requirements or that fails to remain watertight within specified warranty period.
 - 1. Warranty Period: Five (5) years from date of Substantial Completion.

SECTION 07131

SELF-ADHERING SHEET WATERPROOFING

- B. Special Installer's Warranty: Specified form, signed by Installer, covering Work of this Section, for warranty period of five (5) years.

PART 2 - PRODUCTS

2.01 POLYETHYLENE SHEET WATERPROOFING

- A. Polyethylene Sheet: Not less than 40-mil-thick, self-adhering sheet consisting of polyethylene rubberized asphalt adhesive laminated to a polyethylene film with release liner on adhesive side and formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.
 - 1. Basis-of-Design Product: Grace Construction Products; Ice and Water Shield. Subject to compliance with requirements, provide the specified product or a comparable product by one of the following:
 - a. Carlisle Coatings & Waterproofing Inc.
 - b. Meadows, W. R., Inc.
 - c. or equivalent product.
 - 2. Physical Properties:
 - a. Tensile Strength: 250 psi minimum; ASTM D 412, Die C, modified.
 - b. Ultimate Elongation: 250 percent minimum; ASTM D 412, Die C, modified.
 - c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.

2.02 AUXILIARY MATERIALS

- A. General: Furnish all auxiliary materials including tapes, strips, mastic, adhesives, primers, etc, recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
 - 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid solvent-borne primer recommended for substrate by manufacturer of sheet waterproofing material.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to MANUFACTURER's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

SECTION 07131

SELF-ADHERING SHEET WATERPROOFING

- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Bridge and cover isolation joints, expansion joints and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips.

3.03 SHEET WATERPROOFING APPLICATION

- A. Install sheets according to waterproofing manufacturer's written instructions and according to recommendations in ASTM D 6135.
- B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 3-1/2-inch-minimum lap widths and 6-inch end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.
 - 1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.
- D. Apply continuous sheets over sheet strips bridging substrate cracks, construction, and contraction joints.
- E. Install sheet waterproofing and auxiliary materials to tie into adjacent waterproofing.
- F. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches (150 mm) beyond repaired areas in all directions.

3.04 FIELD QUALITY CONTROL

- A. The roofing subcontractor shall engage an independent site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions; surface preparation; membrane application, flashings, protection, and drainage components; and to furnish a report that installation is as per this specification and recommendations of the MANUFACTURER.

3.05 PROTECTION AND CLEANING

- A. Protect waterproofing from damage and wear during remainder of construction period.

SECTION 07131

SELF-ADHERING SHEET WATERPROOFING

- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07131

SECTION 07132

VERTICAL SUB SURFACE WATERPROOFING

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Application of self-adhering membrane system.

1.02 RELATED SECTIONS

- A. Cast-in-place concrete Section 03300.
- B. Joint sealers Section 07900.
- C. Self-Adhering Membrane Section 07265.

1.03 REFERENCES

- A. ASTM C 836 – Standard Specification for High Solids Content, Cold Liquid Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.
- B. ASTM D 146 – Standard Test Methods for Sampling and Testing Bitumen-Saturated Felts and Fabrics Used in Roofing and Waterproofing.
- C. ASTM D 412 – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
- D. ASTM D 570 – Standard Test Method for Water Absorption of Plastics.
- E. ASTM D 882 – Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
- F. ASTM D 903 – Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.
- G. ASTM D 1000 – Standard Test Methods for Pressure-Sensitive, Adhesive-Coated Tapes used for Electrical and Electronic Applications.
- H. ASTM D 1876 – Standard Test Method for Peel Resistance of Adhesives.
- I. ASTM D 1970 – Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection – Section 7.6 Low Temperature Flexibility.
- J. ASTM D 5385 – Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes.
- K. ASTM E 96 (Method B) – Standard Test Methods for Water Vapor Transmission of Materials.
- L. ASTM E 154 – Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
- M. General Services Administration, Public Building Service: GSA-PBS-07115 Guide Specification for Elastomeric Waterproofing.

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VERTICAL SUB SURFACE WATERPROOFING

1.04 SUBMITTALS

- A. Provide submittals in accordance with Section 01300.
- B. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations.
- C. Samples: Submit representative samples of the following for approval:
 - 1. Sheet Membrane
 - 2. Protection Board
 - 3. Prefabricated Drainage Composite
 - 4. Perimeter Drainage Composite

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Sheet Membrane must be manufactured by a company with a minimum of ten (10) years of experience in the production and sales of membrane waterproofing materials.
- B. Applicator Qualifications: A firm having at least three (3) years of experience in applying these types of specified materials and specifically accepted in writing by the membrane system manufacturer.
- C. Materials: For each type of material required to complete the work of this section, provide primary materials which are the products of a single manufacturer.
- D. Pre-Application Conference: A pre-application conference shall be held to establish procedures and to review conditions, installation procedures and coordination with other related work. Meeting agenda shall include review of special details and flashing.
- E. Manufacturer's Representative: Arrange to have trained representative of the manufacturer on site periodically to review installation procedures.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer. \
- B. Store materials in a clean, dry area in accordance with manufacturer's instructions.
- C. Store adhesives at temperatures of 40° F (5°C) and above to facilitate handling.
- D. Store membrane cartons on pallets.
- E. Keep away from sparks and flames.
- F. Completely cover when stored outside. Protect from rain.
- G. Protect materials during handling and application to prevent damage or contamination.
- H. Avoid use of products which contain tars, solvents, pitches, polysulfide polymers, or PVC materials that may come into contact with waterproofing membrane system.

SECTION 07132

VERTICAL SUB SURFACE WATERPROOFING

1.07 PROJECT CONDITIONS

- A. Perform work only when existing and forecasted weather conditions are within the limits established by the membrane manufacturer. Do not apply membrane if the temperature is below 25°F (-4°C) or to a damp, frost covered, or otherwise contaminated surface.
- B. Proceed with installation only when substrate construction and preparation work is complete. If necessary, ensure that subsoil is approved by architect or geotechnical firm.
- C. Warn personnel against breathing of vapors and contact with skin and eyes; wear appropriate protective clothing and respiratory equipment.
- D. Keep flammable products away from spark or flame. Post "No Smoking" signs. Do not allow use of spark-producing equipment during application and until all vapors have dissipated.
- E. Maintain work area in a neat and workmanlike condition. Remove empty cartons and rubbish from the site daily.

1.08 WARRANTY

- A. Manufacturer warrants only that this product is free of defects, since many factors which affect the results obtained from this product are beyond our control; such as weather, workmanship, equipment utilized and prior condition of the substrate. We will replace, at no charge, proven defective product within twelve (12) months of purchase, provided it has been applied in accordance with our written directions for uses we recommended as suitable for this product. Proof of purchase must be provided.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. BASIS OF DESIGN, EQUALS ARE ACCEPTABLE:
 - 1. Polyguard Products Inc.
P.O. Box 755 Ennis, TX 75120-0755
Phone: (214) 515-5000
Fax: (972) 875-9425 Email: info@polyguardproducts.com

2.02 SYSTEM MATERIALS

- A. Self-adhesive membrane waterproofing: Shall be Polyguard® 650 Membrane, a 60-mil rubberized-asphalt membrane consisting of a high-density polyethylene film bonded to a layer of rubberized-asphalt meeting or exceeding the following requirements:

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VERTICAL SUB SURFACE WATERPROOFING

PHYSICAL PROPERTIES

PROPERTY	TEST METHOD	TYPICAL VALUE
FILM COLOR		Black/White
MEMBRANE THICKNESS	ASTM D 1000	60 mils
TENSILE STRENGTH - MEMBRANE	ASTM D 412 Modified Die C	370 PSI
ELONGATION - ULTIMATE FAILURE OF RUBBERIZED ASPHALT	ASTM D 412	600%
TENSILE STRENGTH - FILM	ASTM D 882	7294 PSI
PERMEANCE	ASTM E 96 Method B	0.022 Perms
CRACK CYCLING	ASTM C 836 Tested @-15°F (-26°C)	No effect
PEEL ADHESION	ASTM D 903	17 lbs./in. width
LAP PEEL ADHESION	ASTM D 1876	8.0 lbs./in. width
LOW TEMPERATURE FLEXIBILITY (-15°F)	ASTM D 1970 Modified	Pass
PLIABILITY	ASTM D 146 180° bend over 1" mandrel at -25°F (-32°C)	No effect
PUNCTURE RESISTANCE - MEMBRANE	ASTM E 154	69 lbs.
RESISTANCE TO HYDROSTATIC HEAD	ASTM D 5385	> 231 ft.
EXPOSURE TO FUNGI IN SOIL	GSA-PBS 07115 (16 weeks)	No effect
WATER ABSORPTION	ASTM D 570	0.1%

2.03 SYSTEM ACCESSORIES

- A. Surface Primer Roller-grade Adhesive:
1. Polyguard® 650 LT Liquid Adhesive: A rubber-based, tacky adhesive which is specifically formulated to provide excellent adhesion.
 2. Polyguard® California Sealant: A rubber-based sealant which is specifically formulated to provide excellent adhesion. The VOC (Volatile Organic Compound) content meets the South Coast Air Quality Management District regulations established under the February 1, 1991 version of Rule 1168 © (2) Adhesion and Sealant Applications. California Sealant is classified as an Architectural Sealant Primer Porous, with VOC of 527 g/L. Current SCAQMD regulations for this type sealant primer are 775 g/L.
 3. Polyguard® Shur-Tac Liquid Adhesive: A polymer emulsion-based adhesive which is specifically formulated to provide excellent adhesion.
- B. Detail Tape:
1. Polyguard® Detail Tape: Rubberized-asphalt waterproofing membrane laminated to polypropylene backing. The membrane is wound onto a disposable, silicone-treated release sheet to prevent the membrane from sticking onto itself while in the roll. Use Detail Tape for applications (1) inside/outside corners and penetrating items (2) for patching damaged areas.

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VERTICAL SUB SURFACE WATERPROOFING

- C. Liquid Membranes:
 - 1. Polyguard® LM-85 SL (Self-Leveling): A two-component, self-leveling, asphalt-modified, urethane material.
 - 2. Polyguard® LM-95 Liquid Membrane: A two-component, asphalt-modified, urethane.
- D. Detail Sealant:
 - 1. Polyguard® Detail Sealant PW™: A single-component, STPE, 100% solid moisture-cured, elastomeric sealant. It is an environmentally-friendly, non-isocyanate product that replaces silicone and urethane sealants. It is also a low VOC / HAPS-free, cold-applied, self-adhesive, elastomeric sealant.
- E. Mastic:
 - 1. Polyguard® 650 Mastic: A polymer-modified, asphalt-based material.
- F. Drainage Composite:
 - 1. Polyguard® Lowflow™ Protection and Drainage System: High-strength, multi-layer fabric composite in a 4' x 200' roll. Its purpose is to protect underlying waterproofing membranes and is suitable for most clay soil conditions.
 - 2. Polyguard® Polyflow® 10 Drainage Mat: Vertical use. Two-part, prefabricated, geocomposite drain consisting of a formed polystyrene core covered on one side with polypropylene filter fabric. The fabric allows water to pass into the drain core while restricting the movement of soil particles which might clog the core. The core allows the water to flow to designated drainage exits.
 - 3. Polyguard® Polyflow® 15 Drainage Mat: Two-part, prefabricated, geocomposite drain consisting of a formed polystyrene core covered on one side with polypropylene filter fabric. The fabric allows water to pass into the drain core while restricting the movement of soil particles which might clog the core. The core allows water to flow to designated drainage exits.
 - 4. Polyguard® Polyflow® 18 Drainage Mat: Two-part, prefabricated, geocomposite drain consisting of a formed polystyrene core covered on one side with woven mono-filament filter fabric. The fabric allows water to pass into the drain core while restricting the movement of soil particles which might clog the core. The core allows the water to flow to designated drainage exits.
 - 5. Polyguard® Totalflow™: Totalflow is a combination of our Polyguard sheet drain products with our unique Totalflow™ product. In the Totalflow™ system, the sheet drain performs its normal function of water collection, while the Totalflow™ section provides both water collection and a high-profile section allowing for high-capacity water flow to designated drainage exits.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine surfaces to receive self-adhering membrane. Notify the general contractor if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.02 SURFACE PREPARATION

- A. Protect adjacent surfaces not designated to receive waterproofing.
- B. Clean surfaces to receive waterproofing in accordance with MANUFACTURER's instructions.

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VERTICAL SUB SURFACE WATERPROOFING

- C. Do not apply waterproofing to surfaces unacceptable to manufacturer.
- D. Concrete surfaces must be clean, smooth, and free of standing water.
- E. Patch all holes and voids and smooth out any surface misalignments.
- F. Cast-In-Place Concrete:
 - 1. Normal weight structural concrete must be allowed to cure a minimum of seven (7) days. For lightweight structural concrete, the minimum cure time is fourteen (14) days. All concrete surfaces must be dry to the touch before proceeding with the installation of the waterproofing system.
 - 2. Fill all form tie holes. Finish flush with the surrounding surface.
 - 3. Fill and repair bug holes in concrete. Finish flush with the surrounding surface.
 - 4. All cracks over 1/16-inch in width, and any moving cracks under 1/16-inch, shall be routed out to a minimum of 1/4-inch width and sealed using a high-performance polyurethane sealant. Allow adequate curing time per the manufacturer's directions. Upon cure install an 8-inch wide strip of Polyguard® 650 Membrane over the crack.
- G. Masonry Surfaces:
 - 1. Apply waterproofing membrane over brick or CMU that has been parged using a cementitious parge coat to level surface and reduce porosity.

3.03 APPLICATION

- A. Priming:
 - 1. Apply primer to a cleaned, dust free surface. Apply by roller or spray. Apply Polyguard® 650 LT Liquid Adhesive, Polyguard® California Sealant, or Shur-Tac Liquid Adhesive at a rate of 250-300 sq. ft. per gallon. Allow to dry per manufacturer's directions. Do not prime underneath Polyguard® Detail Sealant PW™ or Polyguard® LM-95 Liquid Membrane.
- B. Membrane Installation - Vertical Surfaces:
 - 1. All inside and outside corners shall be treated either with a 12-inch wide strip of Detail Tape centered along the vertical axis, or by applying a 90-mil thick application of Polyguard® Detail Sealant PW™ or Polyguard® LM-95 Liquid Membrane.
 - 2. Install a 3/4-inch, 45-degree angle cant (fillet) of Polyguard® Detail Sealant PW™ or Polyguard® LM-95 Liquid Membrane at all changes in plane including inside corners to 6" vertically and horizontally beyond the cant (fillet). Do not use wood or fiber cant strips.
 - 3. Waterproofing membrane should be applied vertically in sections of 8 feet in length or less. When vertical walls sections of more than 8-feet are to be waterproofed, apply 650 Membrane in sections no longer than 8-feet, starting from the lower foundation base and rising to the top with the 6-inches overlap, shingling down on each ply of membrane.
 - 4. Side laps should be 2-1/2 inches minimum and staggered end laps should be 6 inches minimum.
 - 5. Use a hard roller or firmly press in the material as it is placed on the vertical surface.
 - 6. At penetrations, posts, or projections, seal with Polyguard® Detail Sealant PW™ or Polyguard® LM-95 Liquid Membrane 6 inches onto concrete and 3 inches onto penetrating item; then apply a second flashing sheet over the penetration extending a minimum of 6 inches from the detail. The seal the cut edges of all terminations must be sealed with Polyguard® Detail Sealant PW™ or Polyguard® LM-95 Liquid Membrane.

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VERTICAL SUB SURFACE WATERPROOFING

7. All terminations of the membrane should receive a troweled bead of Polyguard® Detail Sealant PW™, LM-95 Liquid Membrane, or 650 Mastic to a flat surface approximately 1/8-inch thick by 3/4-inch wide. The mastic should be worked into cut edge terminations.
 8. Inadequately lapped seams and damaged areas should be patched with Polyguard® Detail Tape. Patched areas should extend at least 6 inches in each direction beyond the defect.
 9. Fishmouths and/or severe wrinkles should be slit, flaps overlapped, and repaired.
- C. Membrane Installation – Horizontal Surfaces:
1. All inside and outside corners shall be treated either with 12-inch strips of membrane or a 12-inch wide by 90-mil thick application of Polyguard® Detail Sealant PW™ or Polyguard® LM-95 Liquid Membrane. The field membrane should be centered over the corner. All inside corners shall have a minimum 3/4-inch fillet of Polyguard® Detail Sealant PW™ or Polyguard® LM-95 Liquid Membrane or latex modified cement mortar.
 2. Apply waterproofing membrane to the primed surface starting at the low point and working to the high point in a shingling technique for maximum drainage.
 3. Side laps should be 2-1/2 inches minimum and staggered end laps should be 6-inches minimum. Refer to Polyguard slope and/or zero-slope applications for Balconies and proper lap adhesion requirements.
 4. Firmly roll the entire membrane with a minimum 75 lb. linoleum roller immediately after application. This will insure excellent adhesion and minimize air pockets between the substrate and membrane.
 5. At penetrations, posts, or projections, seal with Polyguard® Detail Sealant PW™ or Polyguard® LM-95 Liquid Membrane 6-inches onto concrete and 3-inches onto penetrating item; then apply a second flashing sheet over the penetration extending a minimum of 6 inches from the detail. The seal the cut edges of all terminations must be sealed with Polyguard® Detail Sealant PW™ or Polyguard® LM-95 Liquid Membrane.
 6. At drains, apply Polyguard® Detail Sealant PW™ or Polyguard® LM-95 Liquid Membrane around the inside edge of the drain out onto substrate at least 6 inches then overlap with sheet membrane a minimum of 6 inches. Seal all permanently-exposed cut edge terminations with Polyguard® Detail Sealant PW™ or Polyguard® LM-95 Liquid Membrane.
 7. Membrane turned up on walls shall be terminated. Firmly press the terminated edge with a hand roller, and protect with a troweled bead of Detail Sealant PW or LM-95 Liquid Membrane.
 8. Inadequately lapped seams and damaged areas should be patched with additional membrane. Extend patch at least 6 inches beyond the defect.
 9. Slit all "fishmouths," overlap the pieces, place patch over area and roll in place. Air blisters are typically caused by exposure and heat; this condition will subside as the sun no longer heats the membrane. This condition does not need attention unless blisters are large or excessive, softball size, and do not dissipate. Puncture large air blisters, expel the air, prime and cover with patch. Extend the patch material at a minimum of 6 inches in all directions beyond the repair area, then seal the patch edges with Detail Sealant PW or LM-95 Liquid Membrane.
 10. Upon completion of horizontal membrane application, Polyguard recommends a flood test or appropriate leak detection method be completed on the surface with 2 inches of water for 24 hours. Check with the structural engineer to make sure the deck structure will withstand the weight of the flood test. Mark any leak areas found during flood test and make repairs.

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VERTICAL SUB SURFACE WATERPROOFING

- D. Protection and Drainage Course:
 - 1. Apply protection board and/or drainage composite and perimeter drainage composite in accordance with MANUFACTURER's written directions.

END OF SECTION 07132

SECTION 07133

HORIZONTAL SUB SURFACE WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Installation of blindside vertical sheet membrane system and accessories.
- C. Accessory Products.

1.02 RELATED SECTIONS

- A. Cast-in-place concrete Section 03300.

1.03 REFERENCES

- A. ASTM C 836 (06) – Standard Specification for High Solids Content, Cold Liquid Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.
- B. ASTM D 412 – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
- C. ASTM D 570 – Standard Test Method for Water Absorption of Plastics.
- D. ASTM D 882 (02) – Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
- E. ASTM D 903 (98) – Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.
- F. ASTM D 1000 – Standard Test Methods for Pressure-Sensitive, Adhesive-Coated Tapes used for Electrical and Electronic Applications.
- G. ASTM D 1434 – Test Method for Determining Gas Permeability Characteristics of Plastic Film and Sheeting.
- H. ASTM D 1876 – Standard Test Method for Peel Resistance of Adhesives (T Peel Test).
- I. ASTM D 1970 (01) – Standard Specification for Self Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
- J. ASTM D 4632 – Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
- K. ASTM D 4716 (01) – Test Method for Determining the (In plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.

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HORIZONTAL SUB SURFACE WATERPROOFING

- L. ASTM D 5385(06) – Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes.
- M. ASTM D 6574 (00) – Test Method for Determining the (In Plane) Hydraulic Transmissivity of a Geosynthetic by Radial Flow.
- N. ASTM E 96 (Method B) – Standard Test Methods for Water Vapor Transmission of Materials.
- O. ASTM E 154 – Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
- P. General Services Administration, Public Building Service: GSA-PBS-07115 Guide Specification for Elastomeric Waterproofing.
- Q. Radon Reduction Technology Laboratory - Resistance to Permeance by Radioactive Radon Gas; Resistance to Diffusion by Radioactive Radon Gas.

1.04 SUBMITTALS

- A. Provide all submittals in accordance with Section 01300.
- B. Product Data: Submit MANUFACTURER's product data, installation instructions, use limitations and recommendations. Include certification of data indicating VOC (Volatile Organic Compound) content of all components of waterproofing system.
- C. Samples: Submit representative samples of the following for approval:
 - 1. Sheet membrane
 - 2. Fabric Tape and Accessories
 - 3. Prefabricated Drainage Composite

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Sheet Membrane Waterproofing Barrier System must be manufactured by a company with a minimum of ten (10) years of experience in the production and sales of membrane waterproofing materials.
- B. Applicator Qualifications: A firm having at least three (3) years of experience in applying these types of specified materials and specifically accepted in writing by the membrane system manufacturer.
- C. Materials: For each type of material required to complete the work of this section, provide primary materials which are the products of a single manufacturer.
- D. Pre-Application Conference: A pre-application conference shall be held to establish procedures and to review conditions, installation procedures and coordination with other related work. Meeting agenda shall include review of special details and flashing.

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HORIZONTAL SUB SURFACE WATERPROOFING

- E. Manufacturer's Representative: Arrange to have trained representative of the manufacturer on-site periodically to review installation procedures.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Store materials in a clean, dry area in accordance with manufacturer's instructions.
- C. Store adhesives at temperatures of 40° F (5°C) and above to facilitate handling.
- D. Store membrane cartons on pallets.
- E. Do not store at temperatures above 90° F (32°C) for extended periods.
- F. Keep away from sparks and flames.
- G. Completely cover when stored outside. Protect from rain.
- H. Protect materials during handling and application to prevent damage or contamination.
- I. Avoid use of products which contain tars, solvents, pitches, polysulfide polymers, or PVC materials that may come into contact with waterproofing membrane system.

1.07 PROJECT CONDITIONS

- A. Perform work only when existing and forecasted weather conditions are within the limits established by the membrane manufacturer. Install Blindside Membrane when temperature is 40°F (5°C) and rising. For low temperature use, between 25°F (-4°C) to 39°F (4°C), use the winter-grade formulation.
- B. Proceed with installation only when substrate construction and preparation work is complete. Ensure that subsoil is approved by architect or geotechnical firm.
- C. Warn personnel against breathing of vapors and contact with skin and eyes; wear appropriate protective clothing and respiratory equipment.
- D. Keep flammable products away from spark or flame. Post "No Smoking" signs. Do not allow use of spark-producing equipment during application and until all vapors have dissipated.
- E. Maintain work area in a neat and workmanlike condition. Remove empty cartons and rubbish from the site daily.

1.08 WARRANTY

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HORIZONTAL SUB SURFACE WATERPROOFING

- A. Manufacturer warrants only that this product is free of defects, since many factors which affect the results obtained from this product are beyond our control; such as weather, workmanship, equipment utilized and prior condition of the substrate. We will replace, at no charge, proven defective product within twelve (12) months of purchase, provided it has been applied in accordance with our written directions for uses we recommended as suitable for this product. Proof of purchase must be provided.

PART 2- PRODUCTS

2.01 MANUFACTURER BASIS OF DESIGN, EQUALS ARE ACCEPTABLE:

- A. Polyguard Products Inc.
P.O. Box 755 Ennis, TX 75120-0755
Phone: (214) 515-5000
Fax: (972) 875-9425
Email: info@polyguardproducts.com

2.02 SYSTEM MATERIALS

- A. High Density Blind Side Waterproofing: Shall be Polyguard Underseal® Blindside Waterproofing Membrane, a strong sheet membrane with a thick, cross-laminated, high-density polyethylene (HDPE) backing, laminated to thick layer of proprietary waterproofing adhesive compound integrated into a nonwoven geotextile fabric. Total membrane thickness is factory controlled at 73 mils.

SECTION 07133

HORIZONTAL SUB SURFACE WATERPROOFING

PHYSICAL PROPERTIES

PROPERTY	TEST METHOD	TYPICAL VALUE
FILM COLOR		Black/White
MEMBRANE THICKNESS	ASTM D 1000	73 mils
TENSILE STRENGTH OF 1" WIDTH SAMPLE POLYPROPYLENE GEOTEXTILE LAYER	ASTM D 4632	80 lb.
HYDRAULIC TRANSMISSIVITY OF A GEOSYNTHETIC USING A CONSTANT HEAD	ASTM D 4716	No measurable flow
(IN PLANE) HYDRAULIC TRANSMISSIVITY OF A GEOSYNTHETIC BY RADIAL FLOW	ASTM D 6574	No water flow
RESISTANCE TO FUNGI IN SOIL	GSA-PBS 07115 – 16 weeks	No effect
RESISTANCE TO PERMEANCE BY METHANE GAS	ASTM D 1434 tested using 99.99% purity	7.2×10^{-7} ft ³ / (ft ² • hr • psi)
RESISTANCE TO RADIOACTIVE RADON GAS	Radon Reduction Technology Laboratory % reduction in radon gas diffusion	97.10%
LAP PEEL ADHESION	ASTM D 1876* Modified ¹ Die C	9.02 lb./in.
PUNCTURE RESISTANCE, MINIMUM	ASTM E 154	217 lb.
RESISTANCE TO HYDROSTATIC HEAD, MINIMUM	ASTM D 5385	231 ft.
PEEL ADHESION TO CONCRETE	ASTM D 903	14.9 lb./in.
ELONGATION, RUBBERIZED ASPHALT SEALANT/ADHESIVE COMPONENT	ASTM D 412	655%
WATER ABSORPTION, MAXIMUM	ASTM D 570	0.1%
CRACK CYCLING	ASTM C 836 Tested @ -15°F	No effect
LOW TEMPERATURE FLEXIBILITY	ASTM D 1970 180° bend over 1" mandrel at -25°F (-29°C)	No effect
BREAKING STRENGTH OF 1" WIDTH SAMPLE POLYETHYLENE GEOMEMBRANE LAYER	ASTM D 882	6500 PSI
PERMEANCE TO WATER VAPOR TRANSMISSION, MAXIMUM	ASTM E 96 Method B**	0.01 perms

*Test is done using smaller sample than standard and at room temperature.

** Test method used: ASTM E 96. Sample preparation for nail puncture: ASTM D 1970.

2.03 SYSTEM ACCESSORIES

A. Surface Primer Roller-Grade Adhesive:

1. Polyguard® 650 LT Liquid Adhesive: A rubber-based, tacky adhesive which is specifically formulated to provide excellent adhesion.

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HORIZONTAL SUB SURFACE WATERPROOFING

2. Polyguard® California Sealant: A rubber-based sealant which is specifically formulated to provide excellent adhesion. The VOC (Volatile Organic Compound) content meets the South Coast Air Quality Management District regulations established under the February 1, 1991 version of Rule 1168 ©) (2) Adhesion and Sealant Applications. California Sealant is classified as an Architectural Sealant Primer Porous, with VOC of 527 g/L. Current SCAQMD regulations for this type sealant primer are 775 g/L.
- B. Fabric Tape:
1. Polyguard® Fabric Tape: A rubberized asphalt waterproofing membrane laminated to polypropylene fabric backing. The membrane is wound onto a disposable silicone treated release sheet to prevent the membrane from sticking onto itself while in the roll. Polyguard® Fabric Tape is used around pipe penetrations with an annular space of pipe through opening exceeding 1/2", end laps and for patching damaged areas.
- C. Liquid Membrane:
1. Polyguard® LM-95 Liquid Membrane: A two-component, asphalt-modified, urethane.
- D. Detail Sealant:
1. Polyguard® Detail Sealant PW™: A Single-component, STPE, 100% solid moisture-cured, elastomeric sealant. It is an environmentally-friendly, non-isocyanate product that replaces silicone and urethane sealants. It is also a low VOC / HAPS-free, cold-applied, self-adhesive, elastomeric sealant.
- E. Detail Adhesive Tape:
1. Polyguard® 606 Tape: High-strength, double-sided tape comprised of rubberized asphalt. The tape is supplied in rolls and utilizes both Kraft paper and plastic film release sheets which are removed prior to application.
- F. Tie Back Cover:
1. Polyguard® Poly Cover: Pre-formed dome shape tie back cover made with heavy-duty, high impact ABS plastic. It is designed to cover protruding tie back bolts less than 6" in height in lagging and retention walls.
- G. Corner Boots:
1. Polyguard® US Inside Corner Boot: 60-mil combination of rubberized asphalt bonded to polyethylene. The adhesive surface is covered with a release liner which will be removed prior to application on an inside corner to reinforce and seal corners of the Blindside Membrane.
 2. Polyguard® US Outside Corner Boot: 60-mil combination of rubberized asphalt bonded to polyethylene. The adhesive surface is covered with a release liner which will be removed prior to application on an outside corner to reinforce and seal corners of the Blindside Membrane.
 3. Polyguard® US Pit Top Corner Boot: 60-mil combination of rubberized asphalt bonded to polyethylene. The adhesive surface is covered with a release liner which will be removed prior to application on all corners to reinforce and seal corners of the Blindside Membrane.

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HORIZONTAL SUB SURFACE WATERPROOFING

H. Drainage Mats:

1. Polyguard® Polyflow® 15 Vertical Drainage Mat: Two-part, prefabricated geocomposite drain consisting of a formed polystyrene core covered on one side with polypropylene filter fabric. The fabric allows water to pass into the drain core while restricting the movement of soil particles which might clog the core. The core allows the water to flow to designated drainage exits.
2. Polyguard® Polyflow® 15P Vertical Drainage Mat: Three-part, prefabricated geocomposite drain consisting of a formed polystyrene core covered on one side with polypropylene filter fabric with a built-in Polymeric film protection layer for use as required by the manufacturer of some waterproofing materials in order to be a compatible protection layer.
3. Polyguard® Totalflow™: Totalflow is a combination of our Polyguard sheet drain products with our unique Totalflow™ product. In the Totalflow™ system, the sheet drain performs its normal function of water collection, while the Totalflow™ section provides both water collection and a high-profile section allowing for high-capacity water flow to designated drainage exits.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine surfaces to receive self-adhering membrane. Notify General Contractor if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.02 SURFACE CONSIDERATIONS

- A. Wood Lagging with Steel Piles.
 1. Make sure all lagging boards are installed flush and inline within 1/2-inch.
 2. Repair damaged/missing lagging boards with concrete grout, treated wood, or both.
 3. Fill or cover all gaps between lagging boards exceeding 2 inches using concrete grout or plywood.
 4. If lagging boards are placed interior to the steel pile, then any gaps between the ends of the boards which exceed 2 inches should be covered with plywood, then secure or grout behind for stability.
- B. Steel Sheet Piling
 1. If the membrane is to be in continuous contact with the profile of the sheet piling, all sharp protrusions must be first addressed or removed.
 2. If waterproofing will span the sheet pilings, place 3/4-inch plywood across the void and mechanically anchor into place every 12-inches O.C. Fill void behind plywood with sand.
- C. Caisson
 1. Surface of augured piers should be relatively smooth to install directly against piers. However, the groove between each pier has to be filled with concrete grout and all sharp protrusions addressed or removed.

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HORIZONTAL SUB SURFACE WATERPROOFING

- D. Shotcrete with Concrete and Chemically Stabilized Earth:
 - 1. Remove all sharp protrusions and fill all voids with concrete grout. The concrete surface profile should be between CSP-3 and CSP-8.
- E. Slurry Wall
 - 1. Clean off all mud and dirt.
 - 2. Remove all sharp protrusions and fill all voids with concrete grout.

3.03 SURFACE PREPARATION

- A. Complete the retention system per project specifications.
- B. Remove objects that could penetrate the membrane, such as nails and concrete fins. Also look for any gaps larger than 2 inches between timber lagging and any change in plane which would result in bridging.
- C. Never place the membrane in standing water.
- D. Provide a dry surface prior to application.

3.04 APPLICATION

- A. Drainage Board Installation:
 - 1. Drainage board should be applied vertically. Apply drainage board with fabric to lagging, caisson, shotcrete, slurry seal or steel piling walls. Bring drainage board over the top of the surface to be waterproofed and securely tack the drainage board to the top. On lagging walls cut holes in the drainboard where the lag bolts are extending out of the wood lagging into the drainage board.
 - 2. Butt drainboard together at side and end seams.
- B. Membrane Installation – Vertical Surfaces:
 - 1. Apply waterproofing membrane with the high-density backing to the drainage board.
 - 2. Install Blindside Membrane when temperatures are 40°F (5°C) and rising. For low temperature use, between 25°F (-4°C) to 39°F (4°C), use the winter-grade formulation.
 - 3. Application up to 20 feet should be done by applying pins with washers every 12 inches across the top lagging thru the membrane and drainage board, allowing the membrane to hang down the wall.
 - 4. For applications over 20 feet, contact the manufacturer for recommendations.
 - 5. Provide vertical wall terminations to protect the self-adhered membrane for critical future tie-in to other products, or for protection from trade damage. Review Polyguard's published details for critical detailing procedures at all top terminations.
 - 6. Side laps are furnished with edge trim of 4'. Apply powder-actuated fasteners every 16-to-24 inches and 1 inch in from the outside edge to secure membrane to wall. Prior to side lap application, remove any debris and dust on the polyethylene backing, clean the backing with 30% Isopropyl Alcohol, and then

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HORIZONTAL SUB SURFACE WATERPROOFING

apply to the edge trim. Finish the seal by rolling with a laminate-type roller to obtain full adhesion.

7. Prime end laps, and on adjoining sheets, with a minimum 6-inch heavy coat of 650 LT Liquid Adhesive or California Sealant at a coverage rate of 50 – 75 sq. ft. per gallon. Allow this adhesive to dry (until tacky) before membrane application. Install a reverse shingle lap with the Blindside Membrane on the vertical wall; at a maximum 4-inch and a minimum 3-inch overlap. Center and place a 12-inch wide piece of Fabric Tape over the primed seam area. Apply even pressure with a roller to obtain full adhesion.
 8. If the annular gap between the rough opening and the pipe, bolt, or other penetration is 1/2-inch diameter or less, apply liquid adhesive to the fabric side of the surrounding field course of Blindside Membrane. Then apply a minimum 3/4-inch cant (fillet) of LM-95 Liquid Membrane, or Detail Sealant PW, around the pipe penetration extending a minimum of 3 inches onto both the prepared fabric side of the Blindside Membrane field course and the penetrating item. Allow the LM-95 Liquid Membrane or Detail Sealant PW to cure for 2 hours.
 9. If the annular gap between the rough opening and the pipe, bolt, or penetration exceeds 1/2-inch diameter, apply a patch of Blindside Membrane tight around the penetrating item with a minimum distance of 6 inches onto the surrounding field course of Blindside Membrane. Then seal with LM-95 Liquid Membrane or Detail Sealant PW as a minimum 3/4-inch cant (fillet) extending onto the Blindside Membrane skirt and the penetrating item a minimum distance of 3 inches. Then apply a heavy coat (approximately 50 – 75 sq. ft. per gallon) of Polyguard® 650 LT Liquid Adhesive or Polyguard® California Sealant onto the fabric side of the Blindside Membrane patch extending 6 inches onto the field coating of Blindside Membrane. Next apply a patch of Polyguard® Fabric Tape around the termination edges of the Blindside Membrane patch. Press or roll the patch firmly to obtain full adhesion to the field coating of Blindside Membrane. Apply another coat of Polyguard® 650 LT Liquid Adhesive or Polyguard® California Sealant to the Polyguard® Fabric Tape patch edges and apply liquid membrane at Fabric Tape edge terminations.
 10. Visually inspect membrane prior to pouring of concrete for any punctures/damage.
 11. Repair damaged Blindside Membrane areas by applying Polyguard® 650 LT Liquid Adhesive or Polyguard® California Sealant at a rate of 50 -75 sq. ft. per gallon to the fabric side of the Blindside Membrane and apply LM-95 Liquid Membrane or Detail Sealant PW a minimum of 3 inches in each direction. Next, apply Polyguard® 650 LT Liquid Adhesive or Polyguard® California Sealant at a rate of 50 -75 sq. ft. per gallon over the Liquid Membrane and the Blindside Membrane field course to a minimum 6 inches in all directions from the damaged area. Apply a Polyguard Fabric Tape patch a minimum 6 inches larger than damaged area in all directions.
- C. Termination Bar
1. (Optional) Secure at top of wall fastening every 7" O.C.
- D. Membrane Installation – Horizontal Surfaces:

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HORIZONTAL SUB SURFACE WATERPROOFING

1. Blindside Membrane may also be installed horizontally over prepared sub base such as mud slab or pea gravel. Refer to Underslab data sheet for additional horizontal installation guidelines.

END OF SECTION 07133

SECTION 07190

WATER REPELLENT

PART 1 - GENERAL

1.01 SUMMARY

- A. Description of scope and intent:
 - 1. CONTRACTOR shall provide all material, labor, and tools required to complete the installation of specified system.
 - 2. Any omission of reference to items required to complete the full operational and functional system specified in the section does not relieve the CONTRACTOR of the obligation to provide same.
 - 3. To provide installation of all items, including delivery, dispersing to the proper locations within the building, and affixing in place.
 - 4. Installation shall be accomplished by workers skilled in their craft that will perform their work in a professional manner and will leave the premises safe, orderly and clean.
 - 5. Drawings and general provisions of Contract, including JEA General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section
 - 6. CONTRACTOR is responsible for coordination of work included in this Specification with all other Specification sections related to furnishing of all materials, labor, permits, fees and services necessary for completion of work in this section.
 - 7. In the event of a conflict between the design drawings, referenced standards and these Specifications, the more stringent shall govern unless directed otherwise by the ENGINEER. CONTRACTOR shall strictly adhere to OSHA requirements and local codes or those of any regulatory agency or body with jurisdiction.
- B. This Section includes clear water-repellent coating for the following exterior, vertical and non-traffic (pedestrian or vehicular) horizontal surfaces of new construction:
 - 1. Masonry units used as exterior veneer

1.02 PERFORMANCE REQUIREMENTS

- A. Provide water repellents with the following properties based on testing manufacturer's standard products, according to test methods indicated, applied to substrates simulating Project conditions using same materials and application methods to be used for Project.
 - 1. Absorption: Minimum 90 percent reduction of absorption after 24 hours in comparison of treated and untreated specimens.
 - a. Concrete Unit Masonry: ASTM C 140.
 - b. Hardened Concrete: ASTM C 642.
 - 2. Water-Vapor Transmission: Maximum 10 percent reduction in rate of vapor transmission in comparison of treated and untreated specimens, per ASTM E 96.

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WATER REPELLENT

3. Water Penetration and Leakage through Masonry: Maximum 90 percent reduction in leakage rate in comparison of treated and untreated specimens, per ASTM E 514.
4. Durability: Maximum 5 percent loss of water repellency after 2500 hours of weathering in comparison to specimens before weathering, per ASTM G 53.
5. Permeability: Minimum 80 percent breathable in comparison of treated and untreated specimens, per ASTM D 1653.
6. Chloride-Ion Intrusion in Concrete: Transportation Research Board, National Research Council's NCHRP Report 244, Series II tests.
 - a. Reduction of Water Absorption: 80 percent.
 - b. Reduction in Chloride Content: 80 percent.

1.03 SUBMITTALS

- A. Provide all submittals in accordance with Section 01300.
- B. Product Data: Include manufacturer's specifications, surface preparation and application instructions, recommendations for water repellents for each surface to be treated, and protection and cleaning instructions. Include data substantiating that materials are recommended by manufacturer for applications indicated and comply with requirements.
- C. Samples: Of each substrate indicated to receive water repellent, 12 inches square, with specified repellent treatment applied to half of each sample.
- D. Applicator Certificates: Signed by manufacturer certifying that the applicator complies with requirements.
- E. Certification by water repellent manufacturer that products supplied complies with local regulations controlling use of VOCs.
- F. Material Test Reports: Indicate and interpret test results for compliance of water repellents with requirements indicated.

1.04 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who employs only persons trained and approved by water repellent manufacturer for application of manufacturer's products.
- B. Testing Agency Qualifications: An independent testing agency with experience and capability to conduct testing indicated in "Performance Requirements" Article without delaying the Work, per ASTM E 548.
- C. Regulatory Requirements: Comply with applicable rules of pollution-control regulatory agency having jurisdiction in Project locale regarding VOCs and use of hydrocarbon solvents.

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WATER REPELLENT

- D. Field Samples: Architect will select one representative surface for each substrate to receive water repellents. Apply water repellent to each substrate, with either partial or full coverage as directed. Comply with application requirements of this Section.
1. Obtain ENGINEER's approval of field samples before applying water repellents.
 2. Maintain field samples during construction in an undisturbed condition as a standard for judging the completed Work.

1.05 PROJECT CONDITIONS

- A. Weather and Substrate Conditions: Do not proceed with application of water repellent under any of the following conditions, except with written instruction of MANUFACTURER:
1. Ambient temperature is less than 40 deg F.
 2. Concrete surfaces and mortar have cured for less than 28 days.
 3. Rain or temperatures below 40 deg F are predicted within 24 hours.
 4. Application is earlier than 24 hours after surfaces have been wet.
 5. Substrate is frozen or surface temperature is less than 40 deg F.
 6. Windy condition exists that may cause water repellent to be blown onto vegetation or surfaces not intended to be coated.

1.06 WARRANTY

- A. Special Warranty: Submit a written warranty, executed by the applicator and water repellent manufacturer, covering materials and labor, agreeing to repair, or replace materials that fail to provide water repellency within the specified warranty period. Warranty does not include deterioration or failure of coating due to unusual weather phenomena, failure of prepared and treated substrate, formation of new joints and cracks more than 1/16-inch-wide, fire, vandalism, or abuse by maintenance equipment.
1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, the products listed in other Part 2 articles.

2.02 PENETRATING WATER REPELLENTS

- A. Silanes, 20 to 40 Percent Solids: Penetrating water repellent. A monomeric compound containing approximately 20 to 40 percent alkyltrialkoxysilanes with alcohol, mineral spirits, water, or other proprietary solvent carrier.

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WATER REPELLENT

- B. VOC-Complying Water Repellents: Products complying with local regulations controlling use of VOCs, as certified by MANUFACTURER.
- C. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Silanes: Penetrating Water Repellant: Clear, monomeric compound containing 20 to 40 percent solids of alkyltrialkoxysilanes; with alcohol, mineral spirits, water, or other propriety solvent carrier; and with 5 lb/gallons or less of VOCs.
 - a. Conspec Marketing and Manufacturing Co., Inc.; either Conspec Silane 20 or Conspec Silane 40.
 - b. Hydrozo, Div. of ChemRex; Silane 40.
 - c. Sonneborn Building Products, Div. of ChemRex; Penetrating Sealer 40.
 - d. Tamms Industries, Inc.; Baracade Silane 40 or Baracade Silane 40 IPA.
 - e. Sure Klean Weather Seal; PROSOCO, Inc.
 - f. White Roc 10 VOC or WB; Sonneborn Building Products, ChemRex Commercial Construction Products Division.
 - g. Aqua-Trete EM; Degussa, Corp.
 - h. DUR A PELL 20; Chemprobe Coating Systems, L.P. (TNEMEC)

PART 3 – EXECUTION

3.01 PREPARATION

- A. Clean substrate of substances that might interfere with penetration or performance of water repellents. Test for moisture content, per repellent manufacturer's written instructions, to ensure surface is sufficiently dry.
- B. Test for pH level, per water repellent manufacturer's written instructions, to ensure chemical bond to silicate minerals.
- C. Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live plants and grass.
- D. Coordination with Sealants: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
 - 1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those used in the work.
- E. Test Application: Before performing water-repellent work, including bulk purchase and delivery of products, prepare a small application in an unobtrusive location and in a manner approved by Architect to demonstrate the final effect (visual,

SECTION 07190

WATER REPELLENT

physical, and chemical) of planned application. Proceed with work only after ENGINEER approves test application or as otherwise directed.

3.02 APPLICATION

- A. Apply a heavy-saturation spray coating of water repellent on surfaces indicated for treatment using low-pressure spray equipment. Comply with MANUFACTURER's written instructions for using airless spraying procedure, unless otherwise indicated.
- B. Apply a second saturation spray coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult MANUFACTURER's technical representative if written instructions are not applicable to Project conditions.

3.03 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Provide services of a factory-authorized technical service representative to inspect and approve the substrate before application and to instruct the applicator on the product and application method to be used.

3.04 CLEANING

- A. Protective Coverings: Remove protective coverings from adjacent surfaces and other protected areas.
- B. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Repair damage caused by water-repellent application. Comply with MANUFACTURER's written cleaning instructions.

PART 4 – SCHEDULE

4.01 WATER REPELLANT

- A. Water repellent work includes, but is not limited to, the following:
 - 1. Providing the application of water repellent to all exterior masonry.

END OF SECTION 07190

SECTION 07210

BUILDING INSULATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Glass fiber blanket/batt.
 - 2. Perlite, loose granular.

1.02 DEFINITIONS

- A. Thermal Resistance (R-value): The temperature difference in degrees F between the two surfaces of a material of given thickness, required to make 1 Btu of energy flow through 1 square foot of the material in 1 hour.

1.03 SUBMITTALS

- A. Product Data: Submit for each product specified in this Section as per Section 01300.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Provide manufacturer's standard preformed insulation units, sized for proper fit in indicated applications.
- B. Glass Fiber Insulation-Blanket/Batt:
 - 1. Unfaced blanket/batt: Type I, (ASTM C 665); passing ASTM E 136 combustion test requirements.
 - 2. R38 Batts – (At roof locations) and R15 Batts 3 ½ inches thick– (At exterior insulated electrical room and restroom walls)
 - 3. Products of the following manufacturers, provided they comply with requirements of the contract documents, will be among those considered acceptable:
 - a. CertainTeed Corporation.
 - b. Manville Roofing Systems, a Division of Schuller International, Inc.
 - c. Owens-Corning Fiberglass Corporation.
- C. Loose granular perlite insulation (Light weight insulating concrete):
 - 1. Type II (ASTM C 549)
 - 2. Density:
 - a. Installed wet weight density - 36-40 pounds per cubic foot.
 - b. Installed dry weight density - 32–40 pounds per cubic foot
 - c. Air dry dead load per inch of thickness – 2.5 pounds per square foot to 2.8 pounds per square foot per inch of thickness
 - 3. Manufacturers: Products of the following manufacturers, provided they comply with requirements of the contract documents, will be among those considered acceptable:
 - a. Producer members of Perlite Institute, Inc.
- D. Vapor Retarder: Polyethylene film

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BUILDING INSULATION

1. Laboratory-tested vapor transmission rating: 0.2 perm.
 2. Thickness: 6 mils.
 3. Color: Natural.
- E. Rigid Extruded Polystyrene Insulation: 2" thick-R10 insulation at CMU wall separating electrical room from pump room; basis of design Owens Corning Foamular 250. To be located in line with the light gauge stud wall construction. Refer to the architectural drawings for location of the rigid extruded polystyrene insulation in and around the electrical room and restroom.

2.02 ACCESSORIES

- A. Provide accessories as necessary to properly install specified products.
1. Screens to be used with loose granular insulation: Provide suitable screens of bronze or stainless steel, properly sized and designed to permanently maintain drainage and ventilation openings.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with insulation manufacturer's recommendations and installation sequence. Provide permanent placement and support of insulation.
- B. Install materials in a manner which will maximize continuity of thermal envelope. Use a single layer of insulation wherever possible to achieve indicated requirements, unless otherwise indicated.
- C. Insulation Blankets/Batts:
1. Application: Wood-framed construction:
 - a. Unfaced insulation: Friction-fit insulation between framing members.
- D. Loose granular insulation:
1. Drainage or ventilation openings: Install suitable screens inside cavities to maintain openings.
 2. Remove obstructions which might interfere with free flow of insulation to intended spaces during pouring. Completely fill indicated cavities and spaces. Leaven no gaps or voids.
- E. Vapor Retarder:
1. Comply with membrane manufacturer's recommendations for installation of membrane as vapor retarder in application indicated.

END OF SECTION 07210

SECTION 07265

UNDERSLAB VAPOR PROTECTION

PART 1 - GENERAL

1.01 SUMMARY

- A. Description of Scope and Intent:
 - 1. CONTRACTOR shall provide all material, labor, and tools required to complete the installation of specified system.
 - 2. Any omission of reference to items required to complete the full operational and functional system specified in the section does not relieve the CONTRACTOR of the obligation to provide same.
 - 3. To provide installation of all items, including delivery, dispersing to the proper locations within the building, and affixing in place.
 - 4. Installation shall be accomplished by workers skilled in their craft that will perform their work in a professional manner and will leave the premises safe, orderly and clean.
 - 5. Drawings and general provisions of Contract, including JEA General Conditions and Division 1 Specification Sections, apply to this Section.
 - 6. CONTRACTOR is responsible for coordination of work included in this specification with all other Specification sections related to furnishing of all materials, labor, permits, fees and services necessary for completion of work in this section.
 - 7. In the event of a conflict between the design Drawings, referenced standards and these Specifications, the more stringent shall govern unless directed otherwise by the ENGINEER. CONTRACTOR shall strictly adhere to OSHA requirements and local codes or those of any regulatory agency or body with jurisdiction.
- B. This Section includes integral pre-applied waterproofing membrane and vapor barrier that bonds to poured concrete for use below slabs on grade, installed in direct contact with concrete.

1.02 SUBMITTALS

- A. Submit MANUFACTURER's product data, installation instructions and membrane samples for approval in accordance with Section 01300.

1.03 REFERENCE STANDARDS

- A. The following standards and publications are applicable to the extent referenced in the text.
- B. American Society for Testing and Materials (ASTM):
 - 1. D 412– Standard Test Methods for Rubber Properties in Tension
 - 2. D 903– Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
 - 3. D 3767– Standard Practice for Rubber - Measurements of Dimensions
 - 4. E 96– Standard Test Methods for Water Vapor Transmission of Materials

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UNDERSLAB VAPOR PROTECTION

5. E 154– Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
 6. E 1643– Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
 7. E 1745– Plastic Vapor Retarders Used in Contact with Soil or Granular fill under Concrete Slabs
- C. American Concrete Institute (ACI) ACI 302.1R-96 Addendum Vapor Retarder Location: For slabs with vapor-sensitive floor coverings, locate retarder in direct contact with the slab (not beneath a layer of granular fill).

1.04 QUALITY ASSURANCE

- A. Materials: For each type of material required for the work of this section, provide primary materials that are the products of one manufacturer.
- B. Schedule Coordination: Schedule work such that membrane will not be left exposed to weather for longer than that recommended by the MANUFACTURER.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 01600. Deliver materials in labeled packages. Store and handle in strict compliance with manufacturer's instructions. Protect from damage from weather, excessive temperature and construction operations. Remove and dispose of damaged material in accordance with applicable regulations.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Basis of Design - Integrally Bonded Vapor Protection: Florprufe™ 120 Membrane by Grace Construction Products, or an equivalent underslab vapor barrier capable of integrally bonding to concrete. The vapor barrier shall be a 0.5 mm (0.021 inch) nominal thickness composite sheet membrane comprising 0.4 mm (0.016 inch) of polyolefin film, and layers of specially formulated synthetic adhesive layers. The membrane shall form an integral and permanent bond to poured concrete to prevent vapor migration at the interface of the membrane and structural concrete.
- B. Provide membrane with the following physical properties:

Property	Typical Value	Test Method
Thickness (nominal)	0.5 mm (0.021 inch)	ASTM D3767 Method A
Water Vapor Permeance	0.03 perms	ASTM E96 Method B *
Tensile Strength	68 lb./inch	ASTM E154 *
Elongation	300%	ASTM D412
Puncture Resistance	3300 grams	ASTM D1709 *
Peel Adhesion to Concrete	>4 lb./inch	ASTM D903

* ASTM E 1745 Requirements.

SECTION 07265

UNDERSLAB VAPOR PROTECTION

PART 3 - EXECUTION

3.01 EXECUTION

- A. The installer shall examine conditions of substrates and other conditions under which this work is to be performed and notify the CONTRACTOR, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

- A. Earth and stone substrates shall be well compacted to produce an even, solid substrate. Remove loose aggregate or sharp protrusions. Concrete substrates shall be smooth or broom finished and monolithic. Remove standing water prior to membrane applications.
- B. Place all foundation and slab insulation around slab/foundation perimeter before installation of membrane. Join the entire perimeter edges of the vapor barrier with the waterproof barrier sealing the foundation walls.
- C. Installation shall be in accordance with manufacturer's instructions and ASTM E 1643-98, including but not limited to, the following:
 - 1. Apply membrane with the HDPE film facing the prepared substrate. Remove the release liner during application.
 - 2. Apply succeeding sheets by overlapping the previous sheet 50-mm (2-inch.) along the marked lap line. End Laps should be staggered to avoid a build up of layers.
 - a. Mechanical Fastening – To prevent the membrane from moving and gaps opening, the laps should be fastened together at 39 in maximum centers. Fix through the center of the lap area using 0.5-inch long washer-head self-tapping galvanized screws.
 - b. Taped Lap – Use manufacturer's recommended tape to secure and seal the overlaps. Overband the lap with 4-inch wide tape using the lap line for alignment. Remove plastic release liner to ensure bond to concrete.
 - 3. Mix and apply liquid detailing compound to seal around penetrations such as drainage pipes, etc.

3.03 CONCRETE PLACEMENT

- A. Place concrete within 30 days. Inspect membrane and repair any damage with patches of tape. Ensure all liner is removed from membrane and tape before concrete placement.

3.04 SCHEDULE

- A. Provide underslab vapor barrier under all building slabs on grade, including the re-pump station building and the sodium hypochlorite structure. Perimeter of underslab vapor barriers shall join the sealant of the foundation.

END OF SECTION 07265

SECTION 07552

SBS-MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes mechanically attached base sheet and two-ply modified bituminous membrane roofing system, including membrane flashing and accessory materials.
- B. The design is based upon Siplast products; however, JEA will accept FM Global Approved total roof system assemblies from Johns Manville, Siplast or Soprema.
- C. Related Sections include the following:
 - 1. Section 03520; Lightweight Concrete Roof Insulation: contains requirements for lightweight concrete insulation that will be the substrate for the modified bitumen roof membrane system.
 - 2. Section 07600; Sheet Metal Flashing and Trim: contains requirements for fabricated metal flashing, counterflashing, and accessory items to be installed in conjunction with the roof membrane system.

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM)
100 Barr Harbor Drive, West Conshohocken, PA 19428.
(601) 832-9500
 - 1. Annual Book of ASTM Standards (latest edition)
- B. Factory Mutual Research Corporation
1151 Boston-Providence Turnpike
Norwood, MA 02062
(781) 255-4681
- C. National Roofing Contractors Association (NRCA)
10255 W. Higgins Road, Suite 600
Rosemont, IL 60018-5607
(847) 299-9070

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SBS-MODIFIED BITUMINOUS MEMBRANE ROOFING

1.04 DEFINITIONS

- A. Roofing Terminology: Refer ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work not otherwise defined in this Section.

1.05 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed a watertight, modified bituminous membrane roofing and base flashing system with compatible components that will not permit the passage of liquid water and will withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture.
- B. FM Listing: Provide roof membrane system evaluated by FM Global and listed in FM Global "RoofNav" system as part of an approved roof assembly which includes all other assembly materials specified for this project. The roof membrane system must be part of an approved FM assembly with the minimum wind uplift classifications specified for this project.

1.06 SUBMITTALS

- A. Provide all submittals in accordance with Section 01300.
- B. Product Data: For modified bitumen membrane assembly and individual system components, including:
 - 1. Base sheet
 - 2. Base sheet fasteners
 - 3. Modified bitumen base ply membrane
 - 4. Modified bitumen cap ply membrane
 - 5. Modified bitumen flashing base ply
 - 6. Modified bitumen flashing cap ply
 - 7. Asphalt roof cement
 - 8. Asphalt primer
- C. Material Safety Data Sheets (MSDS); For modified bitumen membrane assembly and individual system components, including:
 - 1. Modified bitumen base ply membrane
 - 2. Modified bitumen cap ply membrane
 - 3. Asphalt roof cement
 - 4. Asphalt primer
 - 5. Metallic powder
- D. RoofNav Data: Provide the "Roofing System Contractor Package" for verification of wind uplift ratings and component assembly data or a letter from the roofing system MANUFACTURER stating the following:
 - 1. RoofNav assembly numbers.

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SBS-MODIFIED BITUMINOUS MEMBRANE ROOFING

2. Lists all roofing components including but not limited to the membranes, insulation, coverboard, flashing, adhesives, fasteners, fascia and the deck.
 3. States that the system and its components listed above meet the following:
 - a. Factory Mutual Approval Standard 4470 listing for the proposed membrane system. The roofing membrane configuration shall be approved by FM Global for Class 1-SH (severe hail) exposure. The roof shall be approved by FM Global for minimum 1-150 wind uplift construction as listed in RoofNav Assembly # 218284-49238-50987. Provide the perimeter and corner fastening enhancements to meet the minimum design pressures stated below. For FM insured buildings job specific acceptance is must be obtained by local FM Field ENGINEER.
 - 1) Field-of-Roof Uplift Pressure: 120 PSF
 - 2) Perimeter Uplift Pressure: 165 PSF
 - 3) Corner Uplift Pressure: 240 PSF
 - b. Miami-Dade Notice of Acceptance (NOA) for the proposed roof assembly.
 - c. Wind speed: 142 MPH
 4. The system meets the required 20 year No Dollar Limit warranty for 110 MPH wind.
 5. Insulation fastening/ adhesive patterns for corner, perimeter, and field-of-roof locations.
- E. Samples for Verification: Submit physical samples of each of the following products, in MANUFACTURER's standard sample size, wrapped and labeled packaging:
1. Modified bitumen cap ply membrane in specified surface finish and color.
- F. Warranty/ Guarantee: Submit sample document from roof system MANUFACTURER, including addendum as required, indicating compliance with all specified requirements.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer Qualifications: A qualified MANUFACTURER that is FM Global approved for membrane roofing system identical to that used for this Project. FM Global is launching a certified roofing installer program. Insert certification requirements in "Installer Qualifications" Paragraph below if Project is FM Global insured and if a certified roofing installer is required.
- B. Manufacturer Qualifications: A qualified MANUFACTURER that is FM Global approved for membrane roofing system identical to that used for this Project.
- C. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system MANUFACTURER to install MANUFACTURER's product and that is eligible to receive MANUFACTURER's special warranty.

SECTION 07552

SBS-MODIFIED BITUMINOUS MEMBRANE ROOFING

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with MANUFACTURER's name, product brand name and type, date of manufacture, approval or listing agency markings, and bearing the proper Underwriters Laboratories (UL) and/or Factory Mutual (FM) labels.
- B. Deliver materials in sufficient quantities and/or at sufficient frequency to allow continuity of application.
 - 1. Minimize site deliveries to the greatest extent possible.
- C. Store materials out of direct exposure to the elements, in a dry, well-ventilated location to ensure no moisture pickup and maintain at a temperature exceeding roofing system MANUFACTURER's written instructions. When stored outdoors, cover all materials with breathable canvas tarps. MANUFACTURER's polyethylene wrapping and polyethylene or other non-breathable plastic tarps or coverings are not acceptable. Any materials that are improperly covered overnight or during inclement weather will be marked by the OWNER's representative and must be removed from the jobsite by the CONTRACTOR and replaced with new material at no additional cost to the OWNER.
 - 1. Store rolls of felt and other sheet materials on end and on pallets or other raised surface. Do not double-stack rolls.
 - 2. Store materials such as solvents, adhesives and asphalt cutback products away from open flames, sparks or excessive heat.
 - 3. Handle and store roofing materials and place equipment in a manner to avoid significant or permanent damage to the deck or structural supporting members.
 - 4. Do not leave unused felts and other work sheet materials on the roof overnight or when roofing work is not in progress unless stored on pallets, protected from weather and moisture and unless maintained at a temperature exceeding 50 deg F.

1.09 PROJECT CONDITIONS

- A. Weather Limitations: Do not apply roofing materials during precipitation or in the event there is a probability of precipitation during application. Take all necessary precautions to ensure that materials, applied roofing and building interiors are protected from possible damage or contamination.

1.10 WARRANTY/GUARANTEE

- A. General: The warranties/guaranties specified in this Article shall not deprive the OWNER of other rights the OWNER may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties/ guaranties made by the CONTRACTOR under requirements of the Contract Documents.

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- B. Roofing Manufacturer's Warranty/Guarantee: Submit a written warranty/guarantee, without deductibles or monetary limitation, signed by roofing system MANUFACTURER agreeing to promptly repair leaks or defects in the roof system, including base sheet, base sheet fasteners, roof membrane, membrane flashings and light weight concrete insulation, resulting from defects in materials or workmanship for the period of twenty (20) years from acceptance of the completed roof system by the OWNER.
 - 1. The warranty/guarantee shall not exclude random areas of ponding water from coverage.
- C. CONTRACTOR'S Guarantee: All work included in the project shall be guaranteed by the CONTRACTOR's for a period of two (2) years from the date of acceptance by the OWNER.

1.11 TORCH SAFETY PRECAUTIONS

- A. General: All torch-applied roofing shall be installed in accordance with recommendations provided in Factory Mutual Property Loss Prevention Data Sheet 1-33, "Safeguarding Torch Applied Roof Installations" and shall comply with the Florida State Fire Prevention Code (latest editions)
- B. Permit Requirements
 - 1. The CONTRACTOR must obtain a "Hot Work Permit" from JEA Hot Work Permit Issuing Authority, prior to performing any torch-applied roofing installation. Refer to Special Conditions for additional information on permit procedures.
- C. Installation Safeguards
 - 1. Torches used to secure roofing membranes should be used in accordance with MANUFACTURER's recommendations. The flame from a hand-held torch should be constantly moved from side to side. If a mobile heating apparatus is used, it should be kept in constant motion while operating. To prevent smoldering or ignition of membranes, they should not be overheated.
 - 2. Caution should be used when working around roof openings, penetrations or flashings. Wood nailers, cant strips and metal flashing should not come in direct contact with the flame of the torch. Small torches should be used to heat the underside of the membrane away from these areas before securement. The torch should not be used in areas where the flame impingement cannot be fully viewed. Open flames should not be left unattended. Roof openings/vents should be covered with a stable noncombustible cover to prevent ignition of building components or contents.
 - a. Extreme caution should be used near penetrations such as exhaust vents to prevent ignition of accumulated flammable discharges. Such accumulations should be cleaned/removed before roofing work begins.
 - b. Air conditioning units and ventilating fans should be shut down before torch work is done in surrounding areas.

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- c. Expansion joints should be filled with mineral wool or ceramic fiber with a steel cover plate below.
 - 3. A torch stand should be used to direct the flame upward when momentarily not in use. The cylinder valve should be closed to burn off propane in the line before shutting off the torch head. The gas supply should be shut off whenever a propane odor is detected.
 - 4. Installations should be coordinated with concerned parties, and close supervision should be provided.
 - 5. Torches should not be used near gas lines, electrical wires or flammable liquids during roof construction.
 - 6. The torch flame should not be applied to a combustible substrate when installing the membrane. When foam plastic, kraft faced glass fiber, wood fiber insulation or cant strips, or plastic fastener plates are to be used, they should be covered with a minimum 40 lb. Organic felt base sheet or a glass fiber base sheet before the torch applied membrane is installed. Torch flames should not come in contact with exposed plastic roofing cement.
 - 7. The operator of the torch shall remain on the premises to perform fire watch for a minimum of one (1) hour after the torch is utilized. All roof areas worked on should be checked for "hot spots" and signs of smoldering. The inside of the building should also be inspected for signs of fire or smoke. All "hot spots" or fires, even if extinguished, shall be reported to the OWNER and Fire Department.
- D. Equipment Safeguards
- 1. Proper equipment should be used to heat roofing membranes. Torches should be equipped with a pilot adjustment, flame height adjustment, 25 to 50 feet approved or listed hose, pressure gauge and regulator. A spark ignitor should be used. Torch trolleys and multiple torch head machines should be equipped with listed safety valves.
 - a. Safety caps should be tied to all propane cylinders and installed on the valve whenever cylinders are not in use. Carts used to transport cylinders should be stable. Tall, narrow, standing cylinders should be chained against walls or in proper carts.
 - 2. The propane cylinder should be adequately sized for the torch used. If frost buildup occurs on propane cylinders and the rate of vapor withdrawal is no longer adequate for operating conditions, the cylinder should not be placed on its side or heated with the torch flame. The hose should be disconnected and a larger cylinder used. Liquid propane cylinders may be of either the vapor withdrawal or liquid withdrawal type.
 - a. Liquid withdrawal cylinders are preferred due to frost buildup associated with vapor withdrawal cylinders. However, when vapor withdrawal cylinders are used, or if temperatures are below 20 degrees F, 40 or 100 lb. cylinders should be used with larger torches (such as those used on the field of the roof).
 - 3. Equipment should be thoroughly inspected and repaired as needed. Propane cylinders should be inspected for dents. If dents larger than 1" in diameter are found, the cylinder should be replaced. Torch and cylinder connectors should be visually inspected and checked for leaks with a soap and water solution. An open flame should not be used to test for leaks.

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- a. Leaky equipment should not be used. Regulator adjustments and pressure gauges should be checked to assure they are operable. The vent on the regulator should be checked to ensure it is not blocked. If an unstable flame occurs (one which roars loudly and tends to blow itself out), the equipment should be repaired or replaced immediately.
 4. A Fire watch of all equipment utilized for the torching application should be conducted for at least one (1) hour after torch work has been completed.
- E. Fire Extinguishing Equipment
1. The CONTRACTOR shall provide, on the roof, at least one (1) portable fire extinguisher with a minimum 4-A rating, two (2) portable fire extinguishers with a minimum 2-A rating each, or a water hose connected to a water supply at the building where the torching is being done. In addition, there should be at least one 10-lb. multipurpose dry chemical portable extinguisher within 20 feet horizontal travel distance of torch-applied roofing equipment.
- F. Fuel Handling Safeguards
1. Fuel containers, burners and related appurtenances of roofing equipment in which liquefied petroleum gas is used for heating should comply with Factory Mutual Data Sheet 7-50; "Compressed Gases in Cylinders" and NFPA 58; "Standard for the Storage and Handling of Liquefied Petroleum Gases".
 - a. All fuel containers should be located at least 10 feet from the burner flame or at least 2 feet away when properly insulated from heat of flame.
 - b. Storage of LPG cylinders or containers on rooftops is prohibited. All LPG cylinders or containers shall be removed from the rooftop and placed in a secure area, protected against tampering, at the end of each work shift.
 - c. Propane cylinders should not be hoisted by their valves. Straps placed around the cylinders should be utilized.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design Manufacturer: All products provided under this Section shall be manufactured, supplied or approved in writing as acceptable to the specified roofing MANUFACTURER, included in the MANUFACTURER's total roof system warranty/guarantee and specifically listed in the FM Approval Guide as part of an approved assembly. Provide the following:
1. Siplast, 1000 Rochelle Blvd, Irving Texas 75062

2.02 BASE SHEET

- A. Base Sheet: Asphalt coated fiberglass base sheet meeting or exceeding the requirements of ASTM D 4601, Type II and classified as a UL rated G2 Base Sheet. Retain 1 of 4 subparagraphs below

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1. "Parabase FS" by Siplast, Inc.

2.03 MODIFIED BITUMEN MEMBRANE

- A. Modified Bitumen Membrane Base Ply: Smooth-surfaced modified asphalt sheet, consisting of a reinforcing mat impregnated and coated with Styrene-Butadiene-Styrene (SBS) modified bitumen, with the back surface of the sheet coated with a modified asphalt adhesive layer, formulated for torch application.

1. "Paradiene 20 TG" Siplast, Inc.

- a. Properties:

- 1) Torch Grade, Modified Bitumen Base And Stripping Ply
- 2) Thickness (avg): 114 mils (2.9 mm) (ASTM D 5147)
- 3) Thickness (min): 110 mils (2.8 mm) (ASTM D 5147)
- 4) Weight (min per 100 ft² of coverage): 76 lb (3.7 kg/m²)
- 5) Maximum filler content in elastomeric blend: 35% by weight
- 6) Low temperature flexibility @ -15° F (-26° C) - PASS (ASTM D 5147)
- 7) Peak Load (avg) @ 73°F (23°C): 30 lbf/inch (5.3 kN/m) (ASTM D 5147)
- 8) Peak Load (avg) @ 0°F (-18°C): 75 lbf/inch (13.2 kN/m) (ASTM D 5147)
- 9) Ultimate Elongation (avg.) @ 73°F (23°C): 50% (ASTM D 5147)
- 10) Dimensional Stability (max): 0.1% (ASTM D 5147)
- 11) Compound Stability (min): 250°F (121°C) (ASTM D 5147)
- 12) Approvals: UL Class listed, FM Approved (products shall bear seals of approval)
- 13) Reinforcement: Fiberglass mat or other meeting the performance and dimensional stability criteria

- B. Modified Bitumen Membrane Cap Ply: Fire-rated, reflective ceramic granule-surfaced modified asphalt sheet, consisting of a reinforced mat impregnated and coated with Styrene-Butadiene-Styrene (SBS) modified bitumen, with back surface of the sheet coated with a modified asphalt adhesive layer, formulated for torch applications.

1. "Paradiene 30 FR TG" Siplast, Inc.

- a. Properties:

- 1) Thickness (avg): 138 mils (3.5 mm) (ASTM D 5147)
- 2) Thickness at selvage (coating thickness) (avg): 118 mils (3.0 mm) (ASTM D 5147)
- 3) Thickness at selvage (coating thickness) (min): 114 mils (2.9 mm) (ASTM D 5147)
- 4) Weight (min per 100 ft² of coverage): 112 lb (5.4 kg/m²)
- 5) Maximum filler content in elastomeric blend: 35% by weight
- 6) Low temperature flexibility @ -15° F (-26° C): PASS (ASTM D 5147)
- 7) Peak Load (avg) @ 73°F (23°C): 30 lbf/inch (5.3 kN/m) (ASTM D 5147)
- 8) Peak Load (avg) @ 0°F (-18°C): 75 lbf/inch (13.2 kN/m) (ASTM D 5147)
- 9) Ultimate Elongation (avg.) @ 73°F (23°C): 55% (ASTM D 5147)

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- 10) Dimensional Stability (max): 0.1% (ASTM D 5147)
- 11) Compound Stability (min): 250°F (121° C) (ASTM D 5147)
- 12) Solar Reflectance: 0.73% (ASTM D 1549)
- 13) Thermal Emittance: 0.91% (ASTM D 1371)
- 14) Solar Reflectance Index (avg): 90 (ASTM E 1980)
- 15) Approvals: UL Class listed (product shall bear seals of approval)
- 16) Reinforcement: Fiberglass mat or other meeting the performance and dimensional stability criteria
- 17) Surfacing: white ceramic granule

2.04 FLASHING MEMBRANE

- A. Modified Bitumen Flashing Base Ply: Smooth-surfaced modified asphalt sheet, consisting of a reinforcing mat impregnated and coated with Styrene-Butadiene-Styrene (SBS) modified bitumen, with the back surface of the sheet coated with a modified asphalt adhesive layer, formulated for torch application.

1. "Paradiene 20 TG" Siplast, Inc.

a. Properties:

- 1) Torch Grade, Modified Bitumen Base And Stripping Ply
- 2) Thickness (avg): 114 mils (2.9 mm) (ASTM D 5147)
- 3) Thickness (min): 110 mils (2.8 mm) (ASTM D 5147)
- 4) Weight (min per 100 ft² of coverage): 76 lb (3.7 kg/m²)
- 5) Maximum filler content in elastomeric blend: 35% by weight
- 6) Low temperature flexibility @ -15° F (-26° C) - PASS (ASTM D 5147)
- 7) Peak Load (avg) @ 73°F (23°C): 30 lbf/inch (5.3 kN/m) (ASTM D 5147)
- 8) Peak Load (avg) @ 0°F (-18°C): 75 lbf/inch (13.2 kN/m) (ASTM D 5147)
- 9) Ultimate Elongation (avg.) @ 73°F (23°C): 50% (ASTM D 5147)
- 10) Dimensional Stability (max): 0.1% (ASTM D 5147)
- 11) Compound Stability (min): 250°F (121°C) (ASTM D 5147)
- 12) Approvals: UL Class listed, FM Approved (products shall bear seals of approval)
- 13) Reinforcement: Fiberglass mat or other meeting the performance and dimensional stability criteria

- B. Modified Bitumen Flashing Cap Ply: Foil-laminate-surface modified asphalt sheet, consisting of a reinforcing mat impregnated and coated with Styrene-Butadiene-Styrene (SBS) modified bitumen, with back surface of the sheet coated with a modified asphalt adhesive layer, formulated for torch application. A low softening point asphalt shall be incorporated into the membrane between channel-embossed metal-foil surfacing and the SBS modified bitumen membrane, at the channels, in order to preclude foil delamination during daily thermal cycling.

1. "Veral Aluminum: by Siplast, Inc.

a. Properties:

- 1) Thickness (avg): 150 mils (3.8 mm) (ASTM D 5147)
- 2) Thickness (min): 146 mils (3.7 mm) (ASTM D 5147)

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- 3) Weight (min per 100 ft² of coverage): 96 lb (4.6 kg/m²)
- 4) Coating Thickness – back surface (min): 40 mils (1 mm) (ASTM D 5147)
- 5) Maximum filler content in elastomeric blend: 35% by weight
- 6) Low temperature flexibility @ 0° F (-18° C): PASS (ASTM D 5147)
- 7) Peak Load (avg) @ 73°F (23°C): 85 lbf/inch (15 kN/m) (ASTM D 5147)
- 8) Peak Load (avg) @ 0°F (-18°C): 180 lbf/inch (31.7 kN/m) (ASTM D 5147)
- 9) Ultimate Elongation @ 73°F (23°C): 45% (ASTM D 5147)
- 10) Tear-Strength (avg): 120 lbf (0.54 kN) (ASTM D 5147)
- 11) Dimensional Stability (max): 0.2% (ASTM D 5147)
- 12) Compound Stability (min): 225°F (107°C) (ASTM D 5147)
- 13) Cyclic Thermal Shock Stability (maximum): 0.2% (ASTM D 6298)
- 14) Approvals: UL Approved, FM Approved (products shall bear seals of approval)
- 15) Reinforcement: Fiberglass scrim mat or other meeting the performance and dimensional stability criteria
- 16) Surfacing: aluminum metal foil

2.05 AUXILIARY MATERIALS

- A. General: Furnish Auxiliary materials recommended by roofing system MANUFACTURER for intended use and compatible with SBS-modified bitumen roofing
- B. Reinforced, liquid-applied flashing system: Provide PMMA based resin, catalyst and reinforcing fleece, including all MANUFACTURER required/recommended surface cleaners, primers, etc., for complete five-course (resin/fleece/resin/resin/granules) flashing system approved by the roof system MANUFACTURER.
 1. “Parapro 123 Flashing System” by Siplast, Inc. or FM Global Approved equal from Johns Manville or Soprema.
- C. Base Sheet fastener (lightweight concrete substrate): A single unit, precision formed, electro zinc coated steel fastener, having a 1.2” diameter rib reinforced cap and 1” long (nominal) split-wedge leg, used in combination with a 2-3/4” diameter galvalume stress distribution plate.
 1. “NVS Base Sheet Fastener with Disc” by Siplast, Inc. or FM Global Approved equal from Johns Manville or Soprema.
- D. Flashing Fastener: A carbon steel fastener with electro galvanized yellow chrome coating, with 1-1/4” long, .106” diameter barbed shank, diamond point and 1”x 1” galvanized square metal cap. Subject to compliance with requirements, provide one of the following or approved equal.
 1. “Square Head Metal Cap” by Simplex Nails & Fasteners, Inc.
 2. “Square Cap” by W.H. Maze Co.

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- E. Asphalt primer: A high flash point, quick drying asphalt solvent blend which meets or exceeds requirements of ASTM D 41.
 - 1. "PA-917LS Asphalt Primer" by Siplast, Inc. or FM Global Approved equal from Johns Manville or Soprema.
- F. Asphalt Roofing Cement: Consisting of an asphalt base, volatile petroleum solvents, and mineral and/or other stabilizers, excluding asbestos, mixed to a smooth, uniform consistency suitable for trowel application at expected storage and application temperatures, which meets or exceeds the requirements of ASTM D 4586.
 - 1. "PA-1021 Plastic Cement" by Siplast, Inc. or FM Global Approved equal from Johns Manville or Soprema.
- G. Reinforced, liquid-applied flashing system: Provide PMMA based resin, catalyst and reinforcing fleece, including all manufacturer required/recommended surface cleaners, primers, etc., for complete five-course (resin/fleece/resin/resin/granules) flashing system approved by the roof system MANUFACTURER.
 - 1. "Parapro 123 Flashing System" by Siplast, Inc. or FM Global Approved equal from Johns Manville or Soprema.
- H. Cants: Cant strips factory fabricated, cut from rigid perlite insulation board complying with ASTM C 728 at angles that provide a true 45 degree angle between horizontal and vertical surfaces. Sloped face of cant to be 5" wide, resulting in approx. 3.5" vertical distance between installed top and bottom. Subject to compliance with requirements, provide one of the following or approved equal:
 - 1. "GAFTEMO Cant Strip (#5)" by GAF Materials Corp.
 - 2. "FesCant Plus Cant Strip" by Johns Manville
- I. Roofing Granules: Ceramic-coated roofing granules, No. 11 screen size with 100 percent passing No. 8 sieve and 98% of mass retained on No. 40 sieve.
 - 1. Color: To match MBM cap ply granules.
- J. Metallic Powder: A finely graded metal dust as supplied or approved by the roof membrane MANUFACTURER for use to cover bitumen adhesive overruns at foil-faced flashing membrane.
- K. Membrane Edge Sealant: Provide sealant approved by roof system MANUFACTURER. A single component, high performance, elastomeric sealant. Provide one of the following or approved equal:
 - 1. "Tremseal" by TREMCO, Inc.
 - 2. "Sonolastic NP 1" by Sonneborn Building Products.
- L. Walkpads: Polyester reinforced modified bituminous sheet, with a ceramic granular surface texture, approximately 200 mils thick, manufactured specifically for adhering to modified bituminous membrane roofing as a protection course for foot traffic.
 - 1. "Paratread" by Siplast, Inc. or FM Global Approved equal from Johns Manville or Soprema.
 - a. Properties:

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- 1) Thickness: 0.217 in (5.5 mm)
- 2) Weight: 1.8 lb/ft² (8.8 kg/m²)
- 3) Width: 30 in (76.2 cm)

- M. Walkpad Adhesive: Cold process adhesive, designed for use with walkpad material for adhesion to roof membrane cap ply, meeting or exceeding requirements of ASTM D 4478, Type II for asphalt roof coatings/adhesives. Subject to compliance with requirements, provide one of the following or approved equal:
1. "PA-311 Adhesive" by Siplast, Inc. or FM Global Approved equal from Johns Manville or Soprema.

2.06 ROOF INSULATION

- A. "Section 03520; Lightweight Concrete Roof Insulation: contains requirements for lightweight concrete insulation that will be the substrate for the modified bitumen roof membrane system.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, under which roofing will be applied for compliance with requirements.
- B. Verify that the surface of the lightweight concrete roof insulation is acceptable for application of finished roof system.
- C. Do not proceed with installation until after minimum concrete curing period recommended by roofing system MANUFACTURER.
1. Perform base sheet fastener pullout tests to confirm that concrete has cured sufficiently to resist minimum fastener pullout load of 50 pounds. Provide written pullout test results and written acceptance of lightweight concrete by the roof system MANUFACTURER.
- D. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean substrate of concrete scale, dust, debris, and other substances detrimental to roofing installation. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

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- C. Ensure that no less than three (3) functional fire extinguishers are on the roof, accessible to workers at all times during roofing operations involving torch application. Provide all other precautions and equipment necessary for safe installation of the torch applied roof membrane and flashing plies.

3.03 GENERAL INSTALLATION REQUIREMENTS

- A. Install modified bituminous membrane roofing system according to roofing system MANUFACTURER's written instructions or as otherwise specified or indicated by the contract documents, whichever is more stringent in the opinion of the OWNER.
- B. The overall aesthetic appearance of the finished roof application is a standard requirement for this project. Make all necessary preparations, utilize recommended application techniques, apply the specified materials (i.e. granules, metallic powder etc.) and exercise care in ensuring that the finished product is acceptable to the OWNER.
- C. Cooperate with inspecting and testing agencies engaged or required to perform services for installing modified bituminous membrane roofing system.
- D. Coordinate installation of roofing system components to prevent moisture from entering under installed portions of new roofing.
 - 1. Provide cutoffs at end of each day's work to cover exposed edges of installed membrane assembly with a course of torch applied modified bitumen base ply to seal between top of finished base ply and exposed lightweight concrete insulation.
 - 2. Complete terminations, base flashings and counter flashings associated with each day's work, or provide temporary weatherproof protection, to prevent water from entering completed sections of roofing system. Do not use temporary sealing methods that will permanently seal the base sheet to the substrate and/or prevent moisture vapor migration/ventilation.
 - 3. Remove and discard temporary seals before beginning work on adjoining roof. Do not leave any materials in place that have the potential to seal the base sheet to the lightweight concrete and/or prevent moisture vapor migration/ventilation.

3.04 BASE SHEET INSTALLATION

- A. Lay the base sheet over the entire area to be roofed, free of wrinkles, lapping side and end laps four (4) inches. Extend base sheet up full height of vertical curbs, walls etc. to ensure continuous, unobstructed ventilation space between base sheet and horizontal and vertical substrate.
- B. Base Sheet Fastening: Fasten base sheet to substrate as specified below, in accordance with Factory Mutual (FM) approvals. Fastener spacing shall not be less than 4-inches o.c. in lightweight concrete insulation.

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1. Field Fastening: fasten base sheet to lightweight concrete substrate with base sheet fasteners and stress plates at 7½-inches o.c. through the side laps and 10-inches o.c. in two (2) equally spaced and staggered rows in the field of the sheets. (Meets FM 1-90)
 2. Perimeter Fastening: In 5'-0" wide continuous perimeter of the roof, fasten base sheet to lightweight concrete substrate with base sheet fasteners and stress plates at 7-inches o.c. through the side laps and 10-inches o.c. in three (3) equally spaced and staggered rows in the field of the sheets (Meets FM1-150)
 3. Corner Fastening: In 5'-0" x 5'-0" corners of the roof, fasten base sheet to lightweight concrete substrate with base sheet fasteners and stress plates at 7-inches o.c. through the side laps and 10-inches o.c. in three (3) equally spaced and staggered rows in the field of the sheets. (Meets FM 1-195)
 4. Fasten base sheet to vertical wood sheathing, curbs, blocking and nailers with cap nails at 12-inches o.c. (max.) horizontal and 8-inches o.c. (max.) vertical, from the top of the cant to the top of the wall, curb, etc.
- C. Coat the top of all metal fastening plates with asphalt primer and allow to dry before installing new modified bitumen base ply membrane.

3.05 CANT STRIP INSTALLATION

- A. Install and secure preformed 45-degree cant strips at junctures of modified bituminous membrane roofing system with vertical surfaces or angle changes greater than 45 degrees.
1. Set cant strips on top of mechanically attached base sheet. Adhere cant strips to base sheet in full continuous bed of roof cement. Ensure that base sheet is continuous below cant strip and that roof cement adhesive will not block or restrict the venting air space between the base sheet and substrate below.

3.06 MEMBRANE BASE PLY INSTALLATION

- A. Application of modified bitumen membrane base ply shall immediately follow installation of the mechanically attached base sheet and cant strips.
- B. Starting at the low point of the roof, install base ply sheets perpendicular to the slope of the substrate.
1. Torch apply sheets to the mechanically attached base sheet.
 - a. Fully bond base play membrane on horizontal roof surface only. Extend base ply membrane to top of cant, but leave dry (non-adhered) from bottom of cant to top of cant.
 2. Apply sheets free of wrinkles, creases or fishmouths.
 3. Exert sufficient pressure on the roll during application to ensure prevention of air pockets.

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4. Accurately align sheets, without stretching, and maintain uniform 3" (min.) side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.
 - a. Repair tears and voids in laps and lapped seams not completely sealed.
- C. Flashing Base Ply: Torch apply modified bitumen flashing base ply in sections equal to the roll width (approx. 36-inches wide), continuous from top of wall, curb, etc. and extending 4-inches onto roof past bottom of cant. Maintain plumb and uniform 3-inches laps staggered from laps of roof membrane base ply.
 1. Fully adhere to mechanically attached base sheet above top of cant.
 2. Fully adhere to modified bitumen membrane base ply on cant and roof.
 3. Nail top of flashing as required to prevent moisture from entering the roof system through the open top of the flashing assembly (between base sheet and substrate) prior to completion of all flashing, counter flashing, coping, etc.
 - a. Do not seal between the mechanically attached base sheet and the vertical substrate or prevent or restrict the ventilation/migration of moisture vapor.

3.07 MEMBRANE CAP PLY INSTALLATION

- A. Prior to installation of modified bitumen membrane cap ply, ensure that entire surface of modified bitumen base ply membrane is clean and acceptable to the MANUFACTURER for cap ply installation.
 1. Repair all defects in modified bitumen membrane base ply before proceeding with cap ply installation.
- B. Starting at the low point of the roof, install cap ply sheets perpendicular to the slope of the substrate.
 1. Torch apply sheets to the modified bitumen membrane base ply.
 - a. Extend cap ply membrane to top of cant and fully bond to roof and cant.
 2. Apply sheets free of wrinkles, creases or fishmouths.
 3. Exert sufficient pressure on the roll during application to ensure prevention of air pockets.
 4. Accurately align sheets, without stretching, and maintain uniform 3" (min.) side and end laps. Stagger end laps of adjacent sheets and stagger all laps from laps of modified bitumen base ply below.
 - a. Torch-prime, or apply asphalt primer, to top of previously installed granular surfaced sheet at end laps and laps at any nonselvedge edges.
 - b. Completely bond and seal laps, leaving no voids.
 - c. Repair tears and voids in laps and lapped seams not completely sealed.
- C. Flashing Cap Ply: Torch apply modified bitumen flashing cap ply in sections equal to the roll width (approx. 36-inches wide), continuous from the top of wall, curb, etc. and extending 6" into roof past bottom of cant. Maintain plumb and uniform 3-inch laps, staggered from laps of flashing base ply and roof membrane cap ply.

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1. Torch-prime or apply asphalt primer to granular surface of modified bitumen membrane cap ply on cant and on roof in area to receive flashing. Apply asphalt primer to surface of foil at any non-selvedge flashing membrane laps.
 - a. Allow primer to dry thoroughly before installing flashing.
2. Fully adhere to flashing base ply above top of cant.
3. Fully adhere to primed modified bitumen membrane cap ply on cant and roof.
4. Fasten top of flashing at 8-inches (min.) o.c.
 - a. Fasten to wood substrates (blocking, nailers, etc.) with cap nails.
 - b. Fasten to metal substrates with corrosion resistant self-tapping screws and minimum 2-inch diameter fastening plates or continuous 1-inch wide metal termination bar.
 - c. Fasten to concrete substrates with corrosion resistant expansion anchors with 1-inch wide metal termination bar.
5. Provide weather protection as required to prevent moisture from entering the roof system through the open top of the flashing assembly (between the base sheet and substrate) prior to completion of all flashing, counter flashing, coping etc.

3.08 MISCELLANEOUS FLASHING AND STRIPPING

A. Metal Edge Flashing:

1. Install modified bitumen membrane base ply stripping, fully torch-adhered, from 1-inch below top of sloped metal cant and extending 4-inches onto roof past edge of cant dam flange.
2. Install fully adhered, torch applied, modified bitumen membrane cap ply to top of cant dam.
 - a. Where roof edge is parallel to field sheet direction, eliminate last parallel sheet and install cap membrane in 3'-0" wide pieces, perpendicular to the roof edge. All pieces shall be cut to equal lengths, lapping over last parallel field sheet by 4-inches and terminating in a straight line.
3. Install fully adhered modified bitumen flashing cap ply from 4-inches on roof, up cant and turned down outside face of cant to bottom of wood blocking.

B. Lead Pipe Flashing:

1. Completely prime both sides of the lead flashing flange and allow to dry thoroughly.
2. Set flashing flange in full bed of mastic on top of modified bitumen base ply membrane.
3. Strip-in the flange using torch applied modified bitumen base ply material, extending from the flange-sleeve juncture of the pipe flashing to a minimum of 4-inches beyond all edges of the flange on the roof.
4. Apply the modified bitumen cap ply membrane, terminating at the flange-sleeve juncture of the pipe flashing
5. Install a smooth, continuous bead of elastomeric sealant between the lead sleeve flashing and the edge of the modified bitumen membrane cap ply.

C. Lead drain Flashing:

1. Completely prime both sides of the lead flashing and allow to dry thoroughly.

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2. Set flashing in full bed of mastic on top of modified bitumen membrane base ply and form to turn down into drain bowl.
3. Cover lead flashing with torch applied modified bitumen base ply material, extending from inside the clamping ring seal to a minimum of 4-inches beyond all edges of the flashing onto the roof.
4. Apply the modified bitumen cap ply membrane, terminating inside clamping ring seal and install the clamping ring with all bolts and dome.

3.09 WALKPAD INSTALLATION

- A. Install continuous lines of walkpads, leaving 2-inches drainage spaces between each walkpad, at locations indicated on the roof plan and all other locations required by membrane MANUFACTURER.
- B. Cut walkpads from 30-inches wide roll into 30-inches lengths and allow to relax until pads lay flat.
- C. Apply asphalt primer to granular surface of modified bitumen membrane in areas to receive walkpads, if required by MANUFACTURER, and fully adhere to roof surface with cement/adhesive in accordance with MANUFACTURER's instructions.

3.10 FIELD QUALITY CONTROL

- A. Final Roof Inspection: Arrange for roofing system MANUFACTURER's technical personnel to inspect roofing installation periodically during the project and on completion to prepare a final punchlist.
 1. Notify Architect and OWNER 48 hours in advance of the date and time of final inspection.
 2. Submit written copy of the final punchlist to the OWNER and Architect.

3.11 PROTECTING AND CLEANING

- A. Protect modified bitumen membrane roofing from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and OWNER.
- B. Correct deficiencies in or remove modified bitumen roofing that does not comply with requirements, repair substrates, reinstall roofing, and repair base flashings to a condition free of damage and deterioration at time for Substantial Completion and according to warranty requirements.

END OF SECTION 07552

SECTION 07600

SHEET METAL FLASHING AND TRIM

PART 1 – GENERAL

1.01 FLASHING AND SHEET METAL FLASHING

- A. CONTRACTOR shall provide all labor, equipment, and materials to fabricate and install the following.
1. Edge strip and flashing.
 2. Fascia, scuppers, and trim.
 3. Counter flashings over bituminous base flashing.
 4. Counter flashings for roof accessories.
 5. Counter flashings at roof mounted equipment and vent stacks.
 6. Base flashing coverings.
 7. Coping cap at parapets
 8. Expansion joint area divider, and curb covers.
 9. Panelized wall covering systems
 10. Fascia and edge metal.
 11. Counter flashings at walls and penetrations.
 12. Lead flashing for bituminous membranes.
 13. Other components.

1.02 RELATED SECTIONS

- A. Drawing and general provisions of the Contract, including JEA General Conditions and Division 1 Specification Sections, apply to this Section.
- B. RELATED SECTIONS
1. Section 06100 – Rough Carpentry
 2. Section 07552 – SBS Modified Bituminous Membrane Roofing
 3. Section 07900 - Joint Sealants

1.03 REFERENCES

ASTM A-446	Specification for steel sheet	ASTM B-209	Specification for aluminum sheet
ASTM B-221	Specification for aluminum extruded shape	FS QQ-L-201	Specification for Lead Sheet
ASTM A792	Steel Sheet, Aluminum-Zinc Alloy-Coated, by the Hot-Dip Process		
ASTM B32	Solder Metal		
ASTM B209	Aluminum and Alloy Sheet and Plate	ASTM B486	Paste Solder
ASTM D226	Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing		
ASTM D486	Asphalt Roof Cement, Asbestos-free		
FS O-F-506	Flux, Soldering, Paste and Liquid		
WH	Warnock Hersey International, Inc. Middleton, WI.		
FM	Loss Prevention Data Sheet		
NRCA	National Roofing Contractors Association - Roofing Manual		
SMACNA	Architectural Sheet Metal Manual		

1.04 SUBMITTALS

SECTION 07600

SHEET METAL FLASHING AND TRIM

- A. Provide all submittals in accordance with Section 01300.
- B. Shop Drawings
 - 1. For manufactured and shop fabricated gravel stops, fascia, scuppers, and all other sheet metal fabrications.
 - 2. Shop drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashing, terminations, and installation details.
 - 3. Indicate type, gauge and finish of metal.
- C. Certification
 - 1. Metal fasteners must be certified as acceptable to the roof manufacturer.
 - 2. Metal furnished must be certified as acceptable to roofing manufacturer as a component of roofing system and eligible for roof manufacturer's system warranty.
 - 3. Metal and fastening system furnished must be tested and approved by Factory Mutual for 25-ft tall buildings and below use 1-105 field, 1-150 10-ft perimeter, and 1-210 10-ft by 10-ft in corners) Buildings above 25-ft request RoofNav number and get Factory Mutual's recommendation. Wind Up-Lift Requirements.
- D. Manufacturer's Product Data
 - 1. Metal material characteristics and installation
 - 2. Colors specified must be available

1.05 DESIGN

- A. Sheet metal flashing and fasteners shall be designed and installed according to ANSI/SPRI ES- 1. "Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems" as required by Florida Building Code. Details should also comply with Roof Application Standard (RAS)-No. 111 "Standard Requirements for Attachment of Perimeter Woodblocking and Metal Flashing".

1.06 QUALITY CONTROL

- A. Reference Standards
 - 1. Materials must comply with details and recommendations of SMACNA Manual for workmanship, methods of joining, anchorage, provisions for expansion, etc.
 - 2. Materials must meet Factory Mutual Loss Prevention Data Sheet 1-49 windstorm resistance 1-105, 1-150, 1-210.
- B. Manufacturer's Warranty
 - 1. Pre-finished metal material shall require a written 20-year non-prorated warranty covering fade, chalking and film integrity.
 - 2. The material shall not show a color change greater than 5 NBS color units per ASTM D-2244 or chalking excess of 8 units per ASTM D-659. If either occurs material shall be replaced per warranty, at no cost to JEA.

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SHEET METAL FLASHING AND TRIM

C. CONTRACTOR'S Warranty

1. The CONTRACTOR shall provide JEA with a notarized written warranty assuring that all sheet metal work including caulking and fasteners to be watertight and secure for a period of five years from the date of final acceptance of the building.
2. Warranty shall include all materials and workmanship required to repair any leaks that develop and make good any damage to other work or equipment caused by such leaks or the repairs thereof.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Sheet metal flashing system is to be comprised of minimum 20 gage aluminum for general use buildings. CONTRACTOR shall use 20 gage. stainless steel for use on roofs and/or areas where the JEA Contract Administrator determines.
1. Aluminum, ASTM B209, alloy 3105-H14, in thickness of .036-inch nom. Finish 70% "Kynar 500" or "Hylar 5000" resin finish over epoxy primer: minimum system thickness 1.0 mil. Colors shall be selected by JEA.
 2. Stainless Steel:
 - a. Type 316L, ASTM 240-96, fully annealed
 - b. Type 302/304, ASTM A167, 24 gage, annealed except dead soft where fully concealed by other work, 2D (dull) finished.

2.02 RELATED MATERIALS

- A. Metal Primer:
1. For field applied paint: Zinc chromate type
 2. For asphalt-based roofing materials: Asphalt Primer meeting requirements of ASTM D41, Type II and Manufactured or approved by roof membrane manufacturer.
- B. Plastic Cement: ASTM D 4586
- C. Sealant: Specified in Section 07900 or on drawings.
- D. Lead Flashing:
1. Meets Federal Specifications QQ-L 201, Grade B.
 2. For roof drain Flashing: four pounds per square foot.
 3. For prefabricated plumbing vent pipe flashing: 2.5 pounds per square foot and sleeve diameter shall match plumbing vent pipe.
- E. Solder: ANSI/ASTM B32; 95/05 type.
- F. Flux: FS O-F-506.
- G. Underlayment:
1. ASTM D2178, No15 asphalt saturated roofing felt.
 2. ASTM D1970, self- adhered roofing underlayment for high temperature

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SHEET METAL FLASHING AND TRIM

applications (equivalent to Grace Ice & Water Shield HT with Per-A-Barrier WB Primer depending on substrate)

- H. Slip Sheet: Rosin sized building paper.
- I. Fasteners:
 - 1. Nails for concealed cleats fastened to wood blocking: Stainless steel ring shank
 - 2. Corrosion resistant screw fastener as recommended by metal manufacturer. Finish exposed fasteners same as flashing metal.
 - 3. Fastening shall conform to Factory Mutual 1-105, 1-50, 1-210 requirements or as stated on section details, whichever is more stringent.
- J. Termination Bars:
 - 1. Materials shall be .125-inch x 1-inch (minimum) aluminum conforming to ASTM B-221, mill finish. Bar shall have pre-drilled holes for fasteners and lip or caulk cup and installed with fasteners and Vulkem (grey) sealant as required.
- K. Gutter and Downspout Anchorage Devices: Type recommended by fabricator.
- L. Metal Wall Flashing: Type recommended by fabricator and approved by JEA Contract Administrator.
- M. Sealant: One-part polyurethane sealant complying with ASTM C920, Type S, Grande NS, Class 25 (equivalent to Vulkem 116 manufactured by Tremco). Section 07920.
- N. Backer rod for sealant: Backer rod shall be extruded round, closed cell, low density polyethylene foam material with a skin-like outer texture.
 - 1. Approved backer rods are:
 - a. "ITP Standard Backer Rod Insulation," Industrial Thermo Polymers Limited, Buffalo, NY.
 - b. "SOF Rod," Namaco, Inc., Zebulon, NC.
 - c. "Sonofoam Closed Cell Backer-Rod," ChemRex, Inc., Shakopee, MN.
- O. One-way vents for lightweight insulating concrete decks.
 - 1. One piece spun aluminum manufactured or approved by the primary roof system manufacturer.

PART 3 - EXECUTION

3.01 PROTECTION

- A. CONTRACTOR must protect contact areas of dissimilar metals with heavy asphalt or other approved coating, specifically made to stop electrolytic action.

3.02 GENERAL REQUIREMENTS

SECTION 07600

SHEET METAL FLASHING AND TRIM

- A. Install work watertight, without waves, warps, buckles, fastening stress, or distortion, allowing for expansion and contraction.
- B. Fastening of metal to walls and wood blocking shall comply with SMACNA Architectural Sheet Metal Manual, Factory Mutual 1-105, 1-150, 1-210 wind uplift specifications and/or manufacturer's recommendations whichever is of the highest standard.
- C. All accessories or other items essential to the completeness of sheet metal installation, whether specifically indicated or not, shall be provided and of the same material as item to which applied.
- D. Metal fascia and copings shall be secured to wood nailers at the bottom edge with a continuous cleat. Cleats shall be at least one gauge heavier than the metal it secures. Cleats shall be face nailed through the vertical leg into wood blocking or other substrate material. Fasteners shall be appropriate for substrate material.

3.03 INSPECTION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips and reglets are in place, and nailing strips located.
- B. Verify membrane termination and base flashings are in place, sealed, and secure.
- C. Beginning of installation means acceptance of existing conditions.
- D. Field measure site conditions prior to fabricating work.
- E. Verify wood blocking to receive sheet metal flashing is in good condition and properly secured to the structure. Replace deteriorated wood and add fasteners if necessary.

3.04 SHOP FABRICATED SHEET METAL

- A. Installing CONTRACTOR shall be responsible for determining if the sheet metal systems are in general conformance with roof manufacturer's recommendations and Factory Mutual requirements.
- B. Metal work shall be shop fabricated to configurations and forms in accordance with recognized sheet metal practices.
- C. Hem exposed edges.
- D. Angle bottom edges of exposed vertical surfaces to form drip.
- E. All corners for sheet metal shall be lapped with adjoining pieces fastened and set in sealant.

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SHEET METAL FLASHING AND TRIM

- F. Joints for gravel stop fascia system, cap flashing, and surface-mount counter flashing shall be formed with a 1/2-inch opening between sections. The opening shall be covered by a cover plate or backed by an internal drainage plate formed to the profile of fascia piece. The cover plate shall be embedded in mastic, fastened through the opening between the sections and loose locked to the drip edges.
- G. Install sheet metal to comply with SMACNA Architectural Sheet Metal Manual, (published by Sheet Metal and Air Conditioning CONTRACTOR's National Association Inc.)

3.05 SHEET METAL FLASHING INSTALLATION

- A. Detail references are based on standard details prepared by Johns Manville, if roof membrane systems from other manufactures are used, their standard details and installation methods should be used subject to the approval of JEA.
- B. METAL EDGE FASCIA DETAIL [Detail #DFE-4 (Presto-Tite)]
 - 1. See details for scuppers. For manufactured edge metal, scuppers shall be factory fabricated.
 - 2. Accessories: Joint covers, corners, supports, strip flashing at joining, fastenings and other accessories shall be included.
 - 3. Install continuous cleat fasten 6-inch O.C. Fasten flange to wood nailer every 6-inch staggered.
 - 4. Install new metal edge hooked to continuous cleat.
 - 5. Prime metal edge at a rate of 100 square feet per gallon and allow to dry.
- C. DRIP EDGE DETAIL [Detail #DFE-4 (GS)]
 - 1. Accessories: Joint covers, seam sealant, seam tape, fasteners, and other accessories shall be included.
 - 2. Install continuous cleat fasten 6-inch O.C. Fasten flange to hat channel 1 1/4-inch O.C. with seam tape between metal edge and roof membrane.
 - 3. Install new metal edge hooked to continuous cleat.
 - 4. Metal edge pieces shall be overlapped a minimum of 2-inch or butted at ends with internal drainage plate or sealed batten cover.
- D. RAISED METAL EDGE DETAIL [Detail #DFE-4 (Presto Lock)]
 - 1. See details for scuppers. For manufactured edge metal, scuppers shall be factory fabricated.
 - 2. Accessories: Joint covers, corners, supports, strip flashing at joining, fastenings and other accessories shall be included.
 - 3. Install continuous cleat fasten 6-inch O.C. Fasten flange to wood nailer every 6-inch staggered.
 - 4. Install new metal edge hooked to continuous cleat.
 - 5. Prime metal edge at a rate of 100 square feet per gallon and allow to dry.
- E. RAISED METAL EDGE DETAIL [Detail #DFE-4 (RMCF)]

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1. See details for scuppers. For manufactured edge metal, scuppers shall be factory fabricated.
2. Accessories: Joint covers, corners, supports, strip flashing at joining, fastenings and other accessories shall be included.
3. Install continuous cleat fasten 6-inch O.C.
4. Install new metal edge hooked to continuous cleat.
5. Attach metal edge with approved fasteners with neoprene washers 8-inch O.C.

F. ROOF EDGE WITH GUTTER [Detail #DFE-4 (GTR)]

1. Install gutter and strapping and all necessary support assemblies.
2. Accessories: Joint covers, corners, supports, strip flashing at joining, fastenings and other accessories shall be included.
3. Install continuous cleat fasten 6-inch O.C.
4. Install new metal edge hooked to continuous cleat.
5. Prime metal edge at a rate of 100 square feet per gallon and allow to dry.
6. If possible, install two downspouts per gutter section. Determine size of downspout based on drainage calculations. Secure downspouts to wall with brackets spaced not more than 5-feet on center.

G. SURFACE MOUNTED COUNTERFLASHING/COPING CAP [Detail #DFE-18]

1. Copings shall be provided with factory fabricated welded watertight coping accessories such as miters, transitions, end caps, etc. and finished to match coping system.
2. Accessories: Joint covers, corners, supports, strip flashing at joinings, fastening, and other accessories shall be included.
3. Install continuous cleat fasten 6-inch O.C.
4. Install new coping cap hooked to continuous cleat.

H. SURFACE MOUNTED COUNTERFLASHING

1. Counter flashing shall be provided with watertight accessories such as miters, transitions, end caps, etc. and finished to match counter flashing.
2. Accessories: Joint covers, corners, fasteners, strip flashing at joinings, fastening, and other accessories shall be included.
3. Apply butyl tape to wall behind flashing. Secure termination bar through flashing butyl tape and into wall.
4. Secure new counter flashing set on a butyl tape above flashing 8-inch O.C., caulk top of counter flashing.

I. REGLET MOUNTED COUNTERFLASHING

1. Reglet shall be provided with watertight accessories such as miters, transitions, end caps, etc. and finished to match.
2. Accessories: Joint covers, corners, fasteners, strip flashing at joinings, fastening, and other accessories shall be included.
3. Cut reglet in masonry one joint above flashing.
4. Apply butyl tape to wall behind flashing. Secure termination bar through flashing butyl tape and into wall.
5. Secure reglet counter flashing with expansion fasteners and caulk reglet

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opening.

J. EXPANSION JOINT

1. Expansion Joint shall be provided with watertight accessories such as miters, transitions, end caps, etc. and finished to match.
2. Accessories: Joint covers, corners, fasteners, strip flashing at joinings, fastening, and other accessories shall be included.
3. Install compressible insulation in neoprene cradle.
4. All joint cover laps will have butyl tape in between metal covers.

K. AREA DIVIDER

1. Covers shall be provided with watertight accessories such as miters, transitions, end caps, etc. and finished to match.
2. Accessories: Joint covers, corners, fasteners, strip flashing at joinings, fastening, and other accessories shall be included.
3. Install pre-manufactured expansion joint cover. Fasten sides 24-inch O.C. with fasteners and neoprene washers.
4. All joint cover laps will have butyl tape in between metal covers.

L. PLUMBING VENT STACK

1. Extend vent stack if necessary to provide a minimum flashing height of 12-inches or more if required by the plumbing code.
2. Prime both sides of flange at the rate of 100 square feet per gallon and allow to dry. Flange shall lap at least 4-inches over top ply or cap sheet of roofing membrane.
3. Remove granules from cap sheet to receive target. Target flashing shall extend 12-inches past the edge of the flange.
4. Install flashing properly sized sleeves in a 1/4-inch bed of plastic roofing cement. Turn sleeve a minimum of 1-inch down inside of stack.
5. Install cap sheet target over flange of lead flashing set in bed of plastic roofing cement. Dogear or round corners. Caulk edge of the cap sheet membrane target to the lead flashing with elastomeric sealant.

END OF SECTION 07600

SECTION 07625

SHEET METAL GUTTERS AND DOWNSPOUTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Description of scope and intent:
 - 1. CONTRACTOR shall provide all material, labor, and tools required to complete the installation of specified system.
 - 2. Any omission of reference to items required to complete the full operational and functional system specified in the section does not relieve the CONTRACTOR of the obligation to provide same.
 - 3. To provide installation of all items, including delivery, dispersing to the proper locations within the building, and affixing in place.
 - 4. Installation shall be accomplished by workers skilled in their craft who will perform their work in a professional manner and will leave the premises safe, orderly and clean.
 - 5. Drawings and general provisions of Contract, including JEA General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section
 - 6. CONTRACTOR is responsible for coordination of work included in this specification with all other specification sections related to furnishing of all materials, labor, permits, fees and services necessary for completion of work in this section.
 - 7. In the event of a conflict between the design drawings, referenced standards and these Specifications, the more stringent shall govern unless directed otherwise by the Architect. CONTRACTOR shall strictly adhere to OSHA requirements and local codes or those of any regulatory agency or body with jurisdiction
- B. Section Includes:
 - 1. Gutters, scuppers, collector heads and downspouts.
 - 2. Fasteners and attachment devices.
 - 3. Coatings and slip sheets to isolate sheet metal from dissimilar materials.
- C. NOTE: Required wood blocking, nailers, and edge strips are not specified in this section.

1.02 SUBMITTALS

- A. Provide all submittals in accordance with Section 01300.
- B. Product Data: Manufacturer's technical information and installation instructions, in sufficient detail to demonstrate products comply with contract documents.
- C. Shop Drawings: Detailed drawings clearly indicating component profiles, joints, transitions, fastening methods, and relationship of flashing materials to adjacent construction.
- D. Samples: Submit 6-inch-square samples of each type of metal and finish required.

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SHEET METAL GUTTERS AND DOWNSPOUTS

1.03 QUALITY ASSURANCE

- A. Installer: A company familiar with installing products included in this section and which has completed at least 20 installations similar in scope to work included in this section.
- B. Quality Standard:
 - 1. Fabricate and install sheet metal work in accordance with Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA) "Architectural Sheet Metal Manual," unless specifically indicated otherwise.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Prefinished Aluminum Sheet: ASTM B 209, manufacturer's standard alloy and temper for indicated applications.
 - 1. Minimum thickness: 20 B & S gage (0.0320 inch), except gutters with a girth over fifteen (15) inches shall be 18 B & S gage (.040 inch) minimum.
 - 2. Finish: 70 percent "Kynar 500" or "Hylar 5000" resin finish over epoxy primer; minimum system thickness 1.0 mil. Provide manufacturer's standard prime coat on underside.
 - a. Color: To be selected by Architect from manufacturer standard colors, basis of bid selection to match Berridge Roofing Color "Champagne".
 - 3. Provide strippable plastic protective film on prefinished surface.
 - 4. Manufacturers: Products of the following manufacturers, provided they comply with requirements of the contract documents, will be among those considered acceptable:
 - a. Atlas Aluminum Corporation.
 - b. Copper Sales, Inc.
 - c. MM Systems Corporation.
 - d. Petersen Aluminum Corporation.
 - e. Met-Tile Incorporated.
 - f. Manufacturer of roofing material.

2.02 ACCESSORY MATERIALS

- A. Fasteners: Corrosion-resistant metal of same material as the material being fastened or other material recommended by sheet metal manufacturer. Match finish and color of exposed fastener heads to finish and color of sheet material being fastened.
- B. Sealant: As specified in Division 7.
 - 1. Use noncuring type for concealed joints.
 - 2. Use nonsag elastomeric type for exposed joints.
- C. Joint Adhesive: Two-component noncorrosive epoxy adhesive, recommended by

SECTION 07625

SHEET METAL GUTTERS AND DOWNSPOUTS

metal manufacturer for sealing of nonmoving joints.

- D. Bituminous Coating: Heavy bodied, sulfur-free, asphalt-based paint; FS TT-C-494.
- E. Gutter metal hangers and brackets.
- F. Downspout metal hangers.

2.03 FABRICATION - GENERAL

- A. Form sheet metal to match profiles indicated, substantially free from oil-canning, fish-mouths, and other defects.
- B. Comply with SMACNA "Architectural Sheet Metal Manual" for applications indicated.
- C. Conceal fasteners and expansion provisions wherever possible.
 - 1. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.
- D. Form a 1/2-inch hem on underside of exposed edges.
- E. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.
 - 1. Gage: As recommended by SMACNA or metal manufacturer for application, but in no case less than gage of metal being secured or as otherwise noted.

2.04 GUTTERS AND DOWNSPOUTS

- A. Fabricate to cross-sections indicated and from prefinished aluminum sheet, in minimum 96-inch long sections. Mount gutter sections flat.
- B. Form sheet metal to profile dimensions indicated, free from distortions and defects detrimental to water-tight system.
 - 1. Seam and seal metal joints except for joints indicated by SMACNA to be welded.
 - 2. Provide reinforced emergency overflow openings in gutter face as indicated on the drawings.
- C. Provide built-in expansion joints in gutters at spacing and locations shown on drawings, but not to exceed 40 feet apart.
- D. Provide removable debris screens for gutters, fabricated from 1/4-inch mesh wire cloth of same material used for gutters or approved compatible material. Provide formed sheet metal frame on 4 sides of each screen unit. Length of screen units not to exceed ten (10) feet.
- E. Provide sheet metal baffles 6 inches high with legs 18 inches long at gutter corners below roof valleys.

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SHEET METAL GUTTERS AND DOWNSPOUTS

- F. Provide connection transitions of metal, matching downspout material to securely connect downspouts to 45-degree angle elbow at grade as shown on drawings.
- G. Gutter Supports: Hangers and brackets fabricated from metal matching gutters, of size recommended by SMACNA, but not less than twice the gage of the gutter thickness. Provide supports at maximum of 4 feet on center.
- H. Downspout Supports: Metal brackets fabricated from same metal as downspouts of thickness recommended by SMACNA, but not less than twice the downspout thickness, and as detailed on drawings. Provide one at top and one at bottom plus one at any intermediate point.
- I. Miter all gutter corner joints and downspout elbows.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions under which products of this section are to be installed and verify that work may properly commence. Do not proceed with the work until unsatisfactory conditions have been fully resolved.
 - 1. Verify that nailers, blocking, and other attachment provisions for sheet metal work are properly located and securely fastened to resist effects of wind and thermal stresses.

3.02 PREPARATION

- A. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

3.03 INSTALLATION

- A. General: Comply with sheet metal manufacturer's installation methods and recommendations in the SMACNA "Architectural Sheet Metal Manual."
- B. Sealed Joints: Form minimum 1-inch hooked joints and embed flange into sealant or adhesive. Form metal to completely conceal sealant or adhesive.
 - 1. Use joint adhesive for nonmoving joints specified not to be soldered.
 - 2. Moving joints: When ambient temperature is moderate (40-70 degrees F) at time of installation, set joined members for 50 percent movement either way. Adjust setting position of joined members proportionally for temperatures above 70 degrees F. Do not install sealant at temperatures below 40 degrees F. Refer to section on sealants elsewhere in Division 7 for handling and installation requirements for joint sealers.

3.04 CLEANING AND PROTECTION

- A. Remove protective film from prefinished sheet metal immediately after installation.
- B. Repair or replace work that is damaged or defaced, as directed by the architect.

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SHEET METAL GUTTERS AND DOWNSPOUTS

1. Refinish marred and abraded areas of prefinished sheet using finish manufacturer's recommended methods and materials. Replace units which, in the opinion of the architect, cannot satisfactorily be refinished in place.
- C. Protect sheet metal work as recommended by the installer so that completed work will be clean, secured, and without damage at substantial completion.

END OF SECTION 07625

SECTION 07900

JOINT SEALERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. The sealing of joints indicated on schedule at the end of this Section.
 - 2. The sealing of other joints indicated on drawings.
- B. Joints of a nature similar to that of joints indicated on the schedule shall be sealed with same sealer, whether indicated on drawings to be sealed or not.

1.02 DEFINITIONS

- A. Substrates:
 - 1. M-type substrates: Concrete, concrete masonry units, brick, mortar, natural stone. The term "masonry" means brick, stone, and concrete masonry work.
 - 2. G-type substrates: Glass and transparent plastic glazing sheets.
 - 3. A-type substrates: Metals, porcelain, glazed tile, and smooth plastics.
 - 4. O-type substrates: Wood, unglazed tile; substrates not included under other categories.

1.03 SUBMITTALS

- A. Provide all submittals in accordance with Section 01300.
- B. Product Data
- C. Samples for Color Selection: (Products exposed to view only.)
- D. Certified Product Test Reports
- E. Manufacturer's Certificates

1.04 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install sealers if any of the following conditions exist:
 - 1. Air or substrate temperature exceeds the range recommended by sealer manufacturers.
 - 2. Substrate is wet, damp, or covered with snow, ice, or frost.
- B. Dimensional Limitations: Do not install sealers if joint dimensions are less than or greater than that recommended by sealer manufacturer; notify the engineer and get sealer manufacturer's recommendations for alternative procedures.

1.05 WARRANTY

- A. Submit written warranty signed by contractor and installer guaranteeing to correct failures in sealer work that occur within 5 years after substantial completion, without

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reducing or otherwise limiting any other rights to correction which the owner may have under the contract documents. Failure is defined as failure to remain weather tight due to faulty materials or workmanship. Correction is limited to replacement of sealers.

PART 2 - PRODUCTS

2.01 MATERIALS - GENERAL

- A. General: Provide only products which are recommended and approved by their manufacturer for the specific use to which they are put and which comply with all requirements of the contract documents.
 - 1. Provide only materials which are compatible with each other and with joint substrates.
 - 2. Colors of exposed sealers: As selected by the engineer from manufacturer's standard colors.
- B. Manufacturers: Products of the manufacturers listed, provided they comply with requirements of the contract documents will be among those considered acceptable.
 - 1. Silicone sealants:
 - a. Dow Corning Corporation
 - b. Pecora Corporation
 - c. Tremco, Inc
 - d. GE Silicones
 - 2. Acrylic solvent-release sealants:
 - a. Pecora Corporation
 - b. Koch Protective Treatments, Inc.
 - c. Tremco, Inc.
 - 3. Acrylic-latex emulsion sealant:
 - a. Bostik Inc.
 - b. Pecora Corporation
 - c. Sonneborn Building Products Division/Chemrex, Inc.

2.02 ELASTOMERIC SEALANTS

- A. Elastomeric Sealants - General: Chemically curing elastomeric sealants of types indicated, complying with ASTM C 920, including specific Type, Grade, Class, and Uses indicated, as well as all other requirements specified.
 - 1. Where movement capability exceeding that measured by ASTM C 920 is specified, sealant shall withstand the total movement indicated while remaining in compliance with the other requirements specified, when tested in accord with ASTM C 719, with base joint width measured at the time of application.
 - 2. For M-type substrates: Comply with requirements for Use M.
 - 3. For G-type substrates: Comply with requirements for Use G.
 - 4. For A-type substrates: Comply with requirements for Use A.
 - 5. For O-type substrates: Comply with requirements for Use M (minimum) and Use O for the particular substrate.
- B. High Movement Silicone Sealant: One- or two-part non-acid-curing, Grade NS, Class

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25, Use NT, plus movement capability of more than 50 percent in both extension and compression.

- C. High Strength Silicone Sealant: One- part acid-curing or non-acid curing, Type S, Grade NS, Class 25, Use NT, with not over plus or minus 30 percent in movement capability.

2.03 SOLVENT-RELEASE-CURING SEALANTS

- A. Acrylic Sealant: Nonsag, one-part, solvent-release-curing; complying with ASTM C 920, Type S, Grade NS, use NT, with the following exceptions.
 - 1. Weight loss: 15 percent, maximum.
 - 2. Movement capability: 7 2 percent in both extension and compression, minimum.

2.04 LATEX SEALANTS

- A. Acrylic-latex emulsion sealant: One-part, non-sag, mildew-resistant, paintable; complying with ASTM C 834.

2.05 NONCURING SEALERS

- A. Butyl polyisobutylene sealant: Non-curing, nondrying, solvent-release; complying with 809.2, as described in AAMA 800.

2.06 SEALANT BACKERS

- A. Backers - General: Non-staining; recommended or approved by sealant manufacturer for specific use.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Do not begin joint sealer work until unsatisfactory conditions have been corrected.
- B. Masking Tape: Use masking tape to keep primers and sealers off of adjacent surfaces which would be damaged by contact or by cleanup. Remove tape as soon as practical.

3.02 INSTALLATION

- A. Comply with sealer manufacturers' installation instructions and recommendations, except where more restrictive requirements are specified.

3.03 SCHEDULE OF JOINT SEALERS

- A. Exterior Joints for Which No Other Sealer Is Indicated:
 - 1. Use one of the following sealants:

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JOINT SEALERS

- a. High movement silicone sealant.
 2. Backer: Backer rod.
 3. Joint shape: Concave joint configuration.
- B. Interior Joints for Which No Other Sealer Is Indicated:
1. Use one of the following sealants:
 - a. Acrylic-emulsion latex sealant.
 2. Backer: Backer rod.
 3. Joint shape: Concave joint configuration.
- C. Exterior Joints Well Protected from weather and not subject to movement:
1. Use one of the following sealants:
 - a. Acrylic sealant.
 2. Backer: Backer rod.
- D. Joints around pipes, ducts, and conduit penetrating exterior walls and roofs:
1. Use one of the following sealants:
 - a. Same as used for adjacent substrates.
- E. All exterior flashing:
1. Use one of the following sealants:
 - a. High strength silicone sealant.
- F. Butyl polyisobutylene sealant.
1. Use bond-breaker tape.
 2. Joint shape: Concave joint configuration.

END OF SECTION 07900

SECTION 08110

FRP DOORS AND ALUMINUM FRAMES

PART 1 - GENERAL

1.01 SUMMARY

- A. Fiberglass reinforced plastic (FRP) standard and custom doors.

1.02 RELATED DOCUMENTS

- A. Drawings and General Provisions of Contract, including JEA General Conditions and Division 1 Specification sections, apply to work in this section.
- B. Related Sections include:
 - 1. Door Hardware - Section 08710

1.03 REFERENCES

- A. ASTM D 523 - Standard Test Method for Specular Gloss.
- B. SDI-100 - Recommended Specifications for Steel Doors and Frames.

1.04 SUBMITTALS

- A. Provide all submittals in accordance with Section 01300.
- B. Product Data: Manufacturer's printed product data indicating characteristics of products specified in this Section. Include details of core, stile and rails, hardware mounting, trim for lites, etc.
- C. If required by the architect, furnish a corner sample of the doors showing core, joints, and fasteners, quality of workmanship, hardware reinforcements and accessory items.
- D. Shop Drawings:
 - 1. Plans: Indicate location of each door opening assembly in project.
 - 2. Elevations: Dimensioned elevation of each type door opening assembly in project; indicate sizes and locations of door hardware, and lights and louvers, if specified.
 - 3. Details: Installation details of each type installation condition in project; indicate installation details of glazing, if specified.
 - 4. Schedule: Indicate each door opening assembly in project; cross-reference to plans.
- E. Selection Samples: Manufacturer's standard color chips.
- F. Verification Samples: Two (2) samples to verify color match.

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FRP DOORS AND ALUMINUM FRAMES

- G. Manufacturer's Instructions: Printed installation instructions for door opening assemblies.
- H. Warranty Documents: Manufacturer's warranty documents, executed by manufacturer's representative, countersigned by CONTRACTOR.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Packing, Shipping, Handling and Unloading: Package door opening assemblies in manufacturer's standard containers or protective wrap.
- B. Store door assemblies in manufacturer's standard containers, on end, to prevent damage to face corners and edges.

1.06 WARRANTY

- A. Manufacturer's Warranty: Warrant doors against failure due to defective materials or workmanship for a period of ten (10) years from date of substantial completion of project. Warranty to be written on manufacturer's letterhead and shall provide for the replacement of doors if they should fail within the warranty period. Warranty shall not cover damage due to vandalism, faulty installation or lack of maintenance.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. Basis of design is Special Lite Fiberglass Reinforced Polyester Door System (FRP) with aluminum frame or ENGINEER approved equal.

2.02 MATERIALS

- A. Fiberglass Mat: Minimum 1.5 ounces per square foot.
- B. Resins: Manufacturer's formulation for fabricating units to meet specified requirements.
- C. Anchors: Manufacturer's standard stainless steel expansion anchors for existing openings, and stainless steel masonry tee anchors for new construction.
- D. Fasteners: Stainless steel.

2.03 MANUFACTURED UNITS

- A. Non-rated Fiberglass Reinforced Plastic (FRP) Doors:
 - 1. Thickness: 1-3/4 inches.
 - 2. Minimum thermal Insulating Value: >R factor = 11. (.09 "U" value).
 - 3. Construction:
 - a. Core: Water blown polyurethane foam.
 - b. Door Plates: Molded in one continuous piece, resin reinforced with hand-

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FRP DOORS AND ALUMINUM FRAMES

laid glass fiber mat, nominal 1/8-inch-thick, minimum 15 mil gel-coated surface.

- c. Door Transom: Overhead door transom shall be included for the doorway 102A leading into the Electrical Room.
- d. Door Edges: Minimum three (3) layers resin-reinforced glass fiber mat, nominal 3/8-inch-thick, machine tooled.
- 4. Sizes: Indicated on drawings.
- 5. Finish: Gloss or gelcoat surface, minimum value 88 in accordance with ASTM D 523 or light pebble grain texture.
- 6. Color: As approved by Architect from manufacturer's full range of standard selections.

B. Door Hardware: Specified Section 08710.

2.04 FABRICATION

A. Fiberglass Reinforced Plastic (FRP) Doors:

- 1. Minimum glass fiber to resin ratio: 30 percent.
- 2. Mortise for lockset, and recess for strike plate in lock stile.
- 3. Embed steel reinforcement for hinges in fiberglass matrix; provide for hinge leaf recesses in hinge stile.

B. Aluminum Frames:

- 1. Mortise for lock strike, and recess for strike plate in lock jamb.
- 2. Reinforce for hinges and other indicated hardware.
- 3. 6063-T6 hardened aluminum alloy

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:

- 1. Openings are correctly prepared to receive doors and frames.
- 2. Openings are correct size and depth in accordance with shop drawings.

B. Installer's Examination:

- 1. Have installer examine conditions under which construction activities of this section are to be performed and submit written report if conditions are unacceptable.
- 2. Transmit two copies of installer's report to Architect within 24 hours of receipt.
- 3. Beginning construction activities of this section before unacceptable conditions have been corrected is prohibited.
- 4. Beginning construction activities of this section indicates installer's acceptance of conditions.

3.02 INSTALLATION

A. Install door opening assemblies in accordance with shop drawings, SDI-100, and manufacturer's printed installation instructions, using installation methods and materials specified in installation instructions.

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FRP DOORS AND ALUMINUM FRAMES

- B. Installation of door hardware is specified in Section 08710.
- C. Install door hardware in accordance with manufacturer's printed instructions, using through-bolts to secure surface applied hardware.
- D. Site Tolerances: Maintain plumb and level tolerances specified in manufacturer's printed installation instructions.

3.03 ADJUSTING

- A. Adjust doors in accordance with door manufacturer's maintenance instructions to swing open and shut without binding, and to remain in place at any angle without being moved by gravitational influence.
- B. Adjust door hardware to operate correctly in accordance with hardware manufacturer's maintenance instructions.

3.04 CLEANING

- A. Clean surfaces of door opening assemblies and sight-exposed door hardware in accordance with manufacturer's maintenance instructions.

3.05 PROTECTION OF INSTALLED PRODUCTS

- A. Protect door opening assemblies and door hardware from damage by subsequent construction activities until final inspection

END OF SECTION 08110

SECTION 08331

OVERHEAD COILING DOORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA Conditions and Division 1 Specification Sections, apply to this Section.

1.02 PERFORMANCE REQUIREMENTS

- A. Structural Performance, Exterior Doors: Exterior overhead coiling doors shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated according to SEI/ASCE 7-10 and the current edition of the Florida Building Code that is in effect by the jurisdiction.
 - 1. Wind Loads: Uniform pressure (velocity pressure), acting inward and outward, AS INDICATED ON structural drawings or design pressure of 50 psf whichever is greater.
 - 2. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
 - 3. Rolling doors shall be tested for determination of structural performance under uniform static air pressure difference in accordance with ANSI/DASMA 108, ASTM E 330 Procedure A, or TAS 202.
 - 4. For products tested in accordance with ASTM E 330, testing shall include a load of 1.5 times the required design pressure load sustained for 10 seconds, and acceptable criteria shall be in accordance with ANSI/DASMA 108.
 - 5. Overhead coiling door system shall have a Florida Approval number.
- B. Operability under Wind Load: Design overhead coiling doors to remain operable under uniform pressure (velocity pressure) of 56 lbf/sq. ft. wind load, acting inward and outward.
- C. Operation Cycles: Provide overhead coiling door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
- D. Overhead coiling service doors are to comply with windload requirements and large and small missile impact requirements of the Florida Building Code that is in effect by the jurisdiction.

1.03 SUBMITTALS

- A. Provide all submittals in accordance with Section 01300.
- B. Product Data: For each type and size of overhead coiling door and accessory. Include the following:

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OVERHEAD COILING DOORS

1. Construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
 2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- C. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.
1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 2. Wiring Diagrams: For power, signal, and control wiring.
- D. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
1. Include similar Samples of accessories involving color selection.
- E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
1. Curtain Slats: 12 inches long.
 2. Bottom Bar: 6 inches long with sensor edge.
 3. Guides: 6 inches long.
 4. Brackets: 6 inches square.
 5. Hood: 6 inches square.
- F. Delegated-Design Submittal: For overhead coiling doors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional ENGINEER responsible for their preparation.
1. Summary of forces and loads on walls and jambs.
 2. Verify that motor operating each door is mounted in front of hood and are heavy duty motors (60 to 90 cycles per hour) and meet the requirements of UL Bulletin 325.
 3. Provide motor operator model GH, 120 vac single phase, 1 HP minimum, with motor cover, and surface mounted 3-button push button station – NEMA 1 for each door.
 4. Provide motor mounting device in front of hood that secures front mounted motor and cover to wall.
- G. Qualification Data: For qualified Installer.
- H. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

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OVERHEAD COILING DOORS

- B. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
 - 1. Obtain operators and controls from overhead coiling door manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.01 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
 - 1. Steel Door Curtain Slats: A36 sheet with manufacturer for type of use and finish indicated; thickness of 0.0239 inch (24 gage) and as required to meet requirements.
- B. Endlocks and Windlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on each curtain slats for curtain alignment and resistance against lateral movement.
- C. Bottom Bar for Service Doors: Consisting of two angles, each not less than 1-1/2 by 1-1/2 by 1/8-inch-thick; fabricated from manufacturer's standard steel, or steel extrusions to match curtain slats and finish.
- D. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot boltholes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.

2.02 HOOD

- A. General: Form steel hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that project beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging. Integrate in-front-of-hood mounted motor support system with hood.
 - 1. Steel: 0.030.-inch-thick (22 gage) steel sheet complying with A36 recommended by manufacturer and finisher for type of use and finish indicated. Match color of door.

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2. Hood mounting: Steel of thickness required to support motor. Match color of hood.

2.03 LOCKING DEVICES

- A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
 1. Lock Cylinders: Provide cylinders standard with manufacturer and keyed to building keying system. Match lock cylinders of all locks.
 2. Keys: Provide two (2) for each cylinder.
- B. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.04 CURTAIN ACCESSORIES

- A. Weatherseals: Equip each exterior door with weather-stripping gaskets fitted to entire perimeter of door for a weathertight installation, unless otherwise indicated.
 1. At door head, use 1/8-inch-thick, replaceable, continuous sheet secured to inside of hood.
 2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch-thick seals of flexible vinyl, rubber, or neoprene.
- B. Push/Pull Handles: Equip each door with lifting handles on each side of door, finished to match door.

2.05 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
- C. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

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- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.06 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
 - 1. Comply with NFPA 70.
 - 2. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum internally sourced 24 V, ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Door Operator Location(s):
 - 1. Front of Hood Mounted: Operator is mounted to the outside of hood on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Provide support mounting back to wall (vertical bracket mount).
- D. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 16 unless otherwise indicated.
 - 1. Electrical Characteristics:
 - a. Phase: Single Phase.
 - b. Volts: 120 V.
 - c. Hertz: 60.
 - 2. Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.
 - 3. Motor Size: Minimum size as indicated. Motor shall be large enough to start, accelerate, and operate door in either direction from any position, at a speed of not more than 12 in./sec., without exceeding nameplate ratings or service factor.
 - 4. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 - 5. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
- E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

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- F. Obstruction Detection Device: Equip each motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.
 - 1. Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
- G. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."
 - 1. Interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
 - 2. Exterior units, full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.
- H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.
- I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
- K. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.

2.07 DOOR ASSEMBLY

- A. Service Door: Overhead coiling door formed with curtain of interlocking flat metal slats.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Wayne-Dalton Rolling Service Door – 800 Series, or comparable product by one of the following:
 - a. Alpine Overhead Doors, Inc.
 - b. Cookson Company.
 - c. McKeon Rolling Steel Door Company, Inc.
 - d. Overhead Door Corporation.
 - e. Raynor.
- B. Operation Cycles: Not less than 100,000
- C. Door Curtain Material: Galvanized carbon steel with paint coating.

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- D. Door Curtain Slats: Flat profile slats of 1-7/8-inch maximum center-to-center height.
- E. Curtain Jamb Guides: Steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.
- F. Hood: Match curtain material and finish of steel.
 - 1. Shape: As shown on Drawings.
 - 2. Mounting: As shown on Drawings.
- G. Locking Devices: Equip door with keyed locking device assembly.
 - 1. Locking Device Assembly: Cremone type, both jamb sides locking bars, operable from inside with thumb turn outside with cylinder.
- H. Electric Door Operator: Refer to this specification 2.06 A – K.
- I. Steel Shop Finish: Apply in accordance with manufacturer recommendations and instructions.
 - 1. Steel doors and frame to be galvanized coated to ASTM A653 requirements with a minimum of a G90 galvanizing thickness.
 - 2. New galvanization needs to be brushed blasted SSPC-SPC16 to create a 0.5-1.5 anchor profile to accept primer and finish coats.
 - 3. After galvanizing and surface preparation apply primer and finish coats as listed below:
 - 4. Primer: One shop coat of manufacturer's standard shop primer (S-W Pro Industrial Pro-Cryl Primer) (2.5 mils DFT).
 - 5. Finish Coats: Two shop coats of Standard Industrial Enamel (S-W Industrial Coatings B54 Series) (3.5 mils DFT per coat).

2.08 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.09 STEEL FINISHES

- A. Steel Shop Finish: Apply in accordance with manufacturer recommendations and instructions.
 - 1. Steel doors and frame to be galvanized coated to ASTM A653 requirements with a minimum of a G90 galvanizing thickness.
 - 2. New galvanization needs to be brushed blasted SSPC-SPC16 to create a 0.5-1.5 anchor profile to accept primer and finish coats.

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3. After galvanizing and surface preparation apply primer and finish coats as listed below:
4. Primer: One shop coat of manufacturer's standard shop primer (S-W Pro Industrial Pro-Cryl Primer) (2.5 mils DFT).
5. Finish Coats: Two shop coats of Standard Industrial Enamel (S-W Industrial Coatings B54 Series) (3.5 mils DFT per coat).

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install overhead coiling doors, hoods, and operators at the mounting locations indicated for each door.
- C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.03 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 1. Perform installation and startup checks according to manufacturer's written instructions.
 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.04 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.

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3.05 DEMONSTRATION

- A. Engage a factory-authorized service representative to train OWNER's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 08331

SECTION 08710

DOOR HARDWARE

PART 1 – GENERAL

1.01 SUMMARY

A. General Owner Requirements

1. The hardware schedule is provided as a basis of design only. The OWNER has requested the use of their typical hardware system. Provide and install the following manufacturer's hardware items as follows:
 - a. ANSI A 156.1 Compliant full mortise type hinges.
 - b. ANSI A5111 (Stainless steel). For use on heavy weight doors and doors requiring high frequency service.
 - c. ANSI A5112 (Stainless steel). For use on medium weight doors and doors requiring medium frequency service.
 - d. ANSI A5133 (Stainless steel). For use on medium weight doors or door requiring low frequency service.
 - e. US32D Satin finished
 - f. Stainless steel fasteners
2. Lockset
 - a. Mortise: Corbin Russwin, ML2000 Series-Heavy duty for medium to light used door
 - b. Cylindrical: Corbin Russwin, CL3300 Series-Extra heavy duty for highly used door and Corbin Russwin, CL3500 Series-Heavy duty for medium to lightly used door
3. Handle and Trim
 - a. Mortise: Lustra Lever Design Handle (LWA) for mortise lockset with Satin Stainless Steel US32D (BHMA 630) finish
 - b. Cylindrical: Newport lever handle (NZD) with Satin chrome plated (626) finish
4. Core
 - a. Satin plated chromium (626), Complete Large Format Interchangeable Core (LFIC), 6-Pin high security, keyed to existing Corbin Russwin 60-70 series restricted system with construction control key.
5. Key
 - a. Patented Corbin Russwin Master Keying System
6. Electrified Lockset
 - a. Mortise: Corbin Russwin, ML 20606 NAC Series Electrified Mortise Lock with High Security Monitoring, Full model No. ML 20606 PSM NAC SEC RO4 630 CL6
 - b. Cylindrical
 1. Corbin Russwin, CL33905 Electrified Lockset – Fail Secure, Full Model No. CL33905 PZD 626 M92 SEC CL6
 2. Corbin Russwin, CL33903 Electrified Lockset – Fail Safe, Full RIM Exit Device with Electric Trim

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3. Corbin Russwin, ED5200S Panic- Listed SecureBolt Exit Device, Full Model No. ED5200S PR9905 M92 630 CL6 M54
4. RIM Exit Device with Electric Latch Retraction
5. Corbin Russwin, ED5200S Panic-Listed SecureBolt Exit Device, Full Model No. ED5200S P955 M95 M94 630 CL6 M54

B. Section Includes: Finish Hardware for door openings, except as otherwise specified herein.

1. Door hardware for fiberglass reinforced plastic (FRP) doors.
2. Door hardware for other doors indicated.
3. Keyed cylinders as indicated.

C. Related Sections:

1. Division 6: Rough Carpentry
2. Division 8: FRP Doors and Frames
3. Division 16: Electrical

D. References: Comply with applicable requirements of the following standards. Where these standards conflict with other specific requirements, the most restrictive shall govern.

1. Builders Hardware Manufacturing Association (BHMA)
2. NFPA 101 Life Safety Code
3. NFPA 80 -Fire Doors and Windows
4. ANSI-A156.19- Various Performance Standards for Finish Hardware
5. UL10C – Positive Pressure Fire Test of Door Assemblies
6. ANSI-A117.1 – Accessible and Usable Buildings and Facilities 2009
7. DHI /ANSI A115.IG – Installation Guide for Doors and Hardware
8. Florida Building Codes for Hurricane (NOA) for exterior openings.

E. Intent of Hardware Groups

1. Should items of hardware not definitely specified be required for completion of the Work, furnish such items of type and quality comparable to adjacent hardware and appropriate for service required.
2. Where items of hardware aren't definitely or correctly specified, are required for completion of the Work, a written statement of such omission, error, or other discrepancy to be submitted to Architect, prior to date specified for receipt of bids for clarification by addendum; or, furnish such items in the type and quality established by this specification, and appropriate to the service intended.
3. Due to the corrosive nature of the environment of this project, it is the intent to make all hardware and metals to be protected from the climate. All hardware shall be protected to the greatest extent possible from this environment.

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1.02 SUBMITTALS

- A. Comply with Section 01300.
- B. Special Submittal Requirements: Combine submittals of this Section with Sections listed below to ensure the "design intent" of the system/assembly is understood and can be reviewed together.
- C. Product Data: Manufacturer's specifications and technical data including the following:
 - 1. Detailed specification of construction and fabrication.
 - 2. Manufacturer's installation instructions.
 - 3. Wiring diagrams for each electric product specified. Coordinate voltage with electrical before submitting.
 - 4. Provide 9001-Quality Management and 14001-Environmental Management for products listed in Materials Section 2.2.
- D. Shop Drawings - Hardware Schedule:
 - 1. List groups and suffixes in proper sequence.
 - 2. Completely describe door and list architectural door number.
 - 3. Manufacturer, product name, and catalog number.
 - 4. Function, type, and style.
 - 5. Size and finish of each item.
 - 6. Mounting heights.
 - 7. Explanation of abbreviations and symbols used within schedule.
 - 8. Detailed wiring diagrams, specially developed for each opening, indicating all electric hardware, security equipment and access control equipment, and door and frame rough-ins required for specific opening.
- E. Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.
 - 1. Templates, wiring diagrams and "reviewed Hardware Schedule" of electrical terms to electrical for coordination and verification of voltages and locations.
- F. Contract Closeout Submittals: Comply with Section 01300 including specific requirements indicated.
 - 1. Operating and maintenance manuals: In accordance with Section 01730.
 - a. Complete information in care, maintenance, and adjustment, and data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Name, address, and phone number of local representative for each manufacturer.

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- d. Parts list for each product.
2. Copy of final hardware schedule, edited to reflect, "As installed".
3. Copy of final keying schedule.
4. As installed "Wiring Diagrams" for each piece of hardware connected to power, both low voltage and 110 volts.
5. One set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

1.03 QUALITY ASSURANCE

- A. Comply with Division 01010, 01300, 01600, 01730 and 01740.
 1. Exterior Openings Severe Windstorm Components testing: Listed and labeled by a testing and inspecting agency acceptable to authority having jurisdiction, based on testing according to ANSI A250.13. Further compliance with Florida Building Codes for Hurricane (NOA) for Exterior Openings.
 2. Statement of qualification for distributor and installers.
 3. Statement of compliance with regulatory requirements and single source responsibility.
 4. Distributor's Qualifications: Firm with 3 years' experience in the distribution of commercial hardware.
 - a. Distributor to employ full time Architectural Hardware Consultants (AHC) for the purpose of scheduling and coordinating hardware and establishing keying schedule.
 - b. Hardware Schedule shall be prepared and signed by an AHC.
 5. Installer's Qualifications: Firm with 3 years' experience in installation of similar hardware to that required for this Project, including specific requirements indicated.
 6. Regulatory Label Requirements: Provide testing agency label or stamp on hardware for labeled openings
 - a. Provide UL listed hardware for labeled and 20-minute openings in conformance with requirements for class of opening scheduled.
 - b. Underwriters Laboratories requirements have precedence over this specification where conflict exists.
 7. Single Source Responsibility: Except where specified in hardware schedule, furnish products of only one manufacturer for each type of hardware.
- B. Review Project for extent of finish hardware required to complete the Work. Where there is a conflict between these Specifications and the existing hardware, notify the Architect in writing and furnish hardware in compliance with the Specification unless otherwise directed in writing by the Architect.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Comply with Section 01600.
 1. Deliver products in original unopened packaging with legible manufacturer's identification.
 2. Package hardware to prevent damage during transit and storage.

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3. Mark hardware to correspond with "reviewed hardware schedule".
4. Deliver hardware to door and frame manufacturer upon request.

B. Storage and Protection: Comply with manufacturer's recommendations.

1.05 PROJECT CONDITIONS

A. Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for the proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.

B. Review shop drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.

1.06 WARRANTY

A. Manufacturer's Warranty:

1. Closers: Ten years
2. Exit Devices: Three Years
3. Locksets and Cylinders: Three years
4. All other Hardware: Two years.

1.07 MAINTENANCE

A. Extra Service Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels.

1. Special Tools: Provide special wrenches and tools applicable to each different or special hardware component.
2. Maintenance Tools: Provide maintenance tools and accessories supplied by hardware component manufacturer.
3. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra service materials.

B. Maintenance Service: Submit for Owner's consideration maintenance service agreement for electronic products installed.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. The following manufacturers are the basis of design subject to compliance with requirements of the Contract Documents.

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<u>Item:</u>	<u>Manufacturer:</u>	<u>Approved:</u>
Hinges	Stanley	Bommer, McKinney
Locksets	Corbin Russwin	<u>No Substitute</u>
Cylinders	Corbin Russwin	<u>No Substitute</u>
Exit Devices	Corbin Russwin	Von Duprin, Sargent, Precision
Closers	Corbin Russwin	LCN 4110, Norton 7500
Protection Plates	Trimco	Burns, Rockwood
Overhead Stops	ABH	Rixson, Glynn Johnson
Door Stops	Ives	Burns, Rockwood
Threshold & Gasketing	National Guard	Reese, Zero

2.02 MATERIALS

A. Hinges: Shall be Five Knuckle Ball bearing hinges

1. Template screw hole locations
2. Bearings are to be fully hardened.
3. Bearing shell is to be consistent shape with barrel.
4. Minimum of 2 permanently lubricated non-detachable bearings on standard weight hinge and 4 permanently lubricated bearing on heavy weight hinges.
5. Equip with easily seated, non-rising pins.
6. Non-Removable Pin screws shall be slotted stainless steel screws.
7. Hinges shall be full polished, front, back and barrel.
8. Hinge pin is to be fully plated.
9. Bearing assembly is to be installed after plating.
10. Sufficient size to allow 180-degree swing of door
11. Furnish five knuckles with flush ball bearings
12. Provide hinge type as listed in schedule.
13. Furnish 3 hinges per leaf to 7-foot 6-inch height. Add one for each additional 30 inches in height or fraction thereof.
14. Tested and approved by BHMA for all applicable ANSI Standards for type, size, function and finish
15. UL10C listed for fire rated doors.

B. Cylindrical Type Locks and Latchsets:

1. Tested and approved by BHMA for ANSI A156.2, Series 4000, Operational Grade 1, Extra-Heavy Duty, and be UL10C listed.
2. Provide 9001-Quality Management and 14001-Environmental Management.
3. Fit modified ANSI A115.2 door preparation.
4. Locksets and cores to be of the same manufacturer to maintain complete lockset warranty
5. Locksets to have anti-rotational studs that are thru-bolted
6. Keyed lever shall not have exposed "keeper" hole
7. Each lever to have independent spring mechanism controlling it
8. 2-3/4-inch (70 mm) backset
9. 9/16 inch (14 mm) throw latchbolt
10. Provide sufficient curved strike lip to protect door trim
11. Outside lever sleeve to be seamless, of one-piece construction made of a hardened steel alloy

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12. Keyed lever to be removable only after core is removed, by authorized control key
13. Provide locksets with 7-pin removable and interchangeable core cylinders
14. Hub, side plate, shrouded rose, locking pin to be a one-piece casting with a shrouded locking lug.
15. Locksets outside locked lever must withstand minimum 1400-inch pounds of torque. In excess of that, a replaceable part will shear. Key from outside and inside lever will still operate lockset.
16. Core face must be the same finish as the lockset.
17. Functions and design as indicated in the hardware groups.

C. Exit Devices:

1. Exit devices to meet or exceed BHMA for ANSI 156.3, Grade 1.
2. Exit devices to be tested and certified by UL or by a recognized independent laboratory for mechanical operational testing to 10 million cycles minimum with inspection confirming Grade 1 Loaded Forces have been maintained.
3. Exit devices chassis to be investment cast steel, zinc dichromate.
4. Exit devices to have stainless steel deadlocking $\frac{3}{4}$ -inch through latch bolt.
5. Exit devices to be equipped with sound dampening on touchbar.
6. Touchpad to be "T" style constructed of architectural metal with matching metal end caps.
7. Touchbar assembly on wide style exit devices to have a $\frac{1}{4}$ -inch clearance to allow for vision frames.
8. All exposed exit device components to be of architectural metals and "true" architectural finishes.
9. Provide strikes as required by application.
10. Fire exit hardware to conform to UL10C and UBC 7-2. UL tested for Accident Hazard.
11. Exit device to be heavy investment cast stainless steel. The strike is to be black powder coated finish.
12. Exit devices to have field reversible handing.
13. Provide heavy duty vandal resistant lever trim with heavy duty investment cast stainless steel components and extra strength shock absorbing overload springs. Lever shall not require resetting. Lever design to match locksets and latchsets.
14. Provide 9001-Quality Management and 14001-Environmental Management.
15. Vertical latch assemblies to have gravity operation, no springs.

D. Cylinders

1. Provide the necessary cylinder housings, collars, rings and springs as recommended by the manufacturer for proper installation.
2. Provide the proper cylinder cams or tail piece as required to operate all locksets and other keyed hardware items listed in the hardware sets.
3. Coordinate and provide as required for related sections.

E. Door Closers shall:

1. Tested and approved by BHMA for ANSI 156.4, Grade 1
2. UL10C certified

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3. Provide 9001-Quality Management and 14001-Environmental Management.
 4. Closer shall have extra-duty arms and knuckles
 5. Conform to ANSI 117.1
 6. Maximum 2 7/16-inch case projection with non-ferrous cover
 7. Separate adjusting valves for closing and latching speed, and backcheck
 8. Provide adapter plates, shim spacers and blade stop spacers as required by frame and door conditions
 9. Full rack and pinion type closer with 1½ -inch minimum bore
 10. Mount closers on non-public side of door, unless otherwise noted in specification
 11. Closers shall be non-handed, non-sized and multi-sized.
- F. Door Stops: Provide a dome floor or wall stop for every opening as listed in the hardware sets.
1. Wall stop and floor stop shall be wrought bronze, brass or stainless steel.
 2. Provide fastener suitable for wall construction.
 3. Coordinate reinforcement of walls where wall stop is specified.
 4. Provide dome stops where wall stops are not practical. Provide spacers or carpet riser for floor conditions encountered
- G. Over Head Stops: Provide a surface mounted or concealed overhead when a floor or wall stop cannot be used or when listed in the hardware set.
1. Concealed overhead stops shall be heavy duty bronze or stainless steel.
 2. Surface overhead stops shall be heavy duty bronze or stainless steel.
- H. Kickplates: Provide with four beveled edges ANSI J102, 10 inches high by width less 2 inches on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.
- I. Seals: All seals shall be finished to match adjacent frame color. Seals shall be furnished as listed in schedule. Material shall be UL listed for labeled openings.
- J. Weatherstripping: Provide at head and jambs only those units where resilient or flexible seal strip is easily replaceable. Where bar-type weatherstrip is used with parallel arm mounted closers install weatherstrip first.
1. Weatherstrip shall be resilient seal of (Neoprene, Polyurethane, Vinyl, Pile, Nylon Brush, Silicone)
 2. UL10C Positive Pressure rated seal set when required.
- K. Door Bottoms/Sweeps: Surface mounted or concealed door bottom where listed in the hardware sets.
1. Door seal shall be resilient seal of (Neoprene, Polyurethane, Nylon Brush, Silicone)
 2. UL10C Positive Pressure rated seal set when required.

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- L. Thresholds: Thresholds shall be aluminum beveled type with maximum height of ½-inch for conformance with ADA requirements. Furnish as specified and per details. Provide fasteners and screws suitable for floor conditions.
- M. Silencers: Furnish silencers on all interior frames, 3 for single doors, 2 for pairs. Omit where any type of seals occur.

2.03 FINISH

- A. Designations used in Schedule of Finish Hardware - 3.05, and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products.
- B. Powder coat door closers to match other hardware, unless otherwise noted.
- C. Aluminum items shall be finished to match predominant adjacent material. Seals to coordinate with frame color.

2.04 KEYES AND KEYING

- A. Provide keyed brass construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Owner's permanent keying system or furnished in the same keyway (or key section) as the Owner's permanent keying system. Once the certificate of occupancy is received by the OWNER and the job is finished in its entirety, a representative of the door hardware company shall install the permanent cores (prepared according to the accepted keying schedule) and supply the OWNER with the final keys to the permanent cores. The installation of the cores by the representative of the door hardware company shall not be at the OWNER'S expense.
- B. Cylinders, removable and interchangeable core system
- C. Permanent keys and cores: Stamped with the applicable key mark for identification. These visual key control marks or codes will not include the actual key cuts. Permanent keys will also be stamped "Do Not Duplicate."
- D. Transmit grand master keys, master keys and other security keys to Owner.
- E. Furnish keys in the following quantities:
 - 1. 1 each grand master keys
 - 2. 4 each master keys
 - 3. 2 each change keys each keyed core
 - 4. 15 each construction master keys

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5. 1 each control keys

- F. Once the certificate of occupancy is received by the OWNER and the job is finished in its entirety, a representative of the door hardware company shall install the permanent cores (prepared according to the accepted keying schedule) and supply the OWNER with the final keys to the permanent cores. The installation of the cores by the representative of the door hardware company shall not be at the OWNER'S expense. Construction cores and keys remain the property of the Hardware Supplier.
- G. Keying Schedule: Arrange for a keying meeting, and programming meeting with Architect Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying and programming complies with project requirements. Furnish 3 typed copies of keying and programming schedule to Architect.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verification of conditions: Examine doors, frames, related items and conditions under which Work is to be performed and identify conditions detrimental to proper and or timely completion.
 - 1. Do not proceed until unsatisfactory conditions have been corrected.

3.02 HARDWARE LOCATIONS

- A. Mount hardware units at heights indicated in the following publications except as specifically indicated or required to comply with the governing regulations.
 - 1. Recommended Locations for Builder's Hardware for Standard Steel Doors and Frames, by the Door and Hardware Institute (DHI).
 - 2. Recommended locations for Architectural Hardware for flush wood doors (DHI).
 - 3. WDMA Industry Standard I.S.-1A-04, Industry Standard for Architectural wood flush doors.

3.03 INSTALLATION

- A. Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- B. Conform to local governing agency security ordinance.

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- C. Install Conforming to ICC/ANSI A117.1 Accessible and Usable Building and Facilities.
 - 1. Adjust door closer sweep periods so that from the open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the landing side of the door.
- D. Installed hardware using the manufacturers fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use "Riv-Nuts" or similar products.
- E. Thresholds: Apply continuous bead of sealant to all contact surfaces before installing.

3.04 FIELD QUALITY CONTROL AND FINAL ADJUSTMENT

- A. Contractor/Installers, Field Services: After installation is complete, contractor shall inspect the completed door openings on site to verify installation of hardware is complete and properly adjusted, in accordance with both the Contract Documents and final shop drawings.
 - 1. Check and adjust closers to ensure proper operation.
 - 2. Check latchset, lockset, and exit devices are properly installed and adjusted to ensure proper operation.
 - a. Verify levers are free from binding.
 - b. Ensure latchbolts and dead bolts are engaged into strike and hardware is functioning.
 - 3. Report findings, in writing, to architect indicating that all hardware is installed and functioning properly. Include recommendations outlining corrective actions for improperly functioning hardware if required.

3.05 SCHEDULE OF FINISH HARDWARE

- A. Manufacturer List
 - 1. MK - McKinney
 - 2. MR - Markar
 - 3. SA - SARGENT
 - 4. RU - Corbin Russwin
 - 5. RO - Rockwood
 - 6. PE - Pemko
 - 7. HD - HID
 - 8. SU - Securitron
 - 9. OT - OTHER

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DOOR HARDWARE

Hardware Sets

Set: 1

Doors: 101A, 101B

Description: Exterior Storeroom Function + Closer/Stop

1 Continuous Hinge	FM100 7'2 EL12 Security Studs	628	MR ✂
1 Fail Safe Lock	ML20608 x NAC-SAF LWA CT6B	630	RU ✂
1 Interchangeable Core	CR8500 GMK	626	RU
1 Fail Secure Exit Device	HC LC 55 8876-24v ETJ	US32D SA	✂
1 Rim Exit Device, Exit Only	HC 8810 EO	US32D SA	
1 Surface Closer	DC6210 A11 M75	689	RU
1 Threshold	1715AK WS10SS x Opening Width		PE
1 Sweep	315CN x Door Width		PE
1 ElectroLynx Harness	QC-C2500P		MK ✂
1 ElectroLynx Harness	QC-C300		MK ✂
1 Wall Card Reader	By Owner		HD
1 Mortise Door Monitor Switch	By Owner		SU
1 Power Supply	By Owner		SU

Notes: All exterior doors on this project shall meet FBC standards for windstorm. The door hardware specified is listed as a basis of design. If alternate hardware is proposed, please provide third-party test results and compliance information to architect.

Perimeter gasket by frame manufacturer.

Door contact switch indicates propped door condition.

Security management software and access control panel by others.

Prep door and hinge jamb for electronic lock.

OPERATION: Card Reader outside temporarily unlocks outside lever: auto-relock. Electronic lock function is fail-secure with inside RX switch. Outside trim has key override. Inside trim always allows egress.

Set: 2

Doors: 102A

Description: Exterior Electrical Room Card Access Exit Pair - NEC

1 Continuous Hinge	FM100 7'2 Security Studs	628	MR
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1 Continuous Hinge	FM100 7'2 EL12 Security Studs	628	MR ✂
1 Mullion	HC980	PC	SA
1 Fail Secure Exit Device	HC LC 55 8876-24v ETJ	US32D	SA ✂
1 Rim Exit Device, Exit Only	HC 8810 EO	US32D	SA
1 Interchangeable Core	CR8500 GMK	626	RU
1 Rim Cylinder x Temp Core	CR3580-058- CT6B	626	RU
2 Surface Closer	DC6210 A11 M75	689	RU
1 Threshold	1715AK WS10SS x Opening Width		PE
1 Mullion Gasketing	5110BL x Door Height		PE
2 Sweep	315CN x Door Width		PE
1 ElectroLynx Harness	QC-C2500P		MK ✂
1 ElectroLynx Harness	QC-C300		MK ✂
1 Wall Card Reader	By Owner		HD
2 Mortise Door Monitor Switch	By Owner		SU
1 Power Supply	By Owner		SU

Notes: All exterior doors on this project shall meet FBC standards for windstorm. The door hardware specified is listed as a basis of design. If alternate hardware is proposed, please provide third-party test results and compliance information to architect.

Perimeter gasket by frame manufacturer.

Door contact switch indicates propped door condition.

Security management software and access control panel by others.

Prep door and hinge jamb for electronic lock.

OPERATION: Card Reader outside temporarily unlocks outside lever: auto-relock. Electronic lock function is fail-secure with inside RX switch. Outside trim has key override. Inside trim always allows egress.

Set: 3

Doors: 101C

Description: Overhead Door

1 Interchangeable Core	CR8500 GMK	626	RU
1 Rim Cylinder x Temp Core	CR3580-058- CT6B	626	RU
1 Wall Card Reader	By Owner		HD

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Notes: Balance of hardware by door manufacturer.
Coordinate cylinder requirements with door supplier.

Set: 4

Doors: 102B

Description: Electrical Room Exit - NEC

1 Continuous Hinge	FM100 7'2 Security Studs	628	MR
1 Rim Exit Device, Storeroom	LC 8804 ETL	US32D	SA
1 Fail Secure Exit Device	HC LC 55 8876-24v ETJ	US32D	SA
1 Cylinder	CR3000-058- GMK CMK	626	RU
1 Surface Closer	DC6210 A11 M75	689	RU

Notes: Perimeter gasket by frame manufacturer.

Set: 5

Doors: 103

Description: Privacy Function + Closer

1 Continuous Hinge	FM100 7'2 Security Studs	628	MR
1 Privacy Lock	ML2060 NSA V20	630	RU
1 Surface Closer	DC6210 A11 M75	689	RU

Notes: Perimeter gasket by frame manufacturer.

END OF SECTION 08710

SECTION 08800

GLAZING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Glass for doors
 - 2. Glazing gaskets
 - 3. Glazing sealants
 - 4. Glazing accessories
- B. Types of work in this section include work for:
 - 1. Interior windows in doors.

1.02 SUBMITTALS

- A. Provide submittals in accordance with Section 01300.
- B. Product Data: For each type of product
- C. Glass samples: For insulating glass unit
- D. Samples of Sealants Exposed to View.
- E. Samples of Gaskets.

1.03 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.04 WARRANTY

- A. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

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GLAZING

2.02 INSTALLATION MATERIALS

- A. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall include manufacturer's name, type of glass, thickness and safety glazing standard with which glass complies.
- B. Strength: Where fully tempered float glass is indicated, provide fully tempered float glass.
- C. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

2.03 GLASS TYPES

- A. Glass Types - General: Provide fully tempered float glass types fabricated of the glass products indicated.
 - 1. Overall unit thickness: ¼-inch, unless otherwise indicated.
 - 2. Sealing system: Manufacturer's standard sealants
 - 3. Spacer Specifications: MANUFACTURER's standard spacer material and construction complying with the following requirements:
 - a. Spacer Material: Aluminum anodized finish in color selected by Architect from manufacturer's standard.
 - b. Desiccant: Molecular sieve or silica gel, or blend of both.
 - c. Corner Construction: Manufacturer's standard corner construction.
 - 4. Where safety glazing is required by governing authorities, provide certified safety glazing.
 - 5. Cut glass to size and shape and drill holes prior to tempering.
 - 6. Laminate color: clear.

2.04 INSTALLATION MATERIALS

- A. Installation Materials - General: Select products which have appropriate performance characteristics as recommended by glass and glazing materials manufacturers and which are compatible with all materials with which they will come into contact.
- B. Interior Glazing Sealant: Clear, non-sag silicone sealant.
- C. Sealant Tape: Precured, 100 percent solids butyl polyisobutylene rubber with internal spacer rod or of composition limiting compression to a maximum of 50 percent, complying with 806.3 or 807.3 tape, as described in AAMA 800.
 - 1. Size tape so that it is under compression when glazing is fully installed.
- D. Dense Compression Gaskets: Preformed neoprene, complying with ASTM C 864.
 - 1. Select style and size so that soft gasket will be compressed at least 25 percent when glazing is fully installed.
- E. Soft Compression Gaskets: Black, preformed closed-cell neoprene, complying with ASTM C 509, Type II; shape and density to maintain seal.
 - 1. Sealant tape may be used in lieu of soft gaskets, at CONTRACTOR's option.

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GLAZING

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

- A. Comply with recommendations for installation contained in the FGMA "Glazing Manual" and "Sealant Manual" except when specifically not recommended or prohibited by the glass or glazing material manufacturer; comply with manufacturer's recommendations.
- B. Protect glazing from edge damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that when installed, could weaken glass, impair performance, or impair appearance.
- C. Do not install glass that has edge damage or defects that reduce glass strength or performance or diminish appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. Provide spacers for glass lites where length plus width is larger than 50 inches.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

3.02 GLAZING IN FRAMES

- A. Sealants:
 - 1. Use continuous spacers.
 - a. Exception: For lights of less than 100 united inches, non-continuous spacers may be used, with backer rods to form proper sealant shape.
- B. Compression Gaskets: Secure gaskets so they will not work out under normal movement.
 - 1. Install so they fit tightly at corners, allowing for stretch during installation.

3.03 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.

SECTION 08800

GLAZING

3.04 MONOLITHIC GLASS SCHEDULE

- A. Glass Type G-1: Clear annealed, fully tempered float glass.
 - 1. Minimum thickness: ¼ inch.
 - 2. Safety glazing required.

END OF SECTION 08800

SECTION 09260

GYPSUM WALLBOARD AND SHEATHING ASSEMBLIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Description of Scope and Intent:
 - 1. CONTRACTOR shall provide all material, labor, and tools required to complete the installation of specified system.
 - 2. Any omission of reference to items required to complete the full operational and functional system specified in the section does not relieve the CONTRACTOR of the obligation to provide same.
 - 3. To provide installation of all items, including delivery, dispersing to the proper locations within the building, and affixing in place.
 - 4. Installation shall be accomplished by workers skilled in their craft that will perform their work in a professional manner and will leave the premises safe, orderly and clean.
 - 5. Drawings and general provisions of Contract, including JEA Conditions and Division 1 Specification Sections, apply to this Section
 - 6. CONTRACTOR is responsible for coordination of work included in this specification with all other specification sections related to furnishing of all materials, labor, permits, fees and services necessary for completion of work in this section.
 - 7. In the event of a conflict between the design drawings, referenced standards and these Specifications, the more stringent shall govern unless directed otherwise by the Architect. CONTRACTOR shall strictly adhere to OSHA requirements and local codes or those of any regulatory agency or body with jurisdiction
- B. This Section includes the following:
 - 1. Moisture resistant gypsum board panels.
 - 2. Standard paper faced gypsum board panels.
 - 3. Standard paper faced gypsum finishing.
 - 4. Exterior fiberglass reinforced and faced gypsum board sheathing.

1.02 SUBMITTALS

- A. Provide submittals in accordance with Section 01300.
- B. Product Data: For each type of product indicated.
- C. Samples: For the following products:
 - 1. Trim Accessories: Full-size sample in 12-inch- long length for each trim accessory indicated.
 - 2. Final Finishes: Two (2) foot square for each finish and on same backing indicated for Work.

1.03 QUALITY ASSURANCE

- A. Sound Transmission Characteristics: For standard paper faced gypsum board assemblies with STC ratings, provide materials and construction tested in assembly

SECTION 09260

GYPSUM WALLBOARD AND SHEATHING ASSEMBLIES

indicated according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.

1. STC-Rated Assemblies:
 - a. Walls, partitions, and floor/ceiling assemblies shall have a sound transmission class (STC) of not less than the following for air-borne noise when tested in accordance with ASTM E 90: Forty-five (45) STC
 - b. Floor/ceiling assemblies between rooms shall have an impact insulation class (IIC) rating of not less than 60 (55 if field tested) when tested in accordance with ASTM E 492.
- B. Standard Paper Faced Gypsum Board Finish Mockups: Before finishing gypsum board assemblies, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and qualities of materials and execution.
 1. Install mockups for the following applications:
 - a. Vertical and horizontal surfaces indicated to receive nontextured paint finishes.
 - b. Install at corner condition where paperless and paper faced wall panels abut.
 2. Simulate finished lighting conditions for review of mockups.
 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

1.05 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturers written recommendations, whichever are more stringent.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Gypsum Wallboard and Related Products:
 1. Georgia Pacific.
 2. United States Gypsum Co.
 3. Or equivalent manufacturer

2.02 INTERIOR PAPER FACED GYPSUM WALLBOARD

- A. See schedule at end of specification for material types and locations.

SECTION 09260

GYPSUM WALLBOARD AND SHEATHING ASSEMBLIES

2.03 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: PVC by Plastic Components, Inc., AMICO Vinyl Bead Accessories, Trim-Tex Inc., or equivalent.
 - 2. Shapes:
 - a. Cornerbead: Use at outside corners.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound; use at exposed panel edges.
 - c. L-Bead: L-shaped; exposed long leg receives joint compound; use where indicated.
 - d. Expansion (Control) Joint: Use where indicated, or at maximum spacing of 30 feet. Where sound or fire ratings are prime considerations, provide adequate protection behind joint.
 - e. Reveal Bead: U-shaped, ½-inch deep x ½-inch wide, let into rigid insulation in pattern shown on reflected ceiling plans, long legs on each side receive joint compound on surface.

2.04 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475.
- B. Joint Tape:
 - 1. Interior Gypsum Wallboard: Standard Paper Faced.
- C. Joint Compound for all Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - a. Use setting-type compound for installing nonpaper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use sandable topping compound.
 - 4. Finish Coat: For third coat, use sandable topping compound.

2.05 ACOUSTICAL SEALANT

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Acoustical Sealant for Exposed and Concealed Joints:
 - a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
 - b. United States Gypsum Co.; SHEETROCK Acoustical Sealant
 - c. or equivalent.
 - 2. Acoustical Sealant for Concealed Joints:
 - a. Ohio Sealants, Inc.; Pro-Series SC-170 Rubber Base Sound Sealant.
 - b. Pecora Corp.; BA-98.
 - c. Tremco, Inc.; Tremco Acoustical Sealant
 - d. or equivalent.

SECTION 09260

GYPSUM WALLBOARD AND SHEATHING ASSEMBLIES

- B. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

2.06 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
- C. Isolation Strip at Exterior Walls:
 - 1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8-inch-thick, in width to suit stud size.
- D. Thermal Insulation: As specified in Division 7 Section "Building Insulation."

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and substrates, with Installer present, and, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Furnish concrete inserts and other devices indicated for suspended ceiling systems to other trades for installation in advance of time needed for coordination and construction.

3.03 INSTALLING STEEL FRAMING, GENERAL

- A. Installation Standards: See Structural Specification requirements that apply to framing installation.

3.04 INSTALLING SUSPENDED CEILING

- A. Suspend steel suspension framing system from building structure required by system manufacturer and structural drawings.

SECTION 09260

GYPSUM WALLBOARD AND SHEATHING ASSEMBLIES

3.05 APPLYING AND FINISHING PANELS, GENERAL

- A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.
- B. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.
- C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- D. Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- E. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- F. Attach gypsum panels to framing provided at openings and cutouts.
- G. Form control and expansion joints as necessary, with space between edges of adjoining gypsum panels.
- H. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch-wide spaces at these locations, and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above ceilings.
- J. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
 - 1. Space screws a maximum of 12 inches o.c. for vertical applications.

3.06 PANEL APPLICATION METHODS

- A. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.

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GYPSUM WALLBOARD AND SHEATHING ASSEMBLIES

2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of board.
 - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
- B. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.07 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

3.08 FINISHING STANDARD PAPER FACED GYPSUM BOARD ASSEMBLIES

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Pre-fill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:
 1. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view, unless otherwise indicated.

3.09 FIELD QUALITY CONTROL

- A. Above-Ceiling Observation: Before CONTRACTOR installs gypsum board ceilings, Architect will conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling gypsum board until deficiencies have been corrected.
 1. Notify Architect seven (7) days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.
 2. Notify Architect prior to installation of building insulation scheduled to be installed directly above gypsum board ceilings.

SECTION 09260

GYPSUM WALLBOARD AND SHEATHING ASSEMBLIES

3. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
 - a. Installation, insulation, and leak and pressure testing of water piping systems.
 - b. Installation of air-duct systems.
 - c. Installation of mechanical system.
 - d. Installation of ceiling support framing.

3.10 GYPSUM WALLBOARD AND SHEATHING SCHEDULE

- A. Provide the following material at all interior locations requiring gypsum board panels.
 1. Interior, Standard, Paper Faced Gypsum Board panels equal to:
 - a. Georgia Pacific "Tough-Rock".
 - b. Thickness: 5/8-inch unless otherwise noted.
 - c. Long edges: tapered.
 - d. Non-fire rated.
- B. Provide the following material at all restroom locations requiring moisture resistant gypsum board sheathing including showers, tub areas, and suspended ceilings.
 1. Moisture resistant Gypsum Board panels equal to:
 - a. USG Sheetrock Brand Ultralight panels mold tough
 - b. Thickness: 1/2-inch.

END OF SECTION 09260

SECTION 09512

ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.01 SUMMARY

- A. Description of Scope and Intent:
 - 1. CONTRACTOR shall provide all material, labor, and tools required to complete the installation of specified system.
 - 2. Any omission of reference to items required to complete the full operational and functional system specified in the section does not relieve the CONTRACTOR of the obligation to provide same.
 - 3. To provide installation of all items, including delivery, dispersing to the proper locations within the building, and affixing in place.
 - 4. Installation shall be accomplished by workers skilled in their craft who will perform their work in a professional manner and will leave the premises safe, orderly and clean.
 - 5. Drawings and general provisions of Contract, including JEA General Conditions and Division 1 Specification Sections, apply to this Section
 - 6. CONTRACTOR is responsible for coordination of work included in this specification with all other specification sections related to furnishing of all materials, labor, permits, fees and services necessary for completion of work in this section.
- B. Section Includes:
 - 1. Acoustical tiles
 - 2. Suspended metal grid ceiling system

1.02 DEFINITIONS

- A. CAC: Ceiling Attenuation Class.
- B. LR: Light Reflectance coefficient.
- C. NRC: Noise Reduction Coefficient.
- D. AC: Articulation Class

1.03 SUBMITTAL

- A. Provide all submittals in accordance with Section 01300.
- B. Product Data: For each type of product specified.
- C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Ceiling suspension system members.

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ACOUSTICAL TILE CEILINGS

2. Method of attaching hangers to building structure.
 - a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
 3. Size and location of initial access modules for acoustical tile.
 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 5. Minimum Drawing Scale: 1/8 inch = 1 foot
- D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below. Samples should show the full range of variations expected in these characteristics.
1. Acoustical Tile: Set of Samples of each type, color, pattern, and texture, minimum 6-inch by 6-inch size.
 2. Suspension System Members: 12-inch- long Sample of each type.
 3. Exposed Moldings and Trim: Set of 12-inch- long Samples of each type and color.
- E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specific to those projects.
- F. Maintenance Data: For finishes to include in maintenance manuals.
- G. Certification: Signed by manufacturer that products meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an installer with a minimum of 5-years documented experience who has completed acoustical tile ceilings similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Source Limitations for Ceiling Units and Suspension Systems: Obtain acoustical each type of ceiling tile and supporting suspension system through one source for warranty purposes with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
- C. Mockups: If requested, build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- D. Fire-Test-Response Characteristics: Provide acoustical tile ceilings that comply with the following requirements:
1. Surface-burning characteristics of acoustical tiles comply with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84.

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ACOUSTICAL TILE CEILINGS

- a. Smoke-Developed Index: 450 or less.

- E. Pre-installation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical tiles, suspension system to Project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical tiles, permit them to reach room temperature and stabilized moisture content.
- C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

1.06 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical tile ceilings and components until spaces are enclosed and weatherproof, wet-work in spaces is complete and dry, work above ceilings is complete, areas are free of construction dust and debris and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
 - 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical tile ceiling installation, when applicable.

1.07 COORDINATION

- A. Coordinate layout and installation of acoustical tiles, suspension system and accent canopies with other construction that penetrates ceilings or is supported by them, including but not limited to: light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.08 EXTRA MATERIALS

- A. Deliver extra materials to OWNER. Extra materials are to be packaged with protective covering for storage and identified with labels describing contents.

1.09 WARRANTY

- A. Warranty period:
 - 1. Grid and ceiling tile: 15 – year minimum from date of substantial completion.

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ACOUSTICAL TILE CEILINGS

- B. The warranty shall not deprive the OWNER of other rights the OWNER may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the CONTRACTOR under the requirements of the Contract Documents.

PART 2 - PRODUCTS

- 2.01 Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- A. Ceiling tile units:
 - 1. Armstrong World Industries, Inc.
 - 2. USG Interiors, Inc.
 - 3. Chicago Metallic Corporation
- B. Suspension Systems:
 - 1. Armstrong World Industries, Inc.
 - 2. USG Interiors, Inc.
 - 3. Chicago Metallic Corporation

2.02 ACOUSTICAL TILES, GENERAL

- A. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance, unless otherwise indicated.
- B. Acoustical Tile Colors and Patterns: Match appearance characteristics indicated for each product type.
- C. Tile Characteristics: Comply with requirements indicated in the Acoustical Tile Ceiling Schedule at the end of Part 3, including those referencing ASTM E 1264 classification.

2.03 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements: Armstrong Prelude 15/16-inch exposed tee grid system as indicated, or equivalent.
- B. Suspension System: Intermediate; non-fire rated; exposed T components die cut and interlocking; size as specified; commercial quality cold rolled hot dipped galvanized steel; double web construction; baked polyester paint finish. Light gauge steel cross tees shall have rotary stitches to improve column strength and staked on end detail allowing easy cross tee removal and remounting.
- C. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and

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ACOUSTICAL TILE CEILINGS

designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

- D. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated.
- E. Support Channels and Hangers: Galvanized carbon steel; size and type to suit application to rigidly secure acoustic ceiling system including integral mechanical and electrical components.

2.04 TILE UNIT MATERIALS:

- A. Acoustic tile (ACT-1): Armstrong "Fine Fissured" #1820, or equivalent, with Prelude 15/16-inch tee grid; humidity resistant Humigard Plus performance; Bio-block paint on face and back to inhibit mold and mildew growth:
 - 1. Size: 24-inch x 24-inch
 - 2. Thickness: 3/4-inch
 - 3. Composition: Mineral fiber
 - 4. Average Light reflectance: 0.85
 - 5. NRC: 0.70 Acoustical performance
 - 6. CAC: 35
 - 7. AC: N/A
 - 8. Fire hazard classification: Class A
 - 9. Edge: Angled tegular
 - 10. Surface color: white
 - 11. Surface finish: Medium texture; non-directional pattern
- B. Acoustic tile (ACT-2): "Armstrong Fine Fissured Ceramaguard" Un-perforated #605 with Prelude 15/16-inch tee grid, or equivalent; humidity resistant: Humigard Max performance; totally inorganic material to resist the growth of mold and mildew; washable, scrub-able and soil-resistant. To be provided in areas prone to moisture.
 - 1. Size: 24-inch x 24-inch
 - 2. Thickness: 5/8-inch
 - 3. Composition: Ceramic and mineral fiber composite
 - 4. Light reflectance: 0.88
 - 5. NRC: N/A
 - 6. CAC: 40
 - 7. Fire hazard classification: Class A
 - 8. Edge: Square lay-in
 - 9. Surface color: white
 - 10. Surface finish: Medium texture; non-directional pattern

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and structural framing to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this

SECTION 09512

ACOUSTICAL TILE CEILINGS

and other Sections that affect ceiling installation and anchorage, and other conditions affecting performance of acoustical tile ceilings.

1. Proceed with installation only after unsatisfactory conditions have been corrected.
2. Beginning of installation means installer accepts conditions.

3.02 PREPARATION

- A. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other Sections.
 1. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordinating other work. Provide additional hangers and inserts as required.
- B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width units at borders and comply with layout shown on reflected ceiling plans.

3.03 INSTALLATION

- A. General: Install acoustical tile ceilings to comply with ASTM C636, manufacturer's written instructions and as supplemented in this section.
- B. Suspend ceiling hangers from building's structural members and as follows:
 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 2. Install system capable of supporting imposed load to a deflection of 1/360 of the span.
 3. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, counter splaying, or other equally effective means.
 4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure; that are appropriate for substrate; and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.

SECTION 09512

ACOUSTICAL TILE CEILINGS

7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, powder-actuated fasteners, or drilled-in anchors that extend through forms into concrete.
 8. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 9. Do not attach hangers to steel deck tabs.
 10. Do not attach hangers to steel roof deck. Attach hangers to structural members
 11. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 8 inches from ends of each member.
 12. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Install edge moldings at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical units.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Arrange colored/patterned acoustical tiles as indicated on reflected ceiling plans, if applicable.
- F. Center system on room axis leaving equal border units unless shown otherwise on the reflected ceiling plan.
- G. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.
1. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile.
 2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tile and moldings, spaced 12 inches o.c.
- H. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
- I. Install hold down clips to retain panels tight to grid system within 20'-0" of an exterior door.

SECTION 09512

ACOUSTICAL TILE CEILINGS

3.04 CLEANING

- A. Clean exposed surfaces of acoustical tile ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

PART 4 – SCHEDULE

4.01 ACOUSTICAL TILE CEILING SCHEDULE

- A. Provide ACT-1 in white standard steel grid in all rooms noted on reflected ceiling plans as having acoustic ceiling tile, except as noted below.
- B. Provide ACT-2 in restroom areas and rooms as noted on the reflected ceiling plan.
- C. Coordinate the penetration of the acoustical ceiling where ducts are noted to be vented, refer to reflected ceiling plan. Provide escutcheon rings to create a finished installation. No exposed raw edges of acoustical tile will be accepted.

NOTE: Finishes to be selected/verified upon receipt of submittals and shop drawings. Upon receipt of all interior finish submittals by the Architect, colors will be selected.

END OF SECTION 09512

SECTION 09651

RESILIENT BASE

PART 1 - GENERAL

1.01 SUMMARY

- A. Description of Scope and Intent:
 - 1. CONTRACTOR shall provide all material, labor, and tools required to complete the installation of specified system.
 - 2. Any omission of reference to items required to complete the full operational and functional system specified in the section does not relieve the contractor of the obligation to provide same.
 - 3. To provide installation of all items, including delivery, dispersing to the proper locations within the building, and affixing in place.
 - 4. Installation shall be accomplished by workers skilled in their craft that will perform their work in a professional manner and will leave the premises safe, orderly and clean.
 - 5. Drawings and general provisions of Contract, including JEA Conditions and Division 1 Specification Sections, apply to this Section
 - 6. CONTRACTOR is responsible for coordination of work included in this specification with all other specification sections related to furnishing of all materials, labor, permits, fees and services necessary for completion of work in this section.
 - 7. In the event of a conflict between the design drawings, referenced standards and these Specifications, the more stringent shall govern unless directed otherwise by the Architect. CONTRACTOR shall strictly adhere to OSHA requirements and local codes or those of any regulatory agency or body with jurisdiction
- B. This Section includes the following:
 - 1. Resilient base.

1.02 SUBMITTALS

- A. Provide submittals in accordance with Section 01300.
- B. Product Data: For each type of product indicated.
- C. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design Product: Subject to compliance with requirements, provide Johnsonite product indicated on the drawings or comparable product by one of the following:
 - 1. Armstrong World Industries, Inc.
 - 2. Mondo Rubber International, Inc.
 - 3. Nora Systems, Inc.

SECTION 09651

RESILIENT BASE

- B. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).
 - 1. Group: I (solid, homogeneous).
 - 2. Style A, Straight.
- C. Thickness: 1/8 inch.
- D. Height: 6 inches.
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside corners: Job formed.
- G. Inside corners: Job formed.
- H. Colors: As selected by Architect from manufacturer's standard colors.

2.02 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are the same temperature as the space where they are to be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.02 INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, and other permanent fixtures in rooms and areas where base is indicated on the drawings.

SECTION 09651

RESILIENT BASE

- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. Job-Formed corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a) Form without producing discoloration (whitening) at bends.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - b) Miter or cope corners to minimize open joints.

3.03 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

END OF SECTION 09651

SECTION 09772
FRP WALL PANELS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Prefinished polyester glass reinforced plastic sheets and adhered to unfinished gypsum wallboard.
 - 1. PVC trim.
- B. Products Not Furnished or Installed under This Section:
 - 1. Gypsum substrate board.
 - 2. Resilient Base.

1.02 RELATED SECTIONS

- A. Section 09260 – Gypsum Wallboard Assemblies
- B. Section 05500 – Metal Fabrications
- C. Section 09900- Painting

1.03 REFERENCES

- A. American Society for Testing and Materials: Standard Specifications (ASTM)
 - 1. ASTM D 256 - Izod Impact Strengths (ft #/in)
 - 2. ASTM D 570 - Water Absorption (%)
 - 3. ASTM D 638 - Tensile Strengths (psi) & Tensile Modulus (psi)
 - 4. ASTM D 790 - Flexural Strengths (psi) & Flexural Modulus (psi)
 - 5. ASTM D 2583- Barcol Hardness
 - 6. ASTM D 5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
 - 7. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

- A. Provide all submittals in accordance with Section 01300.
- B. Product Data: Submit sufficient manufacturer's data to indicate compliance with these specifications, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings: Submit elevations of each wall showing location of paneling and trim members with respect to all discontinuities in the wall elevation.

SECTION 09772

FRP WALL PANELS

- D. Selection Samples: Submit manufacturer's standard color pattern selection samples representing manufacturer's full range of available colors and patterns.
- E. Samples for Verification: Submit appropriate section of panel for each finish selected indicating the color, texture, and pattern required.
 - 1. Submit complete with specified applied finish.
 - 2. For selected patterns show complete pattern repeat.
 - 3. Exposed Molding and Trim: Provide samples of each type, finish, and color.
- F. Manufacturers Material Safety Data Sheets (MSDS) for adhesives, sealants and other pertinent materials prior to their delivery to the site.

1.05 QUALITY ASSURANCE

- A. Conform to building code requirements for interior finish for smoke and flame spread requirements as tested in accordance with:
 - 1. ASTM E 84 (Method of test for surface burning characteristics of building Materials)
 - a. Wall Required Rating – Class A.
- B. Sanitary Standards: System components and finishes to comply with:
 - 1. United States Department of Agriculture (USDA) requirements for food preparation facilities, incidental contact.
 - 2. Food and Drug Administration (FDA) 1999 Food Code 6-101.11.
 - 3. Canadian Food Inspection Agency (CFIA) requirements.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials factory packaged on strong pallets.
- B. Store panels and trim lying flat, under cover and protected from the elements. Allow panels to acclimate to room temperature (70°) for 48 hours prior to installation.

1.07 PROJECT CONDITIONS

- A. Environmental Limitations: Building are to be fully enclosed prior to installation with sufficient heat (70°) and ventilation consistent with good working conditions for finish work
- B. During installation and for not less than 48 hours before, maintain an ambient temperature and relative humidity within limits required by type of adhesive used and recommendation of adhesive manufacturer.
 - 1. Provide ventilation to disperse fumes during application of adhesive as recommended by the adhesive manufacturer.

SECTION 09772
FRP WALL PANELS

1.08 WARRANTY

- A. Furnish one year guarantee against defects in material and workmanship.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

- A. Basis of design Manufacturer: Subject to compliance with requirements, provide the following or an approved equal:
1. Marlite
- B. Product:
1. Standard FRP

2.02 PANELS

- A. Fiberglass reinforced thermosetting polyester resin panel sheets complying with ASTM D 5319.
1. Coating: Multi-layer print, primer and finish coats or applied over-layer.
 2. Dimensions:
 - a. Thickness – 0.090-inch (2.29 mm) nominal
 - b. Width – 4-foot (1.22 m) nominal
 - c. Length – 8-foot (2.4 m) nominal
 3. Tolerance:
 - a. Length and Width: +/-1/8-inch (3.175mm)
 - b. Square - Not to exceed 1/8-inch for 8 foot (2.4m) panels
- B. Properties: Resistant to rot, corrosion, staining, denting, peeling, and splintering.
1. Flexural Strength - 1.0×10^4 psi per ASTM D 790. (7.0 kilogram-force/square millimeter)
 2. Flexural Modulus - 3.1×10^5 psi per ASTM D 790. (217.9 kilogram-force/square millimeter)
 3. Tensile Strength - 7.0×10^3 psi per ASTM D 638. (4.9 kilogram-force/square millimeter)
 4. Tensile Modulus - 1.6×10^5 psi per ASTM D 638. (112.5 kilogram-force/square millimeter)
 5. Water Absorption - 0.72% per ASTM D 570.
 6. Barcol Hardness (scratch resistance) of 35 55 as per ASTM D 2583.
 7. Izod Impact Strength of 72 ft. lbs./in ASTM D 256
- C. Back Surface: Smooth. Imperfections which do not affect functional properties are not cause for rejection.
- D. Front Finish: In accordance with preapproved sample.
1. Color: To be chosen from Manufacturer's available standard colors.
 2. Surface: Manufacturer's standard FRP surface textures.

SECTION 09772

FRP WALL PANELS

3. Fire Rating: Class A
4. Coverage of FRP Panels: As indicated on Architectural drawings.

2.03 BASE

- A. Manufacturer's standard Base Molding for 0.090-inch (2.29 mm) thick FRP Panels
 1. Color: Black.

2.04 MOLDINGS

- A. PVC Trim: Thin-wall semi-rigid extruded PVC.
 1. Inside Corner, 10-ft length
 2. Outside Corner, 10-ft length
 3. Division, 10-ft length
 4. Edge, 10-ft length
 5. Color: Match panel colors.
- B. Outside Corner Guard:
 1. Stainless Corner Guard, 10-ft length
 2. Finish: #4 brushed satin

2.05 ACCESSORIES

- A. Fasteners: Non-staining nylon drive rivets.
 1. Match panel colors.
 2. Length to suit project conditions.
- B. Adhesive: Either of the following construction adhesives complying with ASTM C 557.
 1. FRP Adhesive - Water- resistant, non-flammable adhesive.
 2. Construction Adhesive - Flexible, water-resistant, solvent based adhesive, formulated for fast, easy application.
- C. Sealant:
 1. Color Match Sealant.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails countersunk, joints and cracks filled flush and smooth with the adjoining surface.
 1. Verify that stud spacing does not exceed 24" (61cm) on-center.
- B. Repair defects prior to installation.
 1. Level wall surfaces to panel manufacturer's requirements. Remove protrusions and fill indentations.

SECTION 09772

FRP WALL PANELS

3.02 INSTALLATION

- A. Comply with manufacturer's recommended procedures and installation sequence.
- B. Cut sheets to meet supports allowing 1/8-inch (3 mm) clearance for every 8 foot (2.4 m) of panel.
 - 1. Cut and drill with carbide tipped saw blades or drill bits, or cut with shears.
 - 2. Pre-drill fastener holes 1/8" (3 mm) oversize with high speed drill bit.
 - a. Space at 8-inch (200 mm) maximum on center at perimeter, approximately 1-inch from panel edge.
 - b. Space at in field in rows 16-ft (40.64 cm) on center, with fasteners spaced at 12-inch (30.48 cm) maximum on center.
- C. Apply panels to board substrate, above base, vertically oriented with seams plumb and pattern aligned with adjoining panels.
 - 1. Install panels with manufacturer's recommended gap for panel field and corner joints.
 - a. Adhesive trowel and application method to conform to adhesive manufacturer's recommendations.
 - b. Drive fasteners for snug fit. Do not over-tighten.
- D. Apply panel moldings to all panel edges using silicone sealant providing for required clearances.
 - 1. All moldings must provide for a minimum 1/8-inch (3mm) of panel expansion at joints and edges, to insure proper installation.
 - 2. Apply sealant to all moldings, channels and joints between the system and different materials to assure watertight installation.

3.03 CLEANING

- A. Remove excess sealant from panels and moldings. Wipe panel down using a damp cloth and mild soap solution or cleaner.
- B. Refer to manufacturer's specific cleaning recommendations Do not use abrasive cleaners.

END OF SECTION 09772

SECTION 09900

PAINTING

PART 1 - GENERAL

1.01 SCOPE

- A. Perform all work necessary and required for completion of the project as indicated. Work includes furnishing all materials and equipment and the application and completion of all painting and painter's finish on all exposed exterior and interior surfaces as required to complete the finishing as shown and noted on the Drawings and specified herein.
- B. The grade and number of coats of paint to be applied at assigned locations and on different materials; and the kind of materials to be supplied shall conform to this section.
- C. Refer to Section 13216 for specific external and internal ground storage tank coating requirements.

1.02 SUBMITTALS

- A. Type of material to be applied at each location shall be submitted to the ENGINEER with the manufacturer's written recommendation of the type of paint for each item to be painted. The submittal shall include a "Paint Color Schedule" as specified herein.
- B. All colors will be selected by the OWNER from color chips to be submitted by the CONTRACTOR.
- C. The paint manufacturer's submittal shall include a "Paint Color Schedule" of the format shown below, listing all information indicated for each item to be painted:

PAINT COLOR SCHEDULE

Structure	Surface	Dwg. No.	Manufacturer's Product for Final Coat	Color Selection (By Owner)
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1.03 PRODUCT HANDLING

- A. All painting materials shall be delivered to the site in the manufacturer's original containers with labels intact and seals unbroken. They shall be kept in a locked, well-ventilated storage place assigned for this purpose. Receiving, opening, and mixing of all paint materials shall be done in this room. Storage space shall be kept clean and neat. Oily rags shall be removed and disposed of each day, and all other necessary precautions shall be taken to avoid danger of fires.

1.04 ENVIRONMENTAL CONDITIONS

- A. Surfaces shall be painted only when they are free from moisture. No painting on exterior surfaces shall be done within less than 72 hours of actual drying weather after a rain, nor during periods of dew or fog. Receiving surfaces shall be properly

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PAINTING

dried out before proceeding with the work. No painting shall be done when temperature is below 50 degrees F., except when specifically authorized otherwise in writing by the ENGINEER. Clear sealer shall not be applied when air temperature is less than 70 Degrees F. Moisture in walls shall be registered with a meter to determine if they are moisture free. When manufacturer's require minimum humidity limits for application of paint, CONTRACTOR shall provide and maintain records of conditions when applications are made.

1.05 SCAFFOLDING AND PROTECTION

- A. Furnish, maintain and remove all scaffolding, ladders and planks required for this work, and all drop cloths for the protection of concrete walks, floors, prefinished materials, building fixtures, etc. Painted and finished surfaces subject to damage or defacement due to other work on the building shall be properly protected and covered. CONTRACTOR shall be responsible for any and all damage to painted work and to that of other work caused by operations under this section. All surfaces not to be painted shall be kept entirely free of paint by adequate temporary coverage including areas a minimum of 1 inch from joints to subsequently be welded in material coated with zinc base coatings.

1.06 WORK IN CONFINED SPACES

- A. The CONTRACTOR shall provide and maintain safe working conditions for all employees in all spaces as required by OSHA. Fresh air ventilation shall be provided to continuously remove paint fumes from the confined spaces through the combined use of existing openings, forced-draft fans and temporary ducts to the outside. Paint fumes shall, if possible, be exhausted to the outside from the lowest level in the confined space. Electrical fan motors shall, if located in the confined space, be explosion proof. No smoking or open fires will be permitted in the confined space.

1.07 COMPATIBILITY OF SHOP AND FIELD PAINTS

- A. To ensure a satisfactory painting job, it is essential that the paints applied in the shop and in the field be mutually compatible. The shop coats to be applied by others shall be suitable for the field coats to be applied under this Contract.

1.08 GUARANTEE

- A. Paint on all piping systems and interior and exterior concrete masonry units shall be guaranteed for five (5) years.

1.09 APPLICATOR QUALIFICATIONS

- A. The coating application contractor shall be trained in application techniques and procedures of coating materials and shall demonstrate a minimum of 5 years successful experience in such application. The prime contractor shall provide the following references:

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PAINTING

1. 5 Water/Wastewater Treatment Facilities that have been in service for at least 5 years. The projects shall have had been of the same size and scope as the current project. The projects must have utilized the same surface preparation and application techniques required by these project specifications. All references shall include the following information:
 - a. Name of Project
 - b. Project Location
 - c. Owner Name
 - d. Owner Address
 - e. Owners Phone Number
 - f. Owner Contact
 - g. Engineering Firm
 - h. Engineering Firm Address and Phone Number
 - i. Engineering Firm Contact
- B. The CONTRACTOR shall provide the following information regarding the personnel performing the work:
 - a. Project foreman name
 - b. Project foreman experience in high performance coating application
 - c. Projects completed by the foreman of like scope in the last 5 years.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. The paints and paint products of the *Themec Company, Inc.*, mentioned in the following specifications are considered to be the design standard for this work. Other acceptable manufacturers are Corrocoat, Sherwin Williams, or PPG. No request for substitution will be considered which decreases the film thickness and/or the number of coats to be applied, or which offers a change from the generic type of coating specified. Request for substitution shall contain the following:
 1. FULL NAME OF EACH PRODUCT
 2. DESCRIPTIVE LITERATURE
 3. DIRECTIONS FOR USE
 4. GENERIC TYPE
 5. NON VOLATILE CONTENT BY VOLUME
 6. PERFORMANCE DATA LISTED IN SECTION 2.03.
- B. Bidders desiring to use coating materials other than those specified shall submit their proposal based on the specified materials. Submittals shall include a side by side comparison of the performance attributes of the proposed materials as compared to the specified coatings. In no case will the request be considered unless all information is received, in writing, ten days prior to the bid opening date.
- C. Products of other manufacturers may be acceptable provided that they meet the generic type of material specified and the performance requirements outlined in Section 2.03 of these specifications.

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PAINTING

2.02 SUBSTITUTIONS

- A. Comply with the General Conditions, and the requirements of Section 2.01 and Section 2.03 when requesting substitutions.
- B. Obtain review and approval prior to purchase and delivery.

2.03 COATING MATERIALS

- A. Tnemec Series 1 Omnithane
 - 2. Generic Type: NSF Approved Aromatic Moisture Cured Urethane Primer
 - 3. Special Qualifications: Certified in accordance with NSF/ANSI std 61 for potable water applications.
 - 4. Performance Criteria
 - d. Adhesion: ASTM D 4541.
 - e. Humidity: ASTM D 4585. 5,000 hours exposure.
 - f. Salt Spray (Fog): ASTM B 117. 10,250 hours exposure
 - g. Impact: ASTM D 2794.
- B. Tnemec 91 H20 Hydro-Zinc
 - 1. Generic Type: Moisture Cured Zinc Rich Urethane
 - 2. Special Qualifications: Certified in accordance with NSF/ANSI std 61 for potable water applications.
 - 3. Zinc Dust: ASTM D520 Type III
 - 4. Performance Criteria:
 - a. Adhesion: ASTM D4541 (Elcometer):
 - b. Immersion: ASTM D 870. 7 years
 - c. Humidity: ASTM D 4585. 4,000 hours exposure.
 - d. Salt Spray (Fog): ASTM B 117: 50,000 hours exposure.
 - e. Prohesion: ASTM G 85. 15,000 hours.
- C. Tnemec Series N140 Pota-Pox Plus
 - 1. Generic Type: Polyamidoamine Epoxy.
 - 2. Special Qualifications: Certified in accordance with NSF/ANSI std 61 for potable water applications.
 - 3. Performance Criteria:
 - a. Abrasion; ASTM D4060, (CS-17 Wheel, 1,000 grams load, 1,000 cycles):
 - b. Adhesion: ASTM D4541 (Elcometer):
 - c. Immersion: ASTM D 870. 2 years
 - d. Exterior Exposure: 5 years
 - e. Humidity: ASTM D 4585. 10,000 hours exposure.
 - f. Salt Spray (Fog): ASTM B 117: 10,000 hours exposure.
 - g. Moisture Vapor Transmission: ASTM D 1653
 - h. Prohesion: ASTM G 85. 5,000 hours.
- D. Tnemec Series FC22 Epoxoline
 - 1. Generic Type: Modified Amine Epoxy
 - 2. Special Qualifications: Certified in accordance with NSF/ANSI std 61 for potable water applications.

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3. Performance Criteria:
 - i. Abrasion; ASTM D4060, (CS-17 Wheel, 1,000 grams load, 1,000 cycles):
 - j. Adhesion: ASTM D4541 (Elcometer):
 - k. Immersion: ASTM D 870. 2 years
 - l. Immersion: ASTM D 870 – DI Water; 2,000 hours
 - m. Humidity: ASTM D 4585. 4,000 hours exposure.
 - n. Salt Spray (Fog): ASTM B 117: 10,000 hours exposure.
 - o. Moisture Vapor Transmission: ASTM D 1653
 - p. Cathodic Disbondment: ASTM G 8 (1.5v)
 - q. Edge Retention: MIL-PRF 23236
- E. Tnemec Series 66 Epoxoline
 1. Generic Type: Polyamide Epoxy.
 2. Performance Criteria:
 - a. Abrasion; ASTM D4060, (CS-17 Wheel, 1,000 grams load, 1,000 cycles):
 - b. Adhesion: ASTM D4541 (Elcometer):
 - c. Immersion: ASTM D 870. 7 years
 - d. Exterior Exposure (45 degrees facing south): 6 years
 - e. Humidity: ASTM D 4585. 4,500 hours exposure.
 - f. Salt Spray (Fog): ASTM B 117: 10,000 hours exposure.
 - g. Moisture Vapor Transmission: ASTM D 1653
 - h. Prohesion: ASTM G 85. 5,000 hours.
- F. Tnemec Series 156 Enviro-Crete
 1. Generic Type: Modified waterborne acrylate
 2. Performance Criteria:
 - a. Adhesion; ASTM D3359, (Method B, Crosshatch):
 - b. Freeze/Thaw; ASTM D2246: 15 cycles.
 - c. Freeze/Thaw; ASTM D2246: 20 cycles.
 - d. Fungal Resistance; ASTM D3273:
 - e. Humidity; ASTM D4585: 2,000 hours exposure.
 - f. Moisture Vapor Transmission; ASTM D1653
 - g. QUV Exposure; ASTM G53. 4,000 hours exposure
- G. Tnemec Series 297 Enviro-Glaze
 1. Generic Type: Ceramic Modified Waterborne Aliphatic Urethane
 2. Performance Criteria:
 - a. Abrasion; ASTM D4060, (CS-17 Wheel, 1,000 grams load, 1,000 cycles):
 - b. Adhesion: ASTM D4541 (Elcometer):
 - c. Coefficient of Friction: ASTM D 2047
 - d. Flexibility: ASTM D 522 (Method A)
 - e. Impact: ASTM D 2794.
 - f. Scrubbability: ASTM D 4213 (1,000 cycles)
 - g. Moisture Vapor Transmission: ASTM D 1653
 - h. Steam Resistance: 250 F steam @ 15 – 17 psi. 4 hours.

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- H. Thnemec Series 434 Perma-Shield H2S
1. Generic Type: 100% Solids Modified Amine Epoxy
 2. Performance Criteria:
 - a. Abrasion; ASTM D4060, (CS-17 Wheel, 1,000 grams load, 1,000 cycles):
 - b. Adhesion: ASTM D4541 (Elcometer):
 - c. Immersion (140 F DI Water): ASTM D 870. 2,000 hours.
 - d. Severe Waste Water Analysis Test: H2S Autoclave (150F, 500 ppm H2S, 4,000 ppm NaCl, 10% H2SO4). 28 days exposure:
 - e. Salt Spray (Fog): ASTM B 117: 10,000 hours exposure.
 - f. Moisture Vapor Transmission: ASTM D 1653
 - g. Tensile Strength: ASTM D 2370
 - h. Water Absorption: ASTM C 413
 - i. Elongation: ASTM D 638
 - j. Chemical Immersion: NACE TM 0174 (5% Acetic Acid, 10% Sulfuric Acid, 20% Lactic Acid, 50% Citric Acid, 5% Nitric Acid, 5% Calcium Hydroxide)
- I. Thnemec Series 435 Perma-Glaze
1. Generic Type: 100% Solids Modified Amine Epoxy
 2. Performance Criteria:
 - a. Abrasion; ASTM D4060, (CS-17 Wheel, 1,000 grams load, 1,000 cycles):
 - b. Adhesion: ASTM D4541 (Elcometer):
 - c. Immersion (140 F DI Water): ASTM D 870. 2,000 hours.
 - d. Severe Waste Water Analysis Test: H2S Autoclave (150F, 500 ppm H2S, 4,000 ppm NaCl, 10% H2SO4). 28 days exposure:
 - e. Salt Spray (Fog): ASTM B 117: 10,000 hours exposure.
 - f. Moisture Vapor Transmission: ASTM D 1653
 - g. Tensile Strength: ASTM D 2370
 - h. Water Absorption: ASTM C 413
 - i. Elongation: ASTM D 638
 - j. Chemical Immersion: NACE TM 0174 (5% Acetic Acid, 10% Sulfuric Acid, 20% Lactic Acid, 50% Citric Acid, 5% Nitric Acid, 5% Calcium Hydroxide)
- J. Thnemec Series 142 Epoxoline
1. Generic Type: Modified Polyamine Epoxy
 2. Performance Criteria:
 - a. Abrasion; ASTM D4060, (CS-17 Wheel, 1,000 grams load, 1,000 cycles):
 - b. Adhesion: ASTM D4541 (Elcometer):
 - c. Cyclic Salt Fog/UV Exposure: ASTM D 5894, 5,000 hours
 - d. Edge Retention: MIL-PRF-23236, average of 3 tests
 - e. Flexibility & Elongation: ASTM D 522 (Method A, Conical Mandrel)
 - f. Hardness: ASTM D 2240: Shore D Hardness
 - g. Humidity: ASTM D 4585. 2,000 hours
 - h. Immersion (140 F DI Water): ASTM D 870. 1,000 hours.
 - i. Immersion (Tap Water): ASTM D 870, 2 years.
 - j. Salt Spray (Fog): ASTM B 117. 5,000 hours.

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- K. Thnemec - Series 1074U Endura-Shield II
1. Generic Type: Aliphatic Acrylic Urethane
 2. Performance Criteria:
 - a. Abrasion; ASTM D4060, (CS-17 Wheel, 1,000 grams load):
 - b. Adhesion; ASTM D4541 (Elcometer):
 - c. Exterior Exposure; ASTM D 1014 (EMMAQUA): 500 MJ/m2 UV exposure.
 - d. Humidity; ASTM D4585 1,500 hours exposure.
 - e. QUV Exposure; ASTM D 4587. 7,000 hours
 - f. Salt Spray (Fog); ASTM B117: 5,000 hours exposure.
 - g. Flexibility: ASTM D 522 (Method A)
- L. Thnemec Series 113 Tneme-TufCoat
1. Generic Type: Waterborne Acrylic Epoxy.
 2. Performance Criteria:
 - a. Abrasion; ASTM D4060, (CS-17 Wheel, 1,000 grams load):
 - b. Adhesion; ASTM D4541 (Elcometer):
 - c. Exterior Exposure (45 degrees facing south): 3 years
 - d. Humidity; ASTM D4585 1,000 hours exposure.
 - e. Scrubbability: ASTM D 4213, 1,000 cycles.
 - f. Stain Resistance: ASTM D 1308.
 - g. Flexibility: ASTM D 522 (Method A)
- M. Thnemec Series 37H-77 Chem-Prime
1. Generic Type: Modified Phenolic Rust Inhibitive Primer
 2. Performance Criteria:
 - a. Abrasion; ASTM D4060, (CS-17 Wheel, 500 grams load):
 - b. Adhesion; ASTM D4541 (Elcometer):
 - c. Salt Spray (Fog); ASTM B 117, 275 hours
 - d. Exterior Exposure; Exposed 45°Facing South): 3 years exposure exposure.
 - e. Humidity; ASTM D4585 2,000 hours exposure.
- N. Thnemec Series 239SC Chem Bloc SC
1. Generic Type: 100% Modified Novolac Polyamine Epoxy
 2. Performance Criteria:
 - a. Abrasion; ASTM D4060, (CS-17 Wheel, 1,000 grams load, 1,000 cycles):
 - b. Adhesion: ASTM D4541 (Elcometer):
 - c. Compressive Strength; ASTM C 579.
 - d. Flexural Strength and Modulus of Elasticity; ASTM D790
 - e. Impact: MIL D 3134 (modified using 2.5lb Steel Ball):
 - f. Tensile Strength, Elongation and Modulus of Elasticity: ASTM C 307 and ASTM D 638
 - g. Water Absorption: ASTM C 413
 - h. Chemical Immersion: NACE TM 01-74, Procedure B (Aluminum Chloride, Hydrogen Peroxide 30%, Ammonium Hydroxide 5-50%, Bromine 5%, Calcium Hypochlorite 5%, Potassium Permanganate, Phosphoric Acid 10-85%, Sodium Hydroxide 10-50%, Citric Acid 5-50%,

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Sulfuric Acid 10-95%, Methanol Ferric Chloride 5-43%, Sodium Fluoride, Sodium Silicofluoride)

- O. Tnemec Series 282 Tneme-Glaze
 - 1. Generic Type: 100% Modified Novolac Polyamine Epoxy
 - 2. Performance Criteria:
 - a. Abrasion; ASTM D4060, (CS-17 Wheel, 1,000 grams load, 1,000 cycles):
 - b. Adhesion: ASTM D4541 (Elcometer):
 - c. Immersion - 140°DI Water; 2,000 hours
 - d. Humidity; ASTM D 4585; 2,000 hours
 - e. Tensile Strength, Elongation and Modulus of Elasticity: ASTM C 307 and ASTM D 638
 - f. Chemical Immersion: NACE TM 01-74, Procedure B (Sulfuric Acid 95%, Xylene, Soda Ash 99%, Chromic Acid 40%, Varsol Calcium Hydroxide 5%, Ferric Chloride 43%, Propylene Glycol, Isopropyl Alcohol, Calcium Oxide 1%, Methyl Amyl Ketone Butanol, Sodium Hydroxide 50%, Hydrochloric Acid 30%, Toluene, Calcium Hypochlorite 5%, Aluminum Oxide 5%, Butyl Acetate, Citric Acid 5%, Copper Sulfate 98%, Methyl Isobutyl Ketone, Benzyl Alcohol, Sodium Hypochlorite 13%)
- P. Tnemec Series 218 MortarClad
 - 1. Generic Type: 100% Epoxy Mortar
 - 2. Performance Criteria:
 - a. Bond Strength: ASTM C 882
 - b. Compressive Strength; ASTM C 579
 - c. Freeze - Thaw: ASTM 666 Procedure A: 308 Cycles
 - d. Thermal Expansion; ASTM C 531
 - e. Tensile Strength, Elongation and Modulus of Elasticity: ASTM C 307 and ASTM D 638
- Q. Tnemec Series 130 EnviroFill
 - 1. Generic Type: Waterborne Cementitious Acrylic
 - 2. Performance Criteria:
 - a. Adhesion; ASTM D3359, (Method B, Crosshatch):
 - b. Freeze/Thaw; TTM 058, Method D: 30 cycles.
 - c. Humidity; ASTM D4585: 1,500 hours exposure.
 - d. Wind Driven Rain; TT-C-555B, 4.4.7.3; 24 hours
- R. Tnemec Series 135 Chembuild
 - 1. Generic Type: Polyamidoamine.
 - 2. Performance Criteria:
 - a. Abrasion; ASTM D4060, (CS-17 Wheel, 1,000 grams load, 1,000 cycles):
 - b. Adhesion: ASTM D4541 (Elcometer): Rusty Steel, SSPC-SP2 Cleaned
 - c. Flexibility: ASTM D 522 (Method B)
 - d. Humidity: ASTM D 4585. 2,000 hours exposure.
 - e. Salt Spray (Fog): ASTM B 117: SSPC-SP 2 Cleaned Uniformly Rusty Steel, 4,000 hours exposure.

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- f. Moisture Vapor Transmission: ASTM D 1653
 - g. Prohesion: ASTM G 85. 10,000 hours.
- S. Tnemec Series 115 Uni-Bond
 - 1. Generic Type: Waterborne Cementitious Acrylic
 - 2. Performance Criteria:
 - a. Adhesion; ASTM D4541
 - b. Abrasion: ASTM D 4060
 - c. Cyclic Salt Fog/UV Exposure: ASTM D 5894, 7,000 hours
 - d. Salt Spray (Fog): ASTM B117.
 - e. Humidity; ASTM D4585: 2,000 hours exposure.
- T. Tnemec Series 264 Elasto-Shield
 - 1. Generic Type: Modified Polyurethane Liner (NSF Approved)
 - 2. Performance Criteria:
 - a. Abrasion; ASTM D4060, (CS-17 Wheel, 1,000 grams load, 1,000 cycles):
 - b. Adhesion: ASTM D4541 (Elcometer):
 - c. Impact: ASTM 2794
 - d. Mullen Burst Strength: ASTM D 751
 - e. Deflection Temperature: ASTM D 648
 - f. Hydrolytic Stability: Retention of Tensile Strength, four hours, saturated steam – pressure cooker at 15 psi, 250°F.
 - g. Open Flame Carbon Arc: ASTM D 822
 - h. Tear Strength: ASTM D 624
 - i. Tensile Strength, Elongation, Modulus of Elasticity: Retention to Break and psi
 - j. Water Vapor Transmission: ASTM E 96
 - k. Hardness: ASTM D 2240: Shore D Hardness
 - l. Humidity: ASTM D 4585. 2,000 hours
 - m. Salt Spray (Fog): ASTM B 117. 52000 hours.

2.04 COATING SCHEDULE EXTERIOR ENVIRONMENTS

- A. Exterior Steel Surfaces, Non-submerged
 - 1. Shop Primer – Series 91 H20 Hydro-Zinc (NSF approved zinc rich urethane primer), 2.5-3.5 mils.
 - 2. Field Primer – Series 91 H20 Hydro-Zinc (NSF approved zinc rich urethane primer), 2.5-3.5 mils.
 - 3. Intermediate Coat – 66 Epoxoline, 3.0-5.0 mils.
 - 4. Top Coat – Series 1074U or 1075U Endura-Shield II, 2.0-3.0 mils.
 - 5. Total Dry Film Thickness: 7.5 mils.
 - 6. Total Coats: Three (3)
- B. Exterior Steel Doors and Frames (Shop Primed), Interior and Exterior
 - 1. Exterior roll-up door coating, refer to Section 08331.
 - 2. Primer – Series 37H-77 Chem-Prime, 2.5-3.5 mils.
 - 3. Finish – Series 1074U or 1075U Endura-Shield II, two coats, 2.0 – 5.0 mils DFT per coat.
 - 4. Total Dry Film Thickness: 6.5 to 9.5 mils

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5. Total Coats: Three (3)
- C. Chemical Containment, Concrete, and Concrete Block
 1. Primer - Series 201 Epoxoprime, 6.0 – 8.0 mils DFT.
 2. Mortar – Series 239SC-MK ChemBloc SC, 60.0 – 80.0 mils DFT". Embed S211-0215 mat into base coat while still wet.
 3. Saturant – Series 239SC-RK ChemBloc, 8.0 – 12.0 mils DFT.
 4. Top Coat – Series 282 Tneme-Glaze, 8.0 – 12.0 mils DFT.
- D. Exterior and Interior Ductile Iron Pipe, Non-Submerged
 1. Shop Primer – Series N140-1211 Pota-Pox Plus (NSF approved polyamidoamine epoxy), 6.0 – 8.0 mils.
 2. Field Primer – Series N140-1211 Pota-Pox Plus (NSF approved polyamidoamine epoxy), 6.0 – 8.0 mils.
 3. Intermediate – Series 66 Epoxoline, 3.0-5.0 mils.
 4. Finish – Series 1074U Endura-Shield II, 2.0-3.0 mils
 5. Total Dry Film Thickness: 11.0 to 16.0 mils (Excluding Shop Primer).
 6. Total Coats: Three (3)
- E. All Exterior Concrete and CMU (New or Existing)
 1. Surface Preparation: See Section 3.02 / C. / 4.
 2. Primer/Surfacer: Apply one coat of Tnemec Series 218 and mortar clad to seal all surfaces and fill all bug holes, voids, and other defects – 1/16" minimum.
 3. Finish: Two (2) coats of Tnemec Series 156 Enviro-Crete applied at a rate to achieve 4.0 - 6.0 mils DFT per coat.
- F. Exterior Clay Masonry Substrates
 1. First Coat: Tnemec Series 626 Dur-A-Pell GS applied at 125 to 150 SF/Gallon.
 2. Second Coat: Tnemec Series 626 Dur-A-Pell GS applied at 125 to 150 SF/Gallon.
- G. Exterior Galvanized Substrates
 1. Surface Preparation: Abrasive blast referencing SSPC SP16 Abrasive Blasting Non-Ferrous Metals to provide uniform 1.0 mil angular anchor profile.
 2. First Coat: : Tnemec Series 27WB Typoxy applied at 6.0 to 8.0 mils DFT.
 3. Second Coat: Tnemec Series 1074U or 1075U Endura-Shield II applied at 2.0 to 3.0 mils DFT.
 4. Finish: Tnemec Series 1074U or 1075U Endura-Shield II applied at 2.0 to 3.0 mils DFT.
 5. Total Dry Film Thickness: 6.0 to 9.0 mils DFT.
 6. Total Coats: Three (3)
- H. Exterior Aluminum (Non-Anodized or Otherwise Coated) Substrates:
 1. Stripe Coat: Tnemec Series 66 Hi-Build Epoxoline applied at 2.0 to 3.0 mils DFT.
 2. Second Coat: Tnemec Series 66 Hi-Build Epoxoline applied at 2.0 to 3.0 mils DFT.

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3. Finish: Tnemec Series 1074U or 1075U Endura-Shield II applied at 2.0 to 5.0 mils DFT.
 4. Total Dry Film Thickness: 4.0 to 6.0 mils DFT.
 5. Total Coats: Three (3)
- I. Exterior Wood Substrates:
1. Prime Coat: Tnemec Series 10-99W Tnemec Primer applied at 1.0 to 2.0 mils DFT.
 2. Intermediate Coat: Tnemec Series 1028 or 1029 EnduraTone applied at 2.0 to 3.0 mils DFT.
 3. Finish: Tnemec Series 1028 or 1029 EnduraTone applied at 2.0 to 3.0 mils DFT.
 4. Total Dry Film Thickness: 5.0 to 8.0 mils DFT.
- J. Curing and Sealing Concrete Floors
1. All concrete floors in all rooms of each building shall be coated with a 100 percent acrylic water-based floor coating system. Basis of design is Armorseal Tread-Plex Heavy Duty Coating by Sherwin Williams.
- K. Parking Lot Paint
1. Paint shall be non-reflecting white paint conforming to Federal Specifications P115 (Exterior White).

2.05 COATING SCHEDULE – INTERIOR SYSTEMS ALL PLANT ENVIRONMENTS

- A. Interior Steel Doors and Frames (Shop Primed)
1. Primer – Series 37H-77 Chem-Prime, 2.5 to 3.5 mils.
 2. Finish – Series 2H Tnemec-Gloss, two coats, 2.0 to 3.0 mils DFT per coat.
 3. Total Dry Film Thickness: 6.5 to 9.5 mils
 4. Total Coats: Three (3)
- B. Interior Concrete Surfaces and Masonry Substrates:
1. Block Filler – Series 130 EnviroFill, as required to create a pinhole free surface.
 2. Intermediate Coat – Tnemec Series 113 or 114 Tnemec-TufCoat, 4.0 to 6.0 mils DFT.
 3. Finish – Tnemec Series 297 Enviro-Glaze, 2.0 to 3.0 mils DFT.
 4. Total Dry Film Thickness: 8.0 to 12.0 mils (not including block filler).
 5. Total Coats: Three (3)
- C. Interior Steel Substrates (Shop Primed):
1. Surface Preparation: Hand and Power Tool Clean referencing SSPC SP2 and SSPC SP3 as required to provide a clean, dry surface free of contaminants.
 2. Prime Coat – Tnemec Series 135 ChemBuild applied at 4.0 to 6.0 mils DFT.
 3. Finish – Tnemec Series 1074 or 1075 applied at 2.0 to 5.0 mils DFT.
 4. Total Dry Film Thickness: 6.0 to 11.0 mils (not including block filler).
 5. Total Coats: Two (2)

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- D. Interior Galvanized Substrates: (Structure & Miscellaneous)
 - 1. Prime Coat – Tnemec Series 135 ChemBuild applied at 2.0 to 3.0 mils DFT.
 - 2. Finish – Tnemec Series 1074 or 1075 applied at 2.0 to 5.0 mils DFT.
 - 3. Total Dry Film Thickness: 6.0 to 11.0 mils (not including block filler).
 - 4. Total Coats: Two (2)
- E. Interior Galvanized Substrates (Structural Metal Decking): Acrylic Dry-Fall
 - 1. Surface Preparation: Abrasive blast referencing SSPC SP-7 Brush Off Blast Cleaning.
 - 2. Prime Coat – Tnemec Series 115 Uni-Bond applied at 2.0 to 3.5 mils DFT.
 - 3. Finish – Tnemec Series 115 Uni-Bond applied at 2.0 to 3.5 mils DFT.
 - 4. Total Dry Film Thickness: 4.0 to 7.0 mils (not including block filler).
 - 5. Total Coats: Two (2)
- F. Interior Aluminum (Non-Anodized or Otherwise Coated) Substrates:
 - 1. Stripe Coat: Tnemec Series 66 Hi-Build Epoxoline applied at 4.0 to 6.0 mils DFT.
 - 2. Second Coat: Tnemec Series 66 Hi-Build Epoxoline applied at 4.0 to 6.0 mils DFT.
 - 3. Finish: Tnemec Series 1074 or 1075 Endura-Shield II applied at 2.0 to 5.0 mils DFT.
 - 4. Total Dry Film Thickness: 10.0 to 17.0 mils DFT.
 - 5. Total Coats: Three (3)
- G. Ductile Iron Pipe, Non-Submerged
 - 1. Shop Primer – Series N140-1211 Pota-Pox Plus (NSF approved polyamidoamine epoxy), 6.0 – 8.0 mils.
 - 2. Field Primer – Series N140-1211 Pota-Pox Plus (NSF approved polyamidoamine epoxy), 6.0 – 8.0 mils.
 - 3. Intermediate – Series 66 Epoxoline, 3.0-5.0 mils.
 - 4. Finish – Series 1074 Endura-Shield II, 2.0-3.0 mils
 - 5. Total Dry Film Thickness: 11.0 to 16.0 mils (Excluding Shop Primer).
 - 6. Total Coats: Three (3)
- H. Interior Wood Substrates:
 - 1. Prime Coat: Tnemec Series 10-99W Tnemec Primer applied at 1.0 to 2.0 mils DFT.
 - 2. Intermediate Coat: Tnemec Series 1028 or 1029 EnduraTone applied at 2.0 to 3.0 mils DFT.
 - 3. Finish: Tnemec Series 1028 or 1029 EnduraTone applied at 2.0 to 3.0 mils DFT.
 - 4. Total Dry Film Thickness: 5.0 to 8.0 mils DFT.
- I. Interior Gypsum Board Substrates (Standard Exposure):
 - 1. Prime Coat: Tnemec Series 151-1051 Elasto-Grip applied at 1.0 to 2.0 mils DFT.
 - 2. Intermediate Coat: Tnemec Series 113 H.B. Tneme TufCoat applied at 4.0 to 6.0 mils DFT.
 - 3. Finish: Tnemec Series 113 H.B. Tneme TufCoat applied at 4.0 to 6.0 mils DFT.

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4. Total Dry Film Thickness: 9.0 to 14.0 mils DFT.

2.06 IMMERSION COATING SCHEDULE – WASTEWATER TREATMENT PLANTS, RECLAIMED WATER, AND PUMP STATIONS

- A. Steel Surfaces, Submerged in Wastewater or Reclaimed Water
 1. Shop Primer – Series 1 Omnithane (NSF approved mio/zinc MCU Primer), 2.5-3.5 mils.
 2. Field Primer – Series 1 Omnithane (NSF approved mio-zinc MCU Primer), 2.5-3.5 mils.
 3. Stripe Coat – Series 66 Epoxoline, 2.0 – 4.0 mils DFT applied by brush to all weld seams, sharp edges and other difficult to coat areas.
 4. Intermediate Coat – Series 66 Epoxoline, 4.0 – 6.0 mils DFT
 5. Finish – Series 142 Epoxoline, 10.0 to 12.0 mils DFT
 6. Total Dry Film Thickness: 18.5 to 25.5 mils.
 7. Total Coats: Three (3) plus a stripe coat
- B. Ductile Iron Pipe, Submerged (Wastewater or Reclaimed Water)
 1. Shop Primer – Series N140-1211 Pota-Pox Plus (NSF approved polyamidoamine epoxy), 6.0 – 8.0 mils.
 2. Field Primer – Series N140-1211 Pota-Pox Plus (NSF approved polyamidoamine epoxy), 6.0 – 8.0 mils.
 3. Intermediate – Series 66 Epoxoline, 5.0 to 6.0 mils DFT
 4. Finish – Series 142 Epoxoline, 10.0 to 12.0 mils DFT
- C. Concrete Surface, Submerged (Wastewater or Reclaimed Water)
 1. Primer / Surfacers – Apply one coat of Tnemec Series 218 MortarClad to seal all surfaces and fill all bug holes, voids and other defects - 1/16-inch minimum.
 2. Base Coat: Series 434 Perma-Shield H2S, 125 mils DFT.
 3. Finish: Series 435 Perma-Glaze, 15.0 - 20.0 mils DFT
 4. Total Dry Film Thickness – 140.0 mils.
 5. Total Coats: Three (3)
- D. Concrete Masonry Units, Submerged or Intermittently Submerged (Wastewater or Reclaimed Water)
 1. Primer / Surfacers – Apply one coat of Tnemec Series 218 MortarClad to seal all surfaces and fill all bug holes, voids and other defects - 1/16-inch minimum.
 2. Intermediate: Series 27WB Typoxy, 4.0 – 6.0 mils DFT.
 3. Finish: Series 264 Elasto-Shield, 60.0 – 80.0 mils DFT.

2.07 IMMERSION COATING SCHEDULE – POTABLE WATER TREATMENT PLANTS

- A. Steel Surfaces, Submerged in Potable Water
 1. Shop Primer – Series 91 H2O Hydro-Zinc (NSF 61 approved zinc rich urethane primer), 2.5-3.5 mils.
 2. Field Primer – Series 91 H2O Hydro-Zinc (NSF 61 approved zinc rich urethane primer), 2.5-3.5 mils.

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3. Stripe Coat – Series 20-39BL Pota-Pox, 2.0 – 4.0 mils DFT applied by brush to all weld seams, sharp edges and other difficult to coat areas.
 4. Intermediate Coat – Series 20-39BL Pota-Pox, 4.0 – 6.0 mils DFT.
 5. Finish – Series 141 Epoxoline, 10.0 – 12.0 mils DFT.
 6. Total Dry Film Thickness: 16.5 to 21.5 mils.
 7. Total Coats: Three (3) plus a stripe coat
- B. Ductile Iron Pipe, Submerged (Potable Water)
1. Shop Primer – Series N140-1211 Pota-Pox Plus (NSF 61 approved polyamidoamine epoxy), 6.0 – 8.0 mils.
 2. Field Primer – Series N140-1211 Pota-Pox Plus (NSF 61 approved polyamidoamine epoxy), 6.0 – 8.0 mils.
 3. Stripe Coat – Series 20-39BL Pota-Pox, 2.0 – 4.0 mils DFT applied by brush to all bolted connections, sharp edges and other difficult to coat areas.
 4. Intermediate Coat – Series 20-39BL Pota-Pox, 4.0 – 6.0 mils DFT.
 5. Finish – Series 141 Epoxoline, 10.0 – 12.0 mils DFT.
 6. Total Dry Film Thickness: 20.0 to 26.0 mils.
 7. Total Coats: Three (3) plus a stripe coat
- C. Concrete Surface, Submerged (Potable Water)
1. Primer / Surfacer – Apply one coat of Tnemec Series 218 MortarClad to seal all surfaces and fill all bug holes, voids and other defects - 1/16-inch minimum.
 2. Intermediate: Series 27WB Typoxy, 4.0 – 6.0 mils DFT.
 3. Finish: Series 406 Elasto-Shield, 60.0 – 80.0 mils DFT
 4. Total Dry Film Thickness – 64.0 mils.
 5. Total Coats: Three (3)
- D. Concrete Masonry Units, Submerged or Intermittently Submerged (Potable Water)
1. Primer / Surfacer – Apply one coat of Tnemec Series 218 MortarClad to seal all surfaces and fill all bug holes, voids and other defects - 1/16-inch minimum.
 2. Intermediate: Series 27WB Typoxy, 4.0 – 6.0 mils DFT.
 3. Finish: Series 406 Elasto-Shield, 60.0 – 80.0 mils DFT.

2.08 MIXING AND TINTING

- A. Deliver paints and enamels ready-mixed to job site except epoxies.
- B. Mix only in mixing pails placed in suitably sized non-ferrous or oxide resistant metal pans.
- C. Use tinting colors recommended by manufacturer for the specific type of finish.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine surfaces scheduled to receive paint and finishes for conditions that will adversely affect execution, permanence or quality of work and which cannot be put

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into an acceptable condition through preparatory work as included in Paragraph 3.02, PREPARATION OF SURFACES.

- B. Do not proceed with surface preparation or coating application until conditions are suitable.

3.02 PREPARATION OF SURFACES

- A. Wood
 1. Clean soiled surfaces (with alcohol wash).
 2. Sand to smooth and even surface then dust off.
 3. Apply shellac, not over two pounds cut to all knots, pitch and resinous sapwood before prime coat is applied.
 4. Fill nail holes, cracks, open joints and other defects with wood filler after priming coat has dried. Color to match finish color.
- B. Plaster and Gypsum Wallboard
 1. Fill narrow, shallow cracks and small holes with spackling compound.
 2. Rake deep, wide cracks and deep holes.
 - a. Plaster: Fill with thin layers of patching plaster.
 - b. Gypsum Wallboard: Fill with thin layers of drywall joint cement.
 - c. Allow to dry.
 - d. Sand smooth. Do not raise nap of paper on wallboards.
- C. Concrete
 1. All concrete surfaces to be coated shall be clean and dry. All oil, grease, dirt, etc., shall be removed either by steam cleaning with detergent or by scrubbing with a strong commercial type detergent and flushing with water. All chemical contamination shall be neutralized and flushed.
 2. Old paint and unremoved tar stains shall be solvent cleaned with naphtha, trichloroethylene, or perchloroethylene. Proper safety precautions shall be observed if this step is necessary. The surface shall be flushed with fresh water and dried.
 3. Rough, chemically attacked and/or abraded floor and tank interior shall be rebuilt. If a newly poured concrete surface contains air, water pits, splatter, protrusions or other surface irregularities, it shall be rebuilt while the concrete is still "green". Rebuilding shall consist of the following:
 - a. Smooth the concrete surface, breaking down all rough protrusions.
 - b. The entire area shall be sandblasted to remove loose, powdery concrete and open sub-surface air holes (Reference SSCP-SP 13, ICRI CSP 5). Dust shall be removed from the blasted surface by vacuuming or blowing with dry, oil-free air.
 - c. Areas where the aggregate is exposed, or deep pot holes exist shall be resurfaced utilizing Tnemec Series 217 MortarCrete applied in accordance with the manufacturer's instructions.
 4. Concrete surfaces which do not require rebuilding shall be properly prepared. This preparation shall be done in accordance with the coating manufacturer's latest written application instructions.
 - a. Proper preparation shall consist of either mechanically abrading or sandblasting for horizontal surfaces.

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- b. Non-Immersion Service: Proper preparation shall consist of sandblasting to open all bug holes and voids and to provide an adequate surface profile (Reference SSPC-SP 13, ICRI CSP 2 – 3).
 - c. Non-Immersion Service (Exterior Concrete Basins): Proper preparation shall consist of sandblasting to open all bug holes and voids and to provide an adequate surface profile (Reference SSPC-SP 13, ICRI CSP 3 – 5).
 - d. Immersion Service: For concrete in immersion, all surfaces shall be abrasive blasted to remove all form release agents, curing compounds, laitance, and to provide a surface profile (Reference SSPC-SP 13, ICRI CSP 5). Remove all loose materials.
- 5. Concrete shall be fully cured prior to coating. Fully cured shall be defined as: 28 days at 75 Deg. F., or 40 days at 50 Deg. F., or equal. If concrete admixtures or concrete substitutes are used, increase the cure time by 1/3.
 - 6. The concrete surfaces shall be thoroughly dried and cured before application of the coating.
- D. Steel Surfaces
- 1. Remove any oil or grease from surfaces to be coated by solvent cleaning in accordance with Steel Structures Painting Council Specification SP 1-65. Any chemical contamination shall be eliminated by means of neutralization or flushing or both prior to additional surface preparation.
 - 2. For immersion service, all sharp edges and welds shall be ground smooth to a rounded contour and all weld splatter shall be removed prior to sandblasting.
 - 3. For non-immersion service, all sharp edges and welds shall be ground and all weld splatter shall be removed prior to sandblasting.
 - 4. For immersion service, all surfaces to be coated shall be sandblasted to white metal in accordance with Steel Structures Painting Council Specification SP 5-63 or National Association of Corrosion Engineers Specification NACE No. 1 unless otherwise stated in the coating manufacturer's most recent printed Application Instructions or material shall be pickled in accordance with SP-8-63.
 - 5. For non-immersion or intermittent service in a moist area or wherever specified in the coating manufacturer's most recent printed Application Instructions for other services, all surfaces to be coated shall be sandblasted to a finish near white in accordance with Steel Structures Painting Council Specifications SP 10-63 or National Association of Corrosion Engineers Specification NACE No. 2.
 - 6. For non-immersion service, or wherever specified in the coating manufacturer's most recent printed Application Instructions, all surfaces to be coated shall be sandblasted to a commercial sandblast in accordance with Steel Structures Painting Council Specification SP 6-63 or National Association of Corrosion Engineers Specification NACE No. 3.
 - 7. Steel surfaces previously exposed to sulfides shall be sandblasted, flame cleaned, and sandblasted again in accordance with the recommended surface preparation for the particular service in question.
 - 8. After sandblasting, dust and spent sand shall be removed from the surfaces by brushing or vacuum cleaning. The prime coat shall be applied as soon as possible after the blasting preparation is finished and always before the

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surface starts to rust. No sandblasted surface shall stand overnight before coating.

E. Hot Steel Surfaces

1. Surface preparation shall be SSPC-SP-5-63, white metal abrasive blast.

3.03 APPLICATION

A. General Requirements

1. Do not apply initial coating until moisture content of surface is within limitations recommended by paint manufacturer.
 - a. Test with moisture meter
2. Apply paint, enamel, stain and varnish with suitable brushes, rollers, or spraying equipment.
 - a. Rate of application shall not exceed that as recommended by paint manufacturer for the surface involved less ten percent allowance.
 - b. Keep brushes, rollers and spraying equipment clean, dry, free from contaminates and suitable for the finish required.
 - c. Apply stain by brush.
3. Comply with recommendations of product manufacturer for drying time between succeeding coats.
4. Where possible, vary slightly the color of successive coats.
5. Sand and dust between each coat to remove defects visible from a distance of 5 feet.
6. Finish coats shall be smooth, free of brush marks, streaks, laps or pile up of paints, and skipped or missed areas.
 - a. Finished metal surface shall be free of skips, voids or pinholes in any coat when tested with a low voltage detector.
7. Inspection
 - a. Do not apply additional coats until completed coat has been inspected by the ENGINEER.
 - b. Only inspected coats of paint will be considered in determining number of coats applied.
8. Leave all parts of moldings and ornaments clean and true to details with no undue amount of paint in corners and depressions.
9. Make edge of paint adjoining other materials or colors clean and sharp with no overlapping.
10. Apply primer on all work before glazing.
11. Change colors at doors where colors differ between adjoining spaces or rooms and where door frames match wall colors.
12. Refinish whole wall where portion of finish has been damaged or is not acceptable.
13. Hardware, trim and other items shall be removed as required for proper application of coatings.
14. Field Touch-Up Painting:
 - a. Prior to applying finish coats of paint, areas where prime coat has been damaged shall be sanded smooth and touched up with the same primer applied at the shop.
 - b. Remove rust before above specified touch-up is applied.
 - c. Touch-up shall not be obvious.

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B. Painted Work

1. Back prime all exterior woodwork with oil base primer.
2. Runs on face not permitted.

3.04 CLEANING

- A. Remove spilled, splashed, or splattered paint from all surfaces.
- B. Do not mar surface finish of item being cleaned.
- C. Leave storage space clean and in condition required for equivalent spaces in project.
- D. Oily rags, waste, etc., shall be removed at end of each working day.

3.05 PAINTING SCHEDULE

A. General

1. Painting of Piping and Equipment

- a. The CONTRACTOR shall paint all piping, covering, pumps, motors, fans, duct work, including fiber glass duct work, foundations, hangers, supports and all miscellaneous equipment throughout the building and the covering of all concealed piping, or duct work, and all uncovered pipe and duct work in accessible pipe spaces, roof, etc., installed under Mechanical Piping, and Heating and Plumbing specifications. Ducts, pipe and pipe covering installed in completely furred - ceilings, and vertical shafts will not be painted.
- b. All pumps, fans, motors and other mechanical apparatus furnished under the heating and plumbing specifications, shall be painted three coats, one prime coat and two finished coats of machinery enamel, or color as directed.
- c. All pipe hangers and supports (with the exception of stainless steel) shall be painted to match the painting on the pipe covering or the pipe they support.
- d. Identification lettering and directional flow arrows on heating and plumbing piping shall be by Heating and Plumbing Contractors. All other piping - see color code.
- e. Stainless steel hangers, pipe supports, and bolts shall NOT be painted.

2. Miscellaneous Painting

- a. All metal doors other than aluminum shall be painted with two coats.
- b. The painting of exposed panel board faces (aluminum excepted) shall be included.
- c. The painting of all sheet metal work, radiators, convactor enclosures, all pipes and pipe covering in all exposed portions of the building, except as otherwise noted, shall be included within this contract.
- d. The painting of all ducts, pipe and pipe covering occurring in accessible pipe spaces is included under this Contract. Ducts, pipe and pipe covering installed in completely furred-in ceiling and vertical shafts will not be painted. The equipment furnished under the Plumbing, Heating

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and Electrical Contracts will be painted under this section except as otherwise noted.

3. Painting of Electrical Conduit, Boxes and Equipment
 - a. The CONTRACTOR shall paint all conduit work, junction and pull boxes, bus duct, iron work hangers, supports, panel fronts, and all other miscellaneous equipment of the electrical system throughout the finished portions of the building.
 - b. All identification lettering of electrical equipment shall be by the Electrical Contractor.
 4. Parking Lot Striping (as applicable)
 - a. Painting of striping within parking areas shall be to design indicated by ENGINEER.
 - b. Lines shall be four (4) inches wide applied in one coat.
 - c. Handicap area to be painted blue with a white handicap logo.
- B. Standard Color Schedule
1. Architectural Painting: Color charts shall be submitted to the Architect for review with the OWNER for final color selections.
 2. The following color scheme in pipe painting is recommended for purposes of standardization.

Pipe Description	Tnemec Color	Tnemec Code
Drains	Black	35GR
Potable Water	Fountainbleu	25BL
Raw Water	Olive Green	21GN Fairway
Reclaimed Water	Pantone Purple/Purple Rain	14SF
Sample	Light Gray	32GR
Pumps and Pump Bases	Gray	32GR
Fire hydrant – potable water	Safety Yellow Lemon Yellow	02SF
Fire hydrant – reclaimed water	Pantone Purple/Purple Rain	14SF
Sodium Hypochlorite	Federal Safety Yellow	02SF Safety Yellow
Overhead Crane Bridge Beam	Gray	32GR
Overhead Crane Hoist and Trolley	Federal Safety Yellow	02SF Safety Yellow
Overhead Crane Runway Beams and Columns	Gray	32GR

- a. In situations where two colors do not have sufficient contrast to easily differentiate between them, a six-inch band of contrasting color shall be placed on one of the pipes at approximately 30 inch intervals.
 - b. The name of the liquid or gas, with arrows indicating the direction of flow, shall also be indicated on all pipes.
3. Building and Architectural Components

SECTION 09900

PAINTING

- a. All building and CMU colors shall be determined by the OWNER during construction. Other colors, if not identified in appropriate Specification Sections, shall be selected by the ENGINEER and approved by the OWNER.
- C. Finishing Schedule
 - 1. The following items (new) shall be painted in accordance with painting specifications.
 - a. Pump station
 - i. Exposed pumps, pipes, valves, and fittings.
 - ii. Submerged and non-submerged metal surfaces excluding stainless steel, galvanized steel, and aluminum.
 - iii. Refer to Architectural Drawings for finish schedule and areas to receive paint within all rooms, including, but not limited to, the coating of the floors.
 - iv. Exterior roll-up door, refer to 08331.
 - b. Sodium hypochlorite system
 - i. Submerged and non-submerged metal surfaces excluding stainless steel, galvanized steel, and aluminum. Note: The sodium hypochlorite system PEMB covering shall be a metal building system and all primary and secondary structural framing shall be hot-dipped galvanized.
 - ii. The sodium hypochlorite canopy cover framing inclusive of all framing including structural components (i.e. rigid frames, portal frames, etc.) and secondary components (i.e. girts, purlins, eave struts and other miscellaneous metals) shall be hot-dipped galvanized.
 - iii. The sodium hypochlorite canopy roof and sidewall decking shall have a factory applied oven baked finish of Polyvinylidene Difluoride resin such as Kynar 500 or equal. Color selected by the OWNER.
 - iv. All surfaces of the concrete containment shall be coated as specified herein.
 - c. Generator
 - i. Exterior non-submerged metal surfaces excluding stainless steel, galvanized steel, and aluminum.
 - d. Prestressed concrete ground storage tank
 - i. Refer to Section 13216 for all tank coating requirements and shall be provided by the tank CONTRACTOR.
 - ii. Submerged and non-submerged metal surfaces excluding stainless steel, galvanized steel, and aluminum shall be coated as specified herein and installed/coated by the tank CONTRACTOR.

END OF SECTION 09900

SECTION 10200

LOUVERS AND VENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Description of scope and intent:
 - 1. CONTRACTOR shall provide all material, labor, and tools required to complete the installation of specified system.
 - 2. Any omission of reference to items required to complete the full operational and functional system specified in the section does not relieve the CONTRACTOR of the obligation to provide same.
 - 3. To provide installation of all items, including delivery, dispersing to the proper locations within the building, and affixing in place.
 - 4. Installation shall be accomplished by workers skilled in their craft that will perform their work in a professional manner and will leave the premises safe, orderly and clean.
 - 5. Drawings and general provisions of Contract, including JEA Conditions and Division 1 Specification Sections, apply to this Section
 - 6. CONTRACTOR is responsible for coordination of work included in this specification with all other specification sections related to furnishing of all materials, labor, permits, fees and services necessary for completion of work in this section.
 - 7. In the event of a conflict between the design drawings, referenced standards and these Specifications, the more stringent shall govern unless directed otherwise by the Architect. CONTRACTOR shall strictly adhere to OSHA requirements and local codes or those of any regulatory agency or body with jurisdiction
- B. Section Includes:
 - 1. Fixed extruded aluminum hurricane louvers, impact test approved.
 - 2. Insect screens.

1.02 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.
- C. Vertical Louver: Louver with vertical blades.
- D. Storm-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.03 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue

SECTION 10200

LOUVERS AND VENTS

caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on a uniform pressure as shown on structural drawings.
- B. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.
- C. All exterior louvers located within thirty (30) feet of grade shall meet requirements of the Florida Building Code, 2017 impact-resisting standard or the Large Missile Test of ASTM E 1996.

1.04 SUBMITTALS

- A. Provide all submittal in accordance with Section 01300.
- B. Product Data: For each type of product indicated.
 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- C. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
 1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
 2. Show mullion profiles and locations.
- D. Samples for Initial Selection: For units with factory-applied color finishes.
- E. Samples for Verification: For each type of metal finish required.
- F. Delegated-Design Submittal: For louvers indicated to comply with structural performance requirements and design criteria, including analysis data signed and sealed by the qualified professional structural ENGINEER responsible for their preparation. Structural ENGINEER shall be registered in the State of Florida.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.
- H. Florida Product Approval Number: Submitted louvers shall have a valid Florida Product Approval Number.

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LOUVERS AND VENTS

1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain louvers and vents from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
- C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.06 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B 209, Alloy 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Aluminum Castings: ASTM B 26/B 26M, Alloy 319.
- D. Fasteners: Use sizes to suit unit installation conditions.
 - 1. For all fastening, use 300 series stainless-steel fasteners.
 - 2. For color-finished louvers, use fasteners with heads that match color of louvers.
- E. Post-installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.02 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

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- B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
 - 1. Frame Type: Channel unless otherwise indicated.
- D. Include supports, anchorages, and accessories required for complete assembly.
- E. Join frame members to each other and to fixed louver blades with welds concealed from view, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.03 FIXED, EXTRUDED ALUMINUM LOUVERS

- A. Drainable blades:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product by Construction Specialties, Inc, Model DC-9614 Storm Resistant Dade County Hurricane Louver, or equivalent product by another manufacturer.
 - 2. Total Louver Depth: Nine (9) inches.
 - 3. Frame and Blade Nominal Thickness: Not less than 0.080 inch for blades and 0.125 inch for frames.
 - 4. Louver Performance Ratings:
 - a. Free Area: Not less than 9.46 sq. ft. for 48-inch-wide by 48-inch-high louver.
 - 5. Blade Profile: Extra performance drainable blade.
 - 6. Blade Spacing: 4 inches o.c.
 - 7. Mullion Type: N/A.
 - 8. Certifications:
 - a. AMCA 500-L – Air Performance and Wind Driven Rain (Class A (99% effectiveness))
 - b. AMCA 550 – Test Method for High Velocity Wind Driven Rain Resistant Louvers
 - c. AMCA 540 – Test Method for Louvers Impacted by Wind Borne Debris (Basic Protection, Missile Level D and Enhanced Protection, Missile Level E)
 - d. TAS-201
 - e. TAS-202
 - f. TAS-203

2.04 LOUVER SCREENS

- A. General: Provide screen at each exterior louver indicated.
 - 1. Screen Location for Fixed Louvers: Interior face.
 - 2. Screening Type: Insect screening.

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LOUVERS AND VENTS

- B. Secure screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
 - 1. Metal: Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
 - 2. Finish: Same finish as louver frames to which louver screens are attached.
 - 3. Type: Re-wirable frames with a driven spline for insert screens..
- D. Louver Screening for Aluminum Louvers:
 - 1. Insect Screening: Stainless steel, 18-by-18, 0.009-inch wire.

2.05 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.06 ALUMINUM FINISHES

- A. Two (2) coat Fluoropolymer Kynar 500 or Hylar 5000 from a full range of industry colors.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.03 INSTALLATION

- A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

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- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- F. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 7 Section "Joint Sealants" for sealants applied during louver installation.

3.04 ADJUSTING AND CLEANING

- A. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.
- B. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- D. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 10200

SECTION 10281

TOILET ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Description of scope and intent:
 - 1. CONTRACTOR shall provide all material, labor, and tools required to complete the installation of specified system.
 - 2. Any omission of reference to items required to complete the full operational and functional system specified in the section does not relieve the CONTRACTOR of the obligation to provide same.
 - 3. To provide installation of all items, including delivery, dispersing to the proper locations within the building, and affixing in place.
 - 4. Installation shall be accomplished by workers skilled in their craft who will perform their work in a professional manner and will leave the premises safe, orderly and clean.
 - 5. Drawings and general provisions of Contract, including JEA General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
 - 6. CONTRACTOR is responsible for coordination of work included in this specification with all other specification sections related to furnishing of all materials, labor, permits, fees and services necessary for completion of work in this section.
- B. This section includes:
 - 1. Toilet accessories.
 - 2. Under lavatory guards.
 - 3. Custodial accessories.

1.02 SUBMITTALS

- A. Submit all shop drawings in accordance with Section 01300.
- B. Product Data: Include construction details, material descriptions and thickness, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.
- C. Setting Drawings: For cutouts required in other work; include templates, substrate preparation instructions, and directions for preparing cutouts and installing anchoring devices.
- D. Product Schedule: Indicating types, quantities, sizes and installation locations by room of each accessory required. Use designations indicated in the toilet accessory schedule and room designations indicated on Drawings in accessory schedule.
- E. Provide maintenance data for accessories; include in maintenance manuals specified in Section 01730. Provide lists of replacement parts and service recommendations.

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TOILET ACCESSORIES

- F. Product Certificate: Signed by manufacturer certifying that products furnished meet or exceed the specified requirements.

1.03 QUALITY ASSURANCE

- A. Product Options: Accessory requirements, including those for materials, finishes, dimensions, capacities, and performance, are established by specific products indicated in the Toilet Accessory Schedule.

1.04 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories. Notify the Architect in writing of any conflicts concerning product placement for resolution. Do not proceed without resolution.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.05 WARRANTY

- A. General Warranty: 15 years from the date of substantial completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design:
 - 1. Manufacturers: The Basis of Design, subject to compliance with requirements, of the following manufacturers offering accessories that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Toilet Accessories:
 - a. Undersink Piping Cover: Basis of Design: TRUEBRO, INC.; Lav Shield, White. Shall cover all pipes under counter which might injure by burning cutting or puncturing individuals who are confined to wheel chairs.
 - b. Toilet Accessories and Grab Bars: Basis of Design: Bradley, Bobrick, Tork, or equal by others.
- B. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated in the Toilet and Bath Accessory Schedule at the end of Part 3.

2.02 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch minimum nominal thickness, unless otherwise indicated.
- B. Concealed Galvanized Steel Sheet: ASTM A 653/A 653M, G90.

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TOILET ACCESSORIES

- C. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.
- D. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- E. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

2.03 FABRICATION

- A. General: One, maximum 1-1/2-inch-diameter, unobtrusive stamped manufacturer logo, as approved by Architect, is permitted on exposed face of accessories. On interior surface not exposed to view or back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.
- B. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.
- C. Keys: Provide universal keys for internal access to accessories for servicing and re-supplying. Provide minimum of three (3) keys to Owner's representative.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.
- C. Correct unsatisfactory substrate conditions before start of accessory installation.
- D. Beginning of installation means installer's acceptance of surfaces/ substrate.

3.02 ADJUST AND CLEAN

- A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to MANUFACTURER's written recommendations.

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TOILET ACCESSORIES

3.03 TOILET AND BATH ACCESSORY SCHEDULE

- A. Refer to the toilet accessory schedule on the architectural drawings for specific model number and Manufacturers.

END OF SECTION 10281

SECTION 10520

FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Portable fire extinguishers.
 - 2. Fire extinguisher mounting bracket

1.03 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection cabinets.
 - 1. Fire Extinguishers: Include rating and classification.
 - 2. Fire Extinguisher Bracket
- B. Samples for Initial Selection: For fire-protection cabinets with factory-applied color finishes.
- C. Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain fire extinguishers and fire-protection brackets through one source from a single manufacturer.
- B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FMG.
 - 2. Provide and install class ABC 10 lb fire extinguishers with brackets to be located as shown on the floor plan.

1.05 COORDINATION

- A. Coordinate size of fire-protection brackets to ensure that type and capacity of fire extinguishers indicated are accommodated.

SECTION 10520

FIRE-PROTECTION SPECIALTIES

1.06 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Painted steel bracket and aluminum fire extinguisher.

2.02 PORTABLE FIRE EXTINGUISHERS

- A. Available Manufacturers:
 - 1. JL Industries, Inc.
 - 2. Kidde Fyrnetics.
 - 3. Larsen's Manufacturing Company.
- B. General: Provide fire extinguishers of type, size, and capacity for each indicated.
 - 1. Handles and Levers: Manufacturer's standard.
 - 2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.
- C. Multipurpose Dry-Chemical Type in Aluminum Container: Provide and install fire extinguishers and mounting brackets. Size to be 10 lb, with mono-ammonium phosphate-based dry chemical in enameled-aluminum container.

2.03 FIRE EXTINGUISHER BRACKETS

- A. Available Manufacturers:
 - 1. JL Industries, Inc.
 - 2. Kidde Fyrnetics.
 - 3. Larsen's Manufacturing Company.
- B. Bracket Type: Suitable for fire extinguisher, painted steel bracket.
- C. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection wall, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.

SECTION 10520

FIRE-PROTECTION SPECIALTIES

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Install fire-protection specialties in locations and at mounting heights indicated or, if not indicated, at heights indicated below:
 - 1. Fire extinguisher: 54 inches above finished floor to actuator handle.
- B. Fire Extinguisher Bracket: Fasten fire-protection brackets to face of masonry wall with "tapcon" type masonry screws, square, and plumb.

END OF SECTION 10520

SECTION 11200

HORIZONTAL SPLIT CASE CENTRIFUGAL PUMPS FOR NON-POTABLE WATER

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. Furnish, test, and put into operation four (4) electric motor-driven, horizontal (axially) split case, double suction pumps to serve as three (3) re-pumps and one (1) jockey pump for the Twin Creeks Reclaimed Water Re-Pump Station. The CONTRACTOR shall be responsible for equipment unloading, storage, and installation per direction from the pump manufacturer. The pump manufacturer shall be responsible for all submittals to the CONTRACTOR, verification of system installation, development of operation and maintenance information, conducting functional demonstration testing, performance testing, startup, and operation and maintenance training of the OWNER'S personnel.
- B. The units shall be furnished with all necessary accessory equipment including, but not limited to, the pump, motor, base plate, coupling, any specified sensors, spare parts, special tools and any other required ancillary components, whether specifically mentioned in this Section or not, as required for a complete operational system incorporating the highest standards for this type of service including field testing and instructing the regular operating personnel in the care, operation, and maintenance of all equipment. All complete pumping units shall be factory assembled and tested and shall be shipped in as large an assembly as practical to minimize field assembling effort.
- C. Manufacturer and CONTRACTOR shall provide pumping units complying with the HI acceptance criteria specified herein, which require motor horsepower less than the specified motor frame size at all points listed on manufacturer's performance curve, provided during design and upon which driver, pump model and impeller trim size(s) have been specified herein. Compliance shall be demonstrated over full range of 60 hz performance curve at factory acceptance testing. Failure to achieve this horsepower criterion shall require the CONTRACTOR to supply all related pump electrical power supply and cooling equipment (including but not limited to, drives, breakers, power conductors, etc. and HVAC equipment if applicable) at an acceptable larger standard equipment size complying with all US codes and standards, at no additional cost to the Owner. CONTRACTOR and manufacturer are responsible for providing equipment achieving the performance standards and power limits specified herein.

1.02 RELATED WORK

- A. Division 16 for electrical and instrumentation requirements.

1.03 DESCRIPTION OF SYSTEM

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HORIZONTAL SPLIT CASE CENTRIFUGAL PUMPS FOR NON-POTABLE WATER

- A. Four new split case double suction pumping units are required under this CONTRACT. The pumping units shall be installed and arranged as shown on the Drawings.
- B. The pumping units will draw suction from the ground storage tank(s) and discharge into a common header to provide flow to the distribution network.
- C. Pump materials should also be compatible with continuous chlorine concentration dosing between 2 and 4 mg/L.
- D. All working parts of the new pumps and motors, such as bearings, wearing rings, shaft sleeves, motor windings, etc., shall be of standard dimensions built to limit gauges or formed to templates, such that parts will be interchangeable between like units, and such that the OWNER may at any time in the future obtain replacement and repair parts for those furnished in the original machine. All parts shall be properly stamped for identification and location in the machine as shown on the assembly drawings in the instruction books furnished.

1.04 REFERENCED STANDARDS

- A. Design, manufacture, and assembly of elements of the equipment specified herein shall be in accordance with, but not limited to, published standard of the following, as applicable:
 - 1. American Bearing Manufacturers Association (ABMA)
 - 2. American Gear Manufacturers Association (AGMA)
 - 3. American Institute of Steel Construction (AISC)
 - 4. American Iron and Steel Institute (AISI)
 - 5. American National Standards Institute (ANSI)
 - 6. American Petroleum Institute (API)
 - 7. American Society of Mechanical Engineers (ASME)
 - 8. American Society of Testing Materials (ASTM)
 - 9. American Welding Society (AWS)
 - 10. American Water Works Association (AWWA)
 - 11. Hydraulic Institute (HI)
 - 12. Institute of Electrical and Electronics Engineers (IEEE)
 - 13. National Electrical Code (NEC)
 - 14. National Electrical Manufacturers Association (NEMA)
 - 15. Occupational Safety and Health Administration (OSHA)
 - 16. The Society for Protective Coatings (SSPC)
 - 17. Underwriters Laboratories (UL)
 - 18. NSF International
- B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

SECTION 11200

HORIZONTAL SPLIT CASE CENTRIFUGAL PUMPS FOR NON-POTABLE WATER

1.05 QUALIFICATIONS

- A. To assure unity of responsibility, the pumps, bases, motors, and couplings shall be furnished by the pump manufacturer or his authorized representative. The pump Manufacturer shall coordinate with the CONTRACTOR to review that the corresponding variable frequency drives are acceptable. The CONTRACTOR shall assume full responsibility for the satisfactory installation and operation of the entire pumping systems including pump, motor, VFDs, and controls as specified. All pumps shall be the standard catalogued product of a single pump Manufacturer.
- B. The pumps covered by these Specifications shall be standard pumping equipment of proven ability as manufactured by a reputable Manufacturer having long experience in the production of such pumps. The pumps furnished shall be designed, constructed, and installed in accordance with the best practice and methods and shall operate satisfactorily when installed. Pumps shall be manufactured in accordance with the Hydraulic Institute Standards.
- C. All equipment furnished under this Specification shall be new and unused and shall be the standard product of manufacturers having a successful record of manufacturing and servicing the equipment and systems specified herein for a minimum of five (5) years. The pump manufacturer shall assume unit responsibility for proper operation of pumps and motors.
- D. Acceptable manufacturers are listed in Table 11200-1.

1.06 SUBMITTALS

- A. Copies of all materials required to establish compliance with the specifications shall be submitted in accordance with Section 01300. Submittals shall include the following:
 - 1. Certified shop and erection drawings showing all important details of construction, dimensions, and anchor bolt locations.
 - 2. Descriptive literature, bulletins, and/or catalogs of the equipment.
 - 3. Pre-manufacturing submittal data on the characteristics and performance of each pump. Data shall include guaranteed performance curves based upon HI acceptance grade 1E, based on actual shop tests of similar units, which show that they meet the specified requirements for head, capacity, efficiency, NPSHr, 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 no flow at shut off head to runout pump capacity at minimum specified total head. Catalog sheets showing a family of curves will not be acceptable.
 - 4. Mechanical seal and flush piping arrangement diagram, demonstrating conformance with these specifications.

SECTION 11200

HORIZONTAL SPLIT CASE CENTRIFUGAL PUMPS FOR NON-POTABLE WATER

5. Complete master wiring diagrams, elementary or control schematics, including coordination with other electrical control devices such as the pump control system and suitable outline drawings shall be furnished. Provide suitable outline drawings showing such details as are necessary to locate conduit stub-ups and field wiring. Due to the complexity of the system, it is imperative the above drawings be clear and carefully prepared to facilitate interconnections with other equipment. Standard pre-printed sheets or drawings simply marked to indicate applicability to this Contract will be acceptable. Refer to the Drawings for the control wiring diagrams for the pump motors.
 6. The total weight of the equipment, including the weight of the single largest item.
 7. A complete total bill of materials of all equipment.
 8. A list of the MANUFACTURER'S recommended spare parts to be supplied in addition to those specified in Paragraph 1.08, with the MANUFACTURER'S current price for each item. Include gaskets, packing, etc. on the list.
 9. Complete motor data in accordance with Section 16150: Electric Motors.
 10. Maximum reverse runaway speed calculation.
 11. Written documentation provided by the manufacturer warranting the pumps at the minimum flow condition as per Paragraph 2.02 B.
- B. Certification from the pump manufacturer that pumps and all wetted parts are compatible with chlorine concentrations specified.
- C. Factory performance test data, including pump performance curves, showing head-capacity relationship, brake horsepower, efficiency, NPSH requirements, and pump speed. Historical certified data from other pumps with the exact model and exact impeller diameter are not acceptable in lieu of the factory NPSHr test. The curves shall be complete for the entire range of operation from shutoff head to pump curve runout with the supplied motor. Provide actual test speed curves at 10% increments from 50% to 100% speed.
- D. Operation and Maintenance Data in accordance with Section 01730, and Paragraph 1.07.
- E. Field test results for inspection and testing performed in accordance with requirements of Paragraph 3.04 and Section 01465.
- F. Vibration and alignment test reports.
- G. Certified agreement to the conditions of warranty. Warranty conditions shall comply with requirements listed in Paragraph 1.10.

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- H. In the event it is impossible to conform to certain details of the specifications due to different manufacturing techniques, describe completely all non-conforming aspects. Failure to describe any and all deviations from the Specifications will be a cause for rejection.

1.07 OPERATING INSTRUCTIONS

- A. Operating and maintenance manuals shall be furnished. The manuals shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc. that are required to instruct operation and maintenance personnel unfamiliar with such equipment. The number and special requirements shall be as specified in Section 01730.

1.08 TOOLS AND SPARE PARTS

- A. The MANUFACTURER of the equipment specified herein shall furnish a complete list of recommended spare parts necessary for the first five years of operation of the pumping system. Spare parts to be furnished, if any, are listed in the respective paragraphs of PART 2 PRODUCTS.

1.09 PRODUCT HANDLING AND STORAGE

- A. Refer to Section 01600 for all storage, delivery, and handling requirements in addition to those noted below.
- B. All parts shall be properly protected so that no damage or deterioration will occur from the time of shipment until installation is completed and the units and equipment are ready for operational.
- C. All equipment and parts must be properly protected against any damage during a storage period at the site.
- D. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the ENGINEER.
- E. Finished surfaces of all exposed pump openings shall be protected by wooden blanks, strongly built and securely bolted thereto.
- F. Finished iron or steel not painted or electro-polished shall be properly protected to prevent rust and corrosion.
- G. After hydrostatic or other tests, all entrapped water shall be drained prior to shipment, and proper care shall be taken to protect parts from the entrance of water during shipment, storage and handling.

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- H. Each box or package shall be properly marked to show its net weight in addition to its contents.

1.10 WARRANTY

- A. All equipment supplied under this section shall be warranted for a period of one (1) year by the MANUFACTURER from the date of substantial completion. Warranty period shall commence as outlined in Section 01740 and JEA General Conditions.
- 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 OWNER.
- C. The MANUFACTURER'S warranty period shall run concurrently with the CONTRACTOR'S warranty period. No exception to this provision shall be allowed.

PART 2 – PRODUCTS

2.01 MATERIAL AND EQUIPMENT

- A. The pumping units required under this section shall be complete, including pump and motor, with proper alignment and balancing. All parts shall be so designed and proportioned as to have liberal strength, stability, and stiffness and to be especially adapted for the work to be done. Ample room shall be provided for inspection, repairs, and adjustment.
- B. Each base plate for the pumps and drives shall be rigidly and accurately anchored into position. All necessary foundation bolts, wedge anchors, plates, nuts, and washers shall be 316 stainless steel and shall be furnished by the CONTRACTOR in accordance with MANUFACTURER'S recommendations. Level and grout the base plate with non-shrink, epoxy grout in accordance with the MANUFACTURER'S instructions. Submit proposed epoxy grout mix to ENGINEER for approval.
- C. A stainless-steel name plate giving the name of the MANUFACTURER, the rated capacity, head, speed, and all other pertinent data shall be attached to the pump. A similar name plate for motor characteristics shall be attached to the motor.
- D. The pumping units and their driving equipment shall be designed and constructed to withstand the maximum run-away speed of the unit due to back flow through the pumps.
- E. The pumps furnished hereunder must fully comply with the requirements of ANSI/AWWA E-103-7, Horizontal and Vertical Line Shaft Pumps.

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- F. Pump and motor baseplate shall be provided with a standard NEMA 2-hole ground lug attachment on the pump end for auxiliary connection to station ground grid.

2.02 PUMPS

A. General

1. The pumps shall be of the horizontal, centrifugal, split case, double suction, single or double volute type.
2. The pumps shall be of standard dimensions, built to limit gauges or formed to templates, such that parts will be interchangeable between like units.
3. The pumps shall be manufactured by ENGINEER approved pump manufacturers as listed in Table 11200-1.

B. Performance Requirements

1. When operating at the maximum output speed of the motor, each pump shall have a characteristic performance curve which meets all the minimum conditions listed in Table 11200-1. The pump and drive motor shall be capable of operating satisfactorily under the full range of conditions as defined by Table 11200-1, the figures at the end of this Section, and as described herein. The manufacturer shall provide written documentation warranting the pumps to routinely operate at the minimum and maximum flow as well as warrant that the pumps will operate within Hydraulic Institute (HI) standards for vibration at these conditions as demonstrated by factory acceptance testing.
2. There shall be no significant change in vibration and noise level within the entire normal range of operation as identified in graphical figure below. HI limits for acceptable vibration shall not be exceeded for normal operation points outside the HI defined POR, which manufacturer has warranted for satisfactory operation.
3. Provide motor size as listed in Table 11200-1. Manufacturer shall certify that motor shall be non-overloading over the entire operating range identified, with actual pump and motor provided.
4. Certified Factory Test
 - a. Certified factory performance testing shall be performed by the pump manufacturer in accordance with the standards of the Hydraulic Institute. The test shall be witnessed by a test lab manager employed by the MANUFACTURER. The test data and performance curves shall be signed by the test lab manager who witnessed the test. A shop motor may be utilized for all factory testing to confirm pump performance.
 - i. Hydraulic and electrical performance tests shall measure capacity, head, power, current, speed, and voltage at a minimum of six evenly spaced points for each speed. Test points shall include shut-off head and a maximum flow of at least 125% of the flow at best efficiency point (BEP) while operated on a VFD at 10% speed increments from 100% down to 50% speed, or the next lowest 10% increment below

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the lowest normal operating speed identified in the graphical figure below (e.g. if the lowest normal operating speed is 63%, then the lowest speed tested would be 60%). The remaining points shall be evenly spaced along the curve. This array will result in up to 36 data points for each pump. Proposed testing method and points shall be submitted to ENGINEER for approval during shop drawing review and prior to testing.

- ii. An NPSH test shall be performed on one pump at each facility location under this specification to substantiate the maximum NPSHr for the pump at the flow rate listed in Table 11200-1. Pumps shall not be shipped until tests have been submitted and approved by the ENGINEER.
- iii. Provide vibration readings in X, Y, and Z axes at every test point recording (the 36 points identified above) and identify the BEP and manufacturers minimum recommend flow rate (minimum continuous stable flow, MCSF) at every given speed. If requested by the MANUFACTURER and approved by the ENGINEER, the number of test points may be reduced, but, at a minimum, the vibration recordings shall be taken at points of flow and head as follows: 1 recording at the lower bound of the allowable operating region (AOR), 1 recording at the lower bound of the preferred operating region (POR), 1 recording at the BEP, 1 recording at the higher bound of the POR, and 1 recording at the higher bound of the AOR, for each speed tested. Manufacturer shall identify the AOR within testing submittal.
- b. All electronic transducers, meters, gauges, and other test instruments shall be calibrated within the required calibration periods as defined by the Hydraulic Institute and the MANUFACTURER'S quality control program. Differential pressure type flow meters, such as venturis shall have been calibrated within 5 years. Mechanical variation of the meter throat diameter will be accepted as verification of calibration validity.
- c. The pumps shall be tested through the specified range of flow, and head/capacity/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 discharge, head, power input, and efficiency. If the pump fails to meet any specification requirement it will be modified until it meets all specification requirements. However, fine polishing or application of coatings to the impeller shall not be performed without the express written authorization of the Engineer.
- d. In accordance with Paragraph 1.06, certified pump performance curves shall be submitted. Submittal shall include pump curves, and tabulated head, capacity, brake horsepower, and pump efficiency for each pump supplied.

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C. Pump Construction

1. Pump Casing

- a. The pump case shall be of cast iron construction ASTM A-48, Class 30 or 35, having a minimum tensile strength of not less than 30,000 pounds per square inch.
- b. Casings shall be free from blow holes, sand pockets or other imperfections.
- c. The interior and exterior surfaces of the casings shall be smooth with matching flanges. The interior waterways of the pump casings shall be coated with an epoxy coating to improve long term efficiency.
- d. The horizontal casing joint shall be a machined fit, with manufacturer's standard gasket. The case joints shall be made up with stainless steel stud bolts screwed into the lower casing flange or bolts and nuts. Joints shall be fitted with hardened stainless-steel jacking screws or hex head cap screws.
- e. Suction and discharge flanges shall be faced and drilled ANSI Class 125 Standard. There shall be ¼-inch NPT tapped holes in both the suction and discharge flanges of all pumps for test gauge connections.
- f. All holes for flange bolts, studs and cap screws in the casing shall be spot faced. The top half of each case at the topmost part shall have a bossed pipe tap opening not less than ½-inch NPT.
- g. The casing at both suction inlets to the impellers shall be protected with stainless steel renewable wearing rings. The wearing rings shall be of one-piece construction, held rigidly in slots in the case, and shall be ASTM A743 CA 40, 416 Series stainless steel.

2. Impeller

- a. Impellers shall be ASTM A744M Grade CF8M 316 stainless steel enclosed double suction type of one-piece construction. Impeller shall be machined outside and smoothly finished on the internal water passages and shall be balanced.
- b. Impellers shall be protected from wear at both suction inlets with renewable ASTM A743 CA 40, 416 Series stainless steel wearing rings. These rings shall be fastened to the impeller such that they cannot loosen in service.
- c. Impellers shall not have any coating applied.

3. Bearings

- a. The weight of the pump shaft and impeller assembly shall be carried on anti-friction bearings at each end of the pump shaft. Bearings shall be grease lubricated, single row, deep groove ball type antifriction bearings designed for an ABMA L 10 average life of 130,000 hours for any point within the pump operating conditions specified.

4. Shafts

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- a. Pump shafts shall be of ASTM A582, 416 SS, ground and polished over the entire length.
- 5. Mechanical Seals
 - a. The pump shall be equipped with cartridge type mechanical seals as manufactured by pump MANUFACTURER, by Chesterton, John Crane, or JC5610/5611 cartridge seals. Seal materials of construction shall be 316 SS, stationary face is to be carbon, rotating face reaction bonded silicon carbide or tungsten carbide, and the springs are to be Hastelloy and to be isolated from the process. The elastomers shall be EPDM.
 - b. Seal glands shall be 316SS and have two flush ports drilled and tapped 180 degrees apart.
 - c. Pump seals shall be furnished with external seal flush piping to be connected to the volute (API Plan 11). The tubing, fittings and valves shall be 316SS and furnished and installed by the MANUFACTURER. Flush piping may be removed for shipping and installed by the CONTRACTOR at the option of the manufacturer. The piping shall include a blow off connection at the high point piped to a seal drain to allow air venting of the volute and piping.
- 6. Flexible Shaft Coupling
 - a. Each unit shall be provided with a grid type flexible coupling providing a minimum actual service factor rating of 2.0 as manufactured by T.B. Wood's ("Sure-Flex"), Falk ("Steelflex") or other OWNER approved coupling.
 - b. Couplings for connection to driver shafts shall be of the limited end float type.
 - c. Coupling pins or bolts and coupling rubber bushings for the flexible couplings on all pumps shall be interchangeable between the several couplings.
 - d. Each flexible coupling shall be provided with a removable aluminum or stainless-steel coupling guard, not less than 18 gauge. Coupling guards shall meet the applicable requirements of OSHA and the Florida Industrial Safety Laws.
- 7. Pumping Unit Support Baseplate
 - a. Each pumping unit shall be mounted on a continuous fabricated steel baseplate. Baseplate shall be of the box type construction with internal web reinforcing for rigidity and with a moisture collecting drip rim. Baseplates shall be designed so as not to exceed the dimensions of the concrete bases shown on the Drawings. For pumping units of 100-horsepower or greater, baseplates shall comply with API-610.
 - b. The drip rim shall collect condensation moisture from the pump. The drip rim shall extend on both sides of the baseplate from the drive end to the pump end and across the pump end with a slope not less than 1/8-inch per foot. The depth of the drip rim shall be not less than 3/4- inches. At the

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lowest point of the drip rim on the pump end there shall be a 3/4-inch pipe tap for drainage piping. A single drain connection shall be provided. Multiple drain connections are prohibited. The CONTRACTOR shall furnish and install drain piping from each baseplate to the trench drain.

- c. Baseplates shall be of such design and have sufficient grout holes that they can be filled with grout after the units are leveled and aligned.
- d. All items of equipment shall be mounted on heavy mounting pads, and all mounting pads shall have machined surfaces. All square edges and corners of these mounting pads shall have the sharp edges "knocked off" by grinding. All parts of the baseplates which are flame cut and exposed to view shall be ground relatively smooth to remove at least 90 percent of the flame cutting marks.
- e. The equipment shall be held to the mounting pads with cap screws; through bolts will not be considered. If shims are required under the mounting feet of equipment for alignment and leveling purposes, they shall be full faced cut to the contour of the equipment feet.
- f. Each baseplate shall be supplied with sufficient anchor bolts for holding the baseplates in position while installing, leveling, aligning and grouting the units. Anchor bolts shall be sufficiently strong for all stresses which will be imposed on them during the operation of the units. Anchor bolts shall be provided with steel pipe sleeves and heavy semi-finished hex nuts and shall be supplied by the CONTRACTOR.
- g. All studs and alignment pins, if necessary, shall be 316SS or 17-4PH SS.

2.03 ELECTRIC MOTOR

A. General

- 1. Motor shall be ODP and shall conform to all requirements stipulated in Section 16150: Electric Motors. Pump motors shall be inverter duty rated.
- 2. The pump motor shall be of the horizontal squirrel cage induction type.
- 3. Motor must be designed to accept all loads imposed by pump during starting and running.
- 4. All motors shall be built in accordance with latest NEMA, IEEE, ANSI, and ABMA standards where applicable.
- 5. Motor shall be furnished by the pump MANUFACTURER.
- 6. Each motor shall be provided with winding temperature detection in accordance with Section 16150: Electric Motors.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. The CONTRACTOR shall install the equipment in strict accordance with the MANUFACTURER'S instructions and recommendations in the locations shown on the Drawings. Installation shall include furnishing the required oil and grease for

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initial operation. The grades of oil and grease shall be in accordance with the MANUFACTURER'S recommendations. Anchor bolts shall be set in accordance with the MANUFACTURER'S recommendations.

- B. Provide the CONTRACTOR with a certificate stating that the installation of the equipment is satisfactory, that the equipment is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication, and care of each unit.

3.02 ALIGNMENT CRITERIA

- A. All rotating machinery (drivers, transmission devices and driven equipment) shall be installed using the following guidelines for final machinery setup.
- B. Equipment shall be aligned using a certified laser alignment system. These systems shall meet or exceed the capabilities of the OPTALIGN or OPTALIGN plus, which may include the ROTALIGN, ROTALIGN Pro or ROTALIGN Ultra. These systems must be able to print out the final alignment readings to be given to JEA.
- C. Prior to the installation of rotating machines, the concrete pump pedestal shall be checked for level to ensure there is no more than a 0.001-inch slope per foot across the pedestal. These measurements shall be taken in two directions across the pedestal (i.e. the pedestal shall not slope more than 0.001-inch per foot in any direction) and shall be submitted to and approved by the ENGINEER prior to the installation of the pump.
- D. Prior to the installation of rotating machines and alignment of coupling, the sole plates, skid pads, or base plates shall be checked for level to ensure there is no more than a 0.001-inch slope per foot. These measurements shall be taken in two directions across the support (i.e. the support shall not slope more than 0.001-inch per foot in any direction) and shall be submitted to the ENGINEER with the alignment test report. If level cannot be achieved as specified, the CONTRACTOR shall immediately notify the ENGINEER prior to proceeding with alignment. For continuous sole plates, skid pads, or base plates extending across two or more machine hold down feet, a maximum of 0.001-inch per foot or a total of 0.005-inch will be accepted.
- E. The equipment shall be installed on the pad and a final alignment performed prior to any piping or ductwork connections being made. The final alignment shall be performed by the MANUFACTURER and approved by the ENGINEER prior to field operational and vibrational testing. All equipment will be installed with 0.200-inch of shims, not to exceed 5 shims, with no one shim being over 0.100-inch, under each foot to accommodate future alignment changes. (The shims are to be stainless steel, "Full Foot" machine shims, preferably Precision brand, due to testing has shown

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other mfg. shims to have cupping causing induced soft foot of equipment). Soft foot shall not exceed 0.002-inch on each machine foot. A run-out check of the couplings and shafts shall indicate no more than 0.002-inch run-out on machines with a running speed of 1800 rpm or less or no more than 0.001-inch of run-out on machines with a running speed of greater than 1800 rpm.

- F. Pipe strain shall be less than 0.003-inch deflection on equipment and shall not cause the soft foot readings to be greater than 0.002-inch.
- G. The final alignment across the coupling shall not exceed the following tolerance (based on a 10-inch diameter coupling, these values are true centerline to centerline shaft deviations, i.e. they are 1/2 T.I.R. (total indicated run-out)):

Running Speed (rpm)	Parallel Offset (inches)	Angular Offset (GAP)(inches/10-inch dia)
≤ 600	0.003	0.006
1200	0.0025	0.005
1800	0.002	0.003
3600	0.001	0.002
7200	0.0005	0.001

- H. For couplings with a diameter greater than 10-inch, the values for angular offset shall be calculated on a per inch basis following the above. For couplings with a diameter of 10-inch or less, the above numbers shall be used as absolute values.
- I. Machine feet to base gaps shall be field verified with both feeler gauges and dial indicators and no machine foot shall have more than 0.002-inch soft foot when the foot bolts are tightened.

3.02 SHOP PAINTING

- A. Before exposure to weather and prior to shop painting all surfaces shall be thoroughly cleaned, dry and free from all mill-scale, rust grease, dirt, and other foreign matter.
- B. All pumps, including base plates, shall be shop primed with primer compatible with shop painting as specified in Section 09900.
- C. All nameplates shall be properly protected during painting.
- D. Gears, bearing surfaces, and other similar surfaces obviously not to be painted shall be given a heavy shop coat of grease or other suitable rust resistant coating. This coating shall be maintained as necessary to prevent corrosion during periods of

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storage and erection and shall be satisfactory to the ENGINEER up to the time of the final acceptance test.

3.03 FIELD PAINTING

- A. Field painting of the pumps shall be by the CONTRACTOR. The pumps including base plates, shall be factory primed with a coating compatible with field applied coatings and as specified in Section 09900. JEA shall select the finish color from color charts submitted by the CONTRACTOR. All intermediate and finish coats shall be field applied by the CONTRACTOR in accordance with Section 09900.

3.04 FIELD INSPECTION AND TESTING

- A. General
 - 1. The number of visits and testing described herein are outlined as the minimum requirements for completion of work.
 - 2. The equipment MANUFACTURER shall furnish the services of a competent and experienced field technician who has complete knowledge of the proper installation, operation, and maintenance of the equipment to inspect the installed equipment and supervise the initial test run performed by the CONTRACTOR. The MANUFACTURER shall provide laser alignment of the pumps and motors prior to startup as well as a certification that the pumps have been installed correctly and have been tested. The pumps will now be ready for startup and operator training. This includes two 8-hour days exclusive of travel and lodging.
 - 3. During a separate site visit, the MANUFACTURER'S field technician shall provide training for the OWNER'S operational staff. This includes one 8-hour day exclusive of travel and lodging. The final copies of operation and maintenance manuals specified in Section 01300 and 01730 must have been delivered to the ENGINEER prior to scheduling the instruction period with the OWNER.
 - 4. The CONTRACTOR shall be responsible for performing vibration testing. The equipment shall be tested over the entire speed range. The vibration shall be within the limits of ANSI/HI 9.6.4 for field testing and shall be recorded at a minimum of 5 steady state speeds and pumping conditions as defined by JEA's representative as well as under actual variable pressure, flow, and speed pumping conditions. The vibration recordings shall be taken at points of flow and head as follows: 1 recording at the lower bound of the allowable operating region (AOR), 1 recording at the lower bound of the preferred operating region (POR), 1 recording at the BEP, 1 recording at the higher bound of the POR, and 1 recording at the higher bound of the AOR. If more than one trip to test vibration will be required to test all eight pumps, then the additional trips shall be provided by the manufacturer at no additional cost to the Owner. The ground storage tank(s) level and the flow through the pump shall be recorded for each reading taken.

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5. All field testing shall be witnessed by JEA or its representative. The CONTRACTOR shall submit to the ENGINEER a written notification of all pump field tests a minimum of two calendar weeks prior to testing. In the event any of the pumping equipment fails to meet the above test requirements, it shall be modified and retested in accordance with the requirements of these Specifications. The CONTRACTOR shall then certify in writing that the equipment has been satisfactorily tested, and that all final adjustments have been made. Certification shall include date of final acceptance test, as well as a listing of all persons present during tests, and resulting test data. The costs of all work performed in this paragraph by factory-trained representatives shall be borne by the CONTRACTOR.

B. Pump

1. After the pump has been completely installed, vibration testing is satisfactory, and working to the satisfaction of the pump MANUFACTURER, the CONTRACTOR shall conduct in the presence of the ENGINEER and pump supplier representative such tests as are necessary to indicate that the pumping system operates satisfactorily and generally meets the conditions of service specified. This testing shall only take place after the system is in automatic mode from the SCADA system. The pump manufacturer shall record pumping operating data at full speed and at reduced speeds. The data shall be plotted and provided to the ENGINEER for review and approval. The field test shall demonstrate correct mechanical operation after pump startup. Field tests shall include all pumps included under this Section. Supply all labor, equipment and incidentals required to guide the CONTRACTOR to complete the field tests.

C. Motors

1. The CONTRACTOR shall megger each motor winding in accordance with MANUFACTURER'S instructions upon delivery and before energizing the motor, and, if insulation resistance is found to be low, shall notify the ENGINEER and shall not energize the motor.
2. The CONTRACTOR or the MANUFACTURER shall check all motors for correct clearances and alignment and for correct lubrication in accordance with MANUFACTURER'S instructions. The CONTRACTOR shall check direction of rotation of all motors and reverse connections if necessary.

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TABLE 11200-1: PUMP DESIGN REQUIREMENTS

Twin Creeks Re-Pump Station		
Item/Description	Value	Value
Pump Name	Re-Pump	Jockey
Pump Tags	P-402, P-403, P-404	P-401
Number of Pumps (duty/standby)	3 (2/1)	1 (1/0)
Maximum motor synchronous speed (rpm)	1,800	1,800
Pump Acceptance Grade ¹	1E	1E
Maximum motor size to be supplied ² (hp/voltage)	200 / 460	125 / 460
Pump Fluid Temperature (assumed)	60 degrees F	60 degrees F
Pumped Fluid	Reclaimed Water	Reclaimed Water
Minimum suction size (inches)	10	6
Minimum discharge size (inches)	8	5
Minimum pump shut-off head at design speed (feet)	232	209
Primary design and acceptance point (flow in gpm/TDH in feet) ¹	(2,750/200)	(1,375/194)
Minimum pump overall hydraulic efficiency at primary design and acceptance point (%)	76	74
Maximum NPSH required at Primary Design Point (feet)	20	20
Minimum Continuous Stable Flow at 100% Speed (gpm)	1,450	520
Engineer approved pump manufacturer (model)	Aurora (410-8x10x17B) Flowserve (8LR-20A) Peerless (8AE17Q)	Aurora (410-5x6x17) Flowserve (6LR-16B) Peerless (6AE16N)

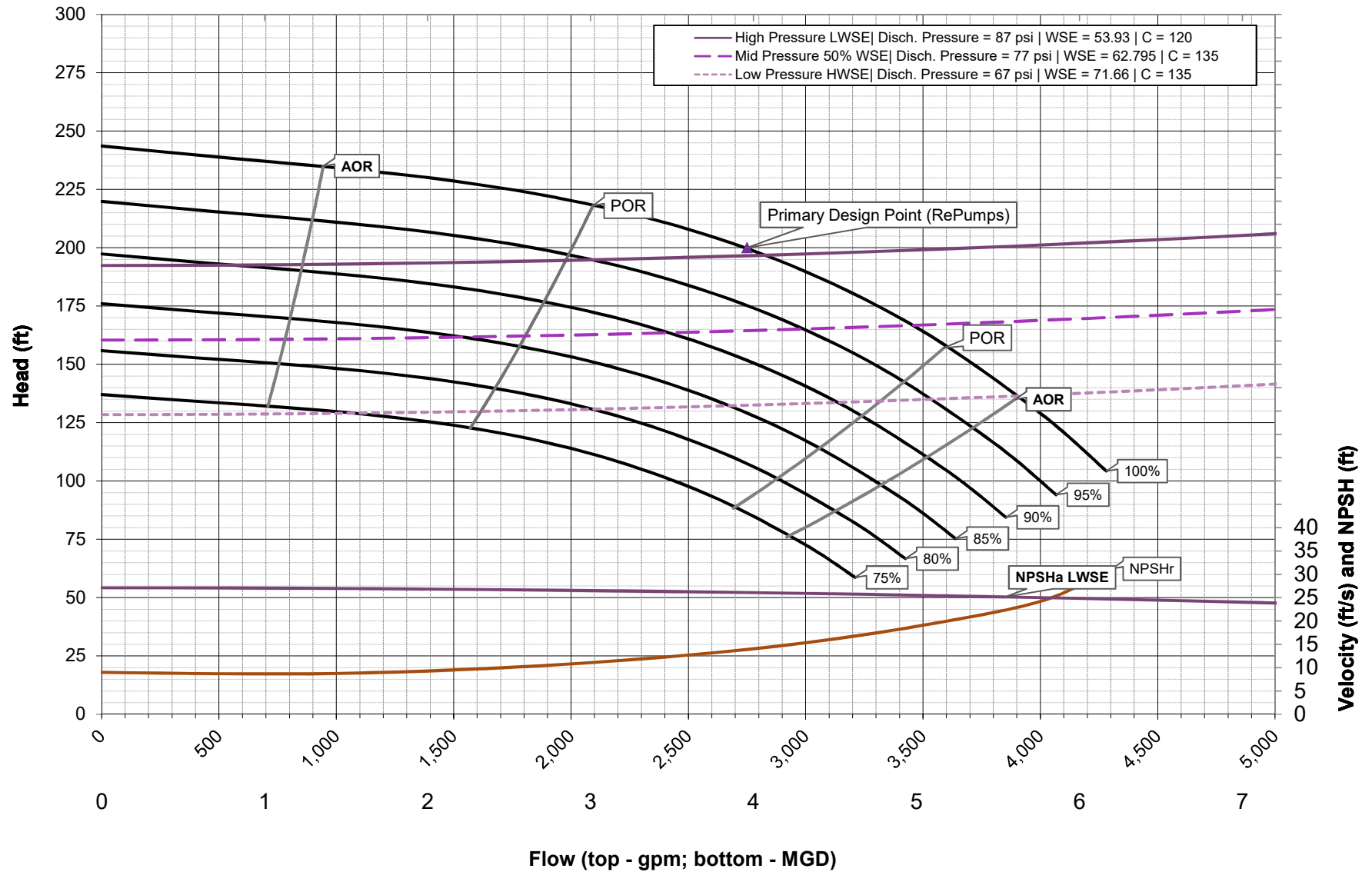
¹ A motor and pump assembly conforming to Hydraulic Institute Acceptance Grade 1E with efficiency as the guaranteed requirement at the primary design and acceptance point shall be provided.

² Sufficient motor horsepower shall be provided by the manufacturer to prevent motor overload exceeding 100% of rated motor horsepower over the entire operating range as identified in the figures below. Figures are based upon information provided and represented as accurate by the manufacturer during the design process. Should pumps fail this criterion at time of factory testing, Owner may at their sole pleaser, refuse acceptance of the pumps without any liability for additional cost or may require the manufacturer to provide a larger motor at the manufacturer's sole expense. Should Owner require larger motor size, CONTRACTOR shall provide large electrical and HVAC equipment at no additional cost to Owner.

END OF SECTION 11200
(CURVES TO FOLLOW)

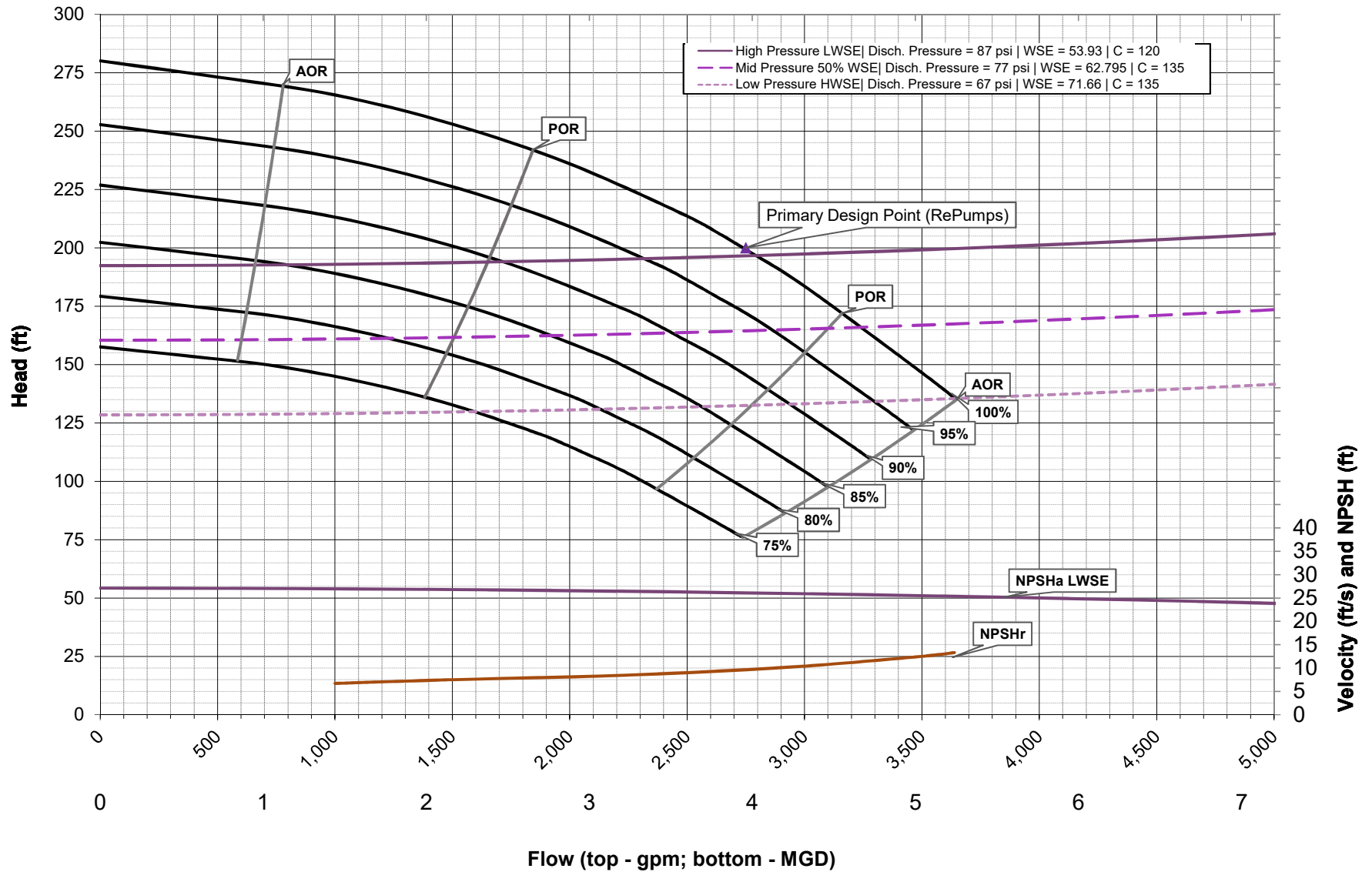
Twin Creeks Pumping System Design - RePump

Aurora 14-8x10x17B 14.81 1775 rpm - 200 hp



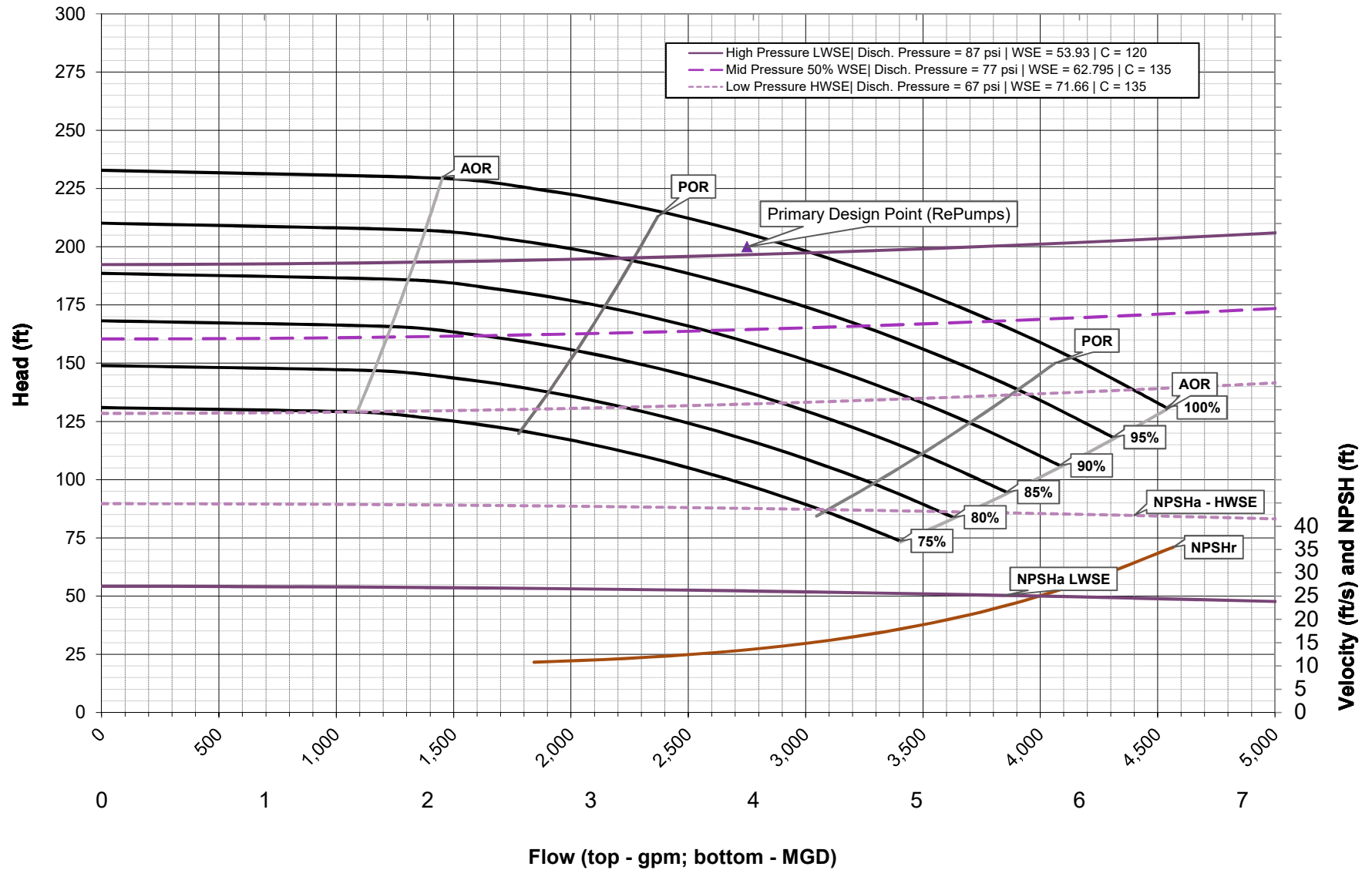
Twin Creeks Pumping System Design - | RePump

Flowserve 8LR-20A 16.30" 1791 rpm - 200 hp



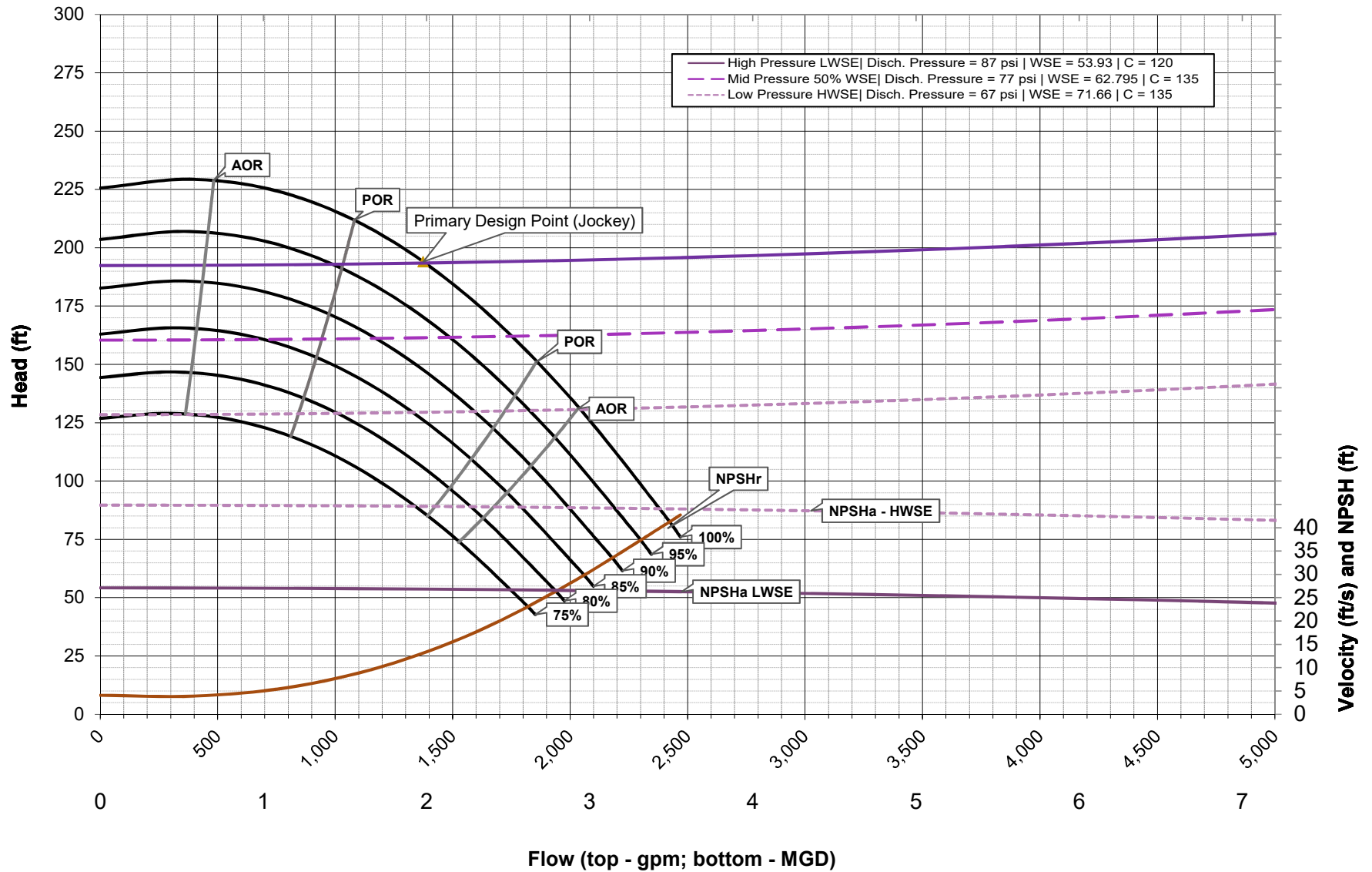
Twin Creeks Pumping System Design - RePump

Peerless 8AE17Q 14.81" 1785 rpm - 200 hp



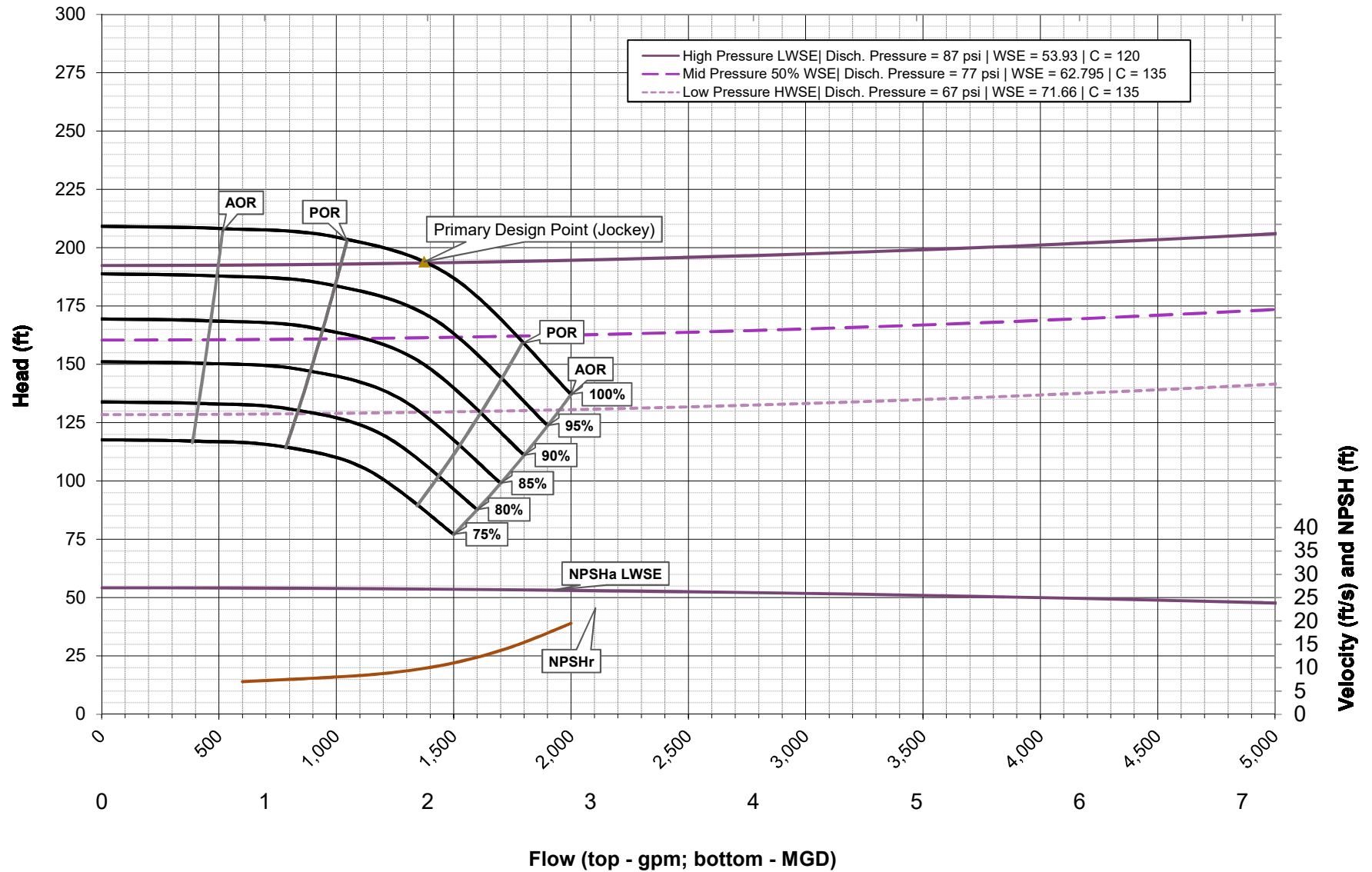
Twin Creeks Pumping System Design - Jockey

Aurora 14-5x6x17 14.19" 1775 rpm - 100 hp



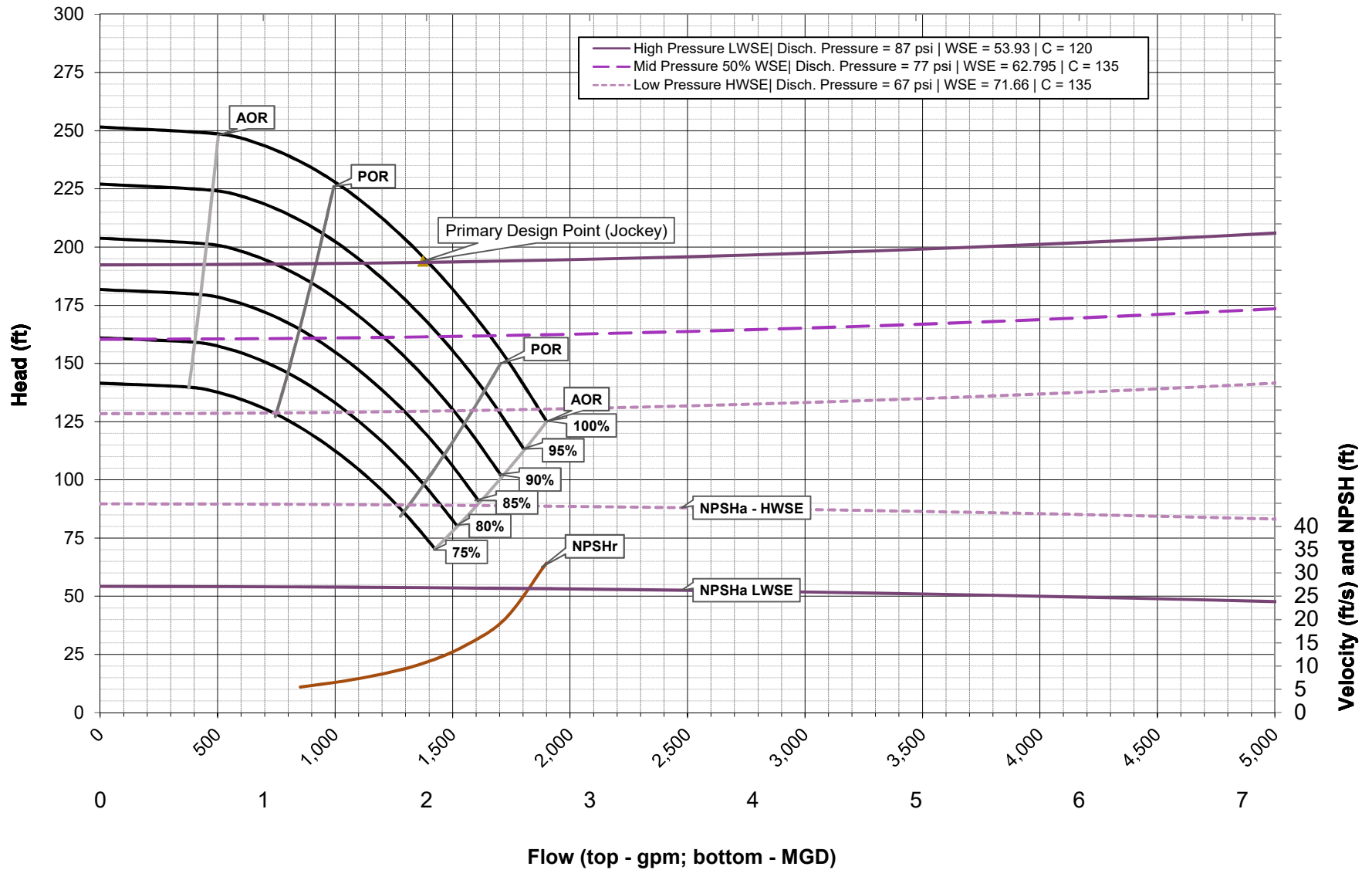
Twin Creeks Pumping System Design - Jockey

Flowserve 6LR-16B 13.75" 1791 rpm - 125 hp



Twin Creeks Pumping System Design - Jockey

Peerless 6AE16N 15.78" 1785 rpm - 100 hp



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CHEMICAL METERING SYSTEMS

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, equipment, materials, and incidentals required and install, complete and ready for operation a chemical dosing and metering system as shown on the Drawings and as specified herein.
- B. Furnish chemical fill station containment pallet(s) as shown on the Drawings and specified herein.
- C. The chemical metering pump skid shall be pre-engineered by the metering pump manufacturer, prefabricated, pre-piped as shown on the drawings and as specified herein as manufactured by Grundfos. The pump skids shall be manufactured with polypropylene or fiberglass reinforced plastic (FRP). The chemical metering skid is required to be fully functional at temperatures up to 104 degrees F.
 - 1. One chemical metering pump skid for sodium hypochlorite to provide a chlorine residual for reclaimed water of 0.5 to 3.0 mg/L.
 - a. The pump skid specified herein shall include, but is not limited to, the following:
 - 1) Chemical feed pumps with integral flow metering module
 - 2) Strainers
 - 3) Calibration columns
 - 4) Pressure gauges
 - 5) Pressure relief valves
 - 6) Pulsation dampeners
 - 7) Backpressure valves
 - 8) Ball valves and unions
 - 9) Pump control panel with SCADA interface
 - 10) Feed system base, deck
 - 11) Miscellaneous piping and accessories
- D. The work includes, but is not limited to, the purchase and installation of new equipment as shown on the Drawings and specified herein.
- E. It is the intent of this specification that a single skid supplier coordinates the products and equipment for the chemical metering system.

1.02 RELATED WORK

- A. Concrete work is included in Division 3.
- B. Shop priming and field painting is included in Division 9.
- C. Chemical storage tank is included in Section 11344.

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- D. PVC pipe and fittings are included in Section 15064.
- E. Pipe hangers and supports are included in Section 15090.
- F. Valves and appurtenances are included in Section 15100.
- G. Field instruments are included in Section 16950.
- H. Electric motors are included in Section 16150.
- I. Control panel fabrication is included in Section 16910.

1.03 SUBMITTALS

- A. Copies of all materials required to establish compliance with the Specifications shall be submitted in accordance with the provisions of Section 01300. Submittals shall include at least the following:
 - 1. Data on the characteristics and performance of all pumps, including Manufacturer's certified rating data.
 - 2. Certified shop drawings showing all important details of construction and dimensions.
 - 3. Descriptive literature, bulletins, and/or catalogs of the equipment.
 - 4. The total weight estimate of the equipment.
 - 5. A complete total bill of materials.
 - 6. A list of the manufacturer's recommended spare parts with the manufacturer's current price for each item. Include gaskets, packing, etc. on the list.
 - 7. All information required by Section 01300.
 - 8. Complete data on motors in accordance with Division 16.
 - 9. Complete wiring diagrams and schematics of each control panel, controllers, control device and operator's station furnished under this section.
 - 10. Complete wiring diagrams and schematics of all power and control systems showing wiring requirements between all system components, motors, sensors, control panels, etc., including connections to work of other sections.
 - 11. Fabrication drawings of pump wall supports, splash guard hangers and splash guards. Drawings shall show pump orientation per the Drawings to show the relationship between the pumps, guards and supports. If CONTRACTOR proposes alternative pump layouts, they shall be shown and clearly stated that a deviation is being requested with this submittal.
 - 12. Data on noise.

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13. The recommended grades of lubricants, along with references to alternative equal products by other manufacturers.
 14. Certification by the supplier that the equipment and materials to be provided are suitable for the service intended.
 15. A complete description of chemical resistance of the component materials that will come in contact with chemicals, as specified herein.
 16. A quality assurance checklist from the supplier identifying that the chemical metering skid system design and installation are sufficient for satisfactory operation of the metering system.
 17. In the event that it is impossible to conform with certain details of the Specifications due to different manufacturing techniques, describe completely all non-conforming aspects.
 18. Product data on the containment pallets.
- B. Operating and Maintenance Data and Training:
1. Operating and maintenance instructions shall be furnished to the ENGINEER as provided in Section 01730. The instructions shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc. that are required to instruct operating and maintenance personnel unfamiliar with such equipment.
 2. A factory representative who has a complete knowledge of the proper operation and maintenance shall be provided for a minimum of 1 day solely to instruct representatives of the OWNER and ENGINEER on proper operation and maintenance of the equipment. One day is defined as 8 hours of instruction, excluding travel and lodging expenses. If there are difficulties in operation of the equipment due to the manufacturer's design or fabrication, additional service shall be provided at no additional cost to the OWNER.
 3. The technical representative shall have at least four years of experience in chemical system training and instruction. Training sessions shall be scheduled not less than two weeks in advance. Written training materials consisting of the final O&M manuals shall be provided to each of the OWNER's personnel in attendance and shall remain with the trainees.

1.04 REFERENCE STANDARDS

- A. National Electrical Manufacturers Association (NEMA)
- B. American Society for Testing and Materials (ASTM)
- C. American National Standards Institute (ANSI)
- D. Anti-Friction Bearing Manufacturers Association (AFBMA)
- E. American Welding Society (AWS)

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- F. Occupational Safety and Health Administration (OSHA)
- G. Underwriters Laboratories (UL)
- H. Where reference is made to one of the above standards, the revision in effect at the time of contract award shall apply.

1.05 QUALITY ASSURANCE

- A. The pumps and skids covered by these Specifications are intended to be standard pumping equipment, as modified by these Specifications, of proven ability, as manufactured by a single manufacturer, having long experience in the production of such pumps. The pumps and skids furnished shall be designed, constructed, and installed in accordance with the best practices and methods, and shall operate satisfactorily when installed as specified herein and shown on the drawings.
- B. Should equipment which differs from these Specifications be offered and approved by ENGINEER and OWNER as equal to that specified, such equipment shall be acceptable only on the basis that any revisions in the design and/or construction of the structure, piping, appurtenant equipment, electrical work, etc. required to accommodate such a substitution shall be made at no additional cost to the OWNER and be as approved by the OWNER and ENGINEER.

1.06 SYSTEM DESCRIPTION

- A. General
 - 1. Mechanically actuated diaphragm pumps will be used to meter liquid sodium hypochlorite at 12.5 percent concentration from the sodium hypochlorite storage tank to one primary injection point on the upstream side of the pumps. The sodium hypochlorite metering pump skid will be mounted adjacent to the storage tank in an uncooled and unventilated open pre-engineered metal building.
 - 2. The variable speed pumps will be controlled by the pump control panel and plant SCADA system based on the respective flow rates of the pumps and residual chlorine concentrations.
 - 3. The sodium hypochlorite metering system shall be suitable materials of construction to operate with sodium hypochlorite products at a concentration of 12.5 to 15 percent.
- B. Refer to the process and instrumentation diagrams in the Drawings and to Division 16 for specific control requirements of the chemical pump systems.

1.07 TOOLS AND SPARE PARTS

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- A. All special tools required for normal operation and maintenance shall be furnished with the equipment.
- B. Manufacturer's preventive maintenance kit shall include the following spare parts at a minimum:
 - 1. One diaphragm assembly.
 - 2. Two check valve assembly.
 - 3. Two sets of valve gaskets, one set of seals, and O-rings.
- C. All tools and spare parts shall be packed and identified in accordance with manufacturer's recommendations.
- D. With the O&M manual submittal, provide a list of all spare and replacement parts.

1.08 POWER SUPPLY

- A. The entire skid mounted chemical metering system shall be designed for operation on a single 120 VAC, 20 Amp, single phase power supply. Metering system control panel shall distribute 120 VAC through protective devices and integral power supplies, as required.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Section 01600 for additional details and requirements related to storage, handling, and delivery.
- B. All pumps, controllers, motors, panels, and appurtenances shall be shipped from the Manufacturer in protective cartons or containers.
- C. All flanges, pipe connections, and electrical connections shall be suitably protected to prevent damage during delivery, storage, and installation.
- D. The Manufacturer shall provide written instructions on storage and handling of the equipment to the CONTRACTOR.
- E. Pump skids shall be delivered as a complete factory piped/ fabricated skid mounted system, protected from the elements via shrink wrap or other suitable means. Manufacturer's written storage instructions shall be followed by the CONTRACTOR.

1.10 WARRANTY

- A. The equipment shall be warranted by the CONTRACTOR and MANUFACTURER for a minimum period of one (1) year from date of substantial completion, to be free from defects in workmanship, design or material. If the equipment should fail during the warranty period due to a defective part(s), it shall be replaced in the machine and the unit(s) restored to service at no additional cost to the OWNER.

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- B. The MANUFACTURER's warranty period shall start concurrently with the CONTRACTOR's warranty period. No exception to this provision shall be allowed.

PART 2 – PRODUCTS

2.01 GENERAL

- A. The Specifications are intended to give a general description of what is required, but do not cover all details which may vary in accordance with the exact requirements of the equipment as offered. They are, however, intended to cover the furnishing, delivery, installation and field testing of all materials, equipment and apparatus as required. Any additional auxiliary equipment necessary for the proper operation of the proposed installation not mentioned in these Specifications or shown on the drawings shall be furnished and installed.
- B. All equipment shall be designed and proportioned to have liberal strength, stability, and stiffness and to be specifically adapted for the intended service.
- C. The equipment, including pump skids, shall be rigidly and accurately anchored into position by CONTRACTOR in accordance with manufacturer's installation recommendations. All necessary foundation bolts, plates, nuts, and washers shall be furnished and installed by CONTRACTOR in accordance with manufacturer's recommendations. Anchor bolts shall be titanium for the sodium hypochlorite metering pumps. Each pump shall be rigidly mounted to a polypropylene channel base of sufficient stiffness to support pump, motor, and reducer. Skids shall be constructed so that the pumps are a minimum of 1.5-inches above the skid slab in the event of a chemical leak. The actual pump skid shall be mounted by the CONTRACTOR on a concrete pad as shown on the Drawings. The final dimensions of the pump pad shall be coordinated to fit the skid during the shop drawing phase.
- D. Provide forklift cutouts for all metering pump skids weighing over 100 lbs.
- E. Stainless steel nameplates giving the name of the manufacturer, model number and serial number, capacity, and other pertinent data shall be attached to each item of equipment.
 - 1. Pump nameplates shall include capacity, head, speed, and any other pertinent information.
 - 2. Motor nameplates shall include horsepower, speed, voltage, amperes, service factor and any other pertinent data.
- F. Nameplates giving the name and number of each pump or item of equipment shall be rigidly fastened to all control panels furnished under this section. All push buttons, selector switches, lights, etc. shall be properly labeled such that the function of each component is clearly identified.

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- G. The chemical feed pumps shall be model DDA 60-10 mechanical diaphragm metering pumps as manufactured by Grundfos.
- H. Vented ball valves shall be used on the sodium hypochlorite system skids.

2.02 METERING PUMPS - GENERAL

- A. All pumps shall be variable speed chemical feed microprocessor-controlled, mechanically actuated diaphragm metering pumps, motor driven, and shall be of suitable materials for pumping the respective chemical solutions. Each pump shall be capable of receiving a 4-20 mA external signal for flow pacing and allow manual control at the pump. Single ball type check valves shall be provided on the suction and discharge, including a replaceable ball guide. The pumps shall be dry-lift self-priming and capable of indefinite operation without process fluid.
 - 1. All pumps shall be designed to deliver the capacity tabulated below at the minimum discharge pressure specified.
 - 2. All pumps shall be provided with a motor with a constant suction stroke speed and adjustable discharge stroke speed. Pump delivery shall be repeatable within plus or minus 1.6 percent accuracy at the design point.
 - 3. All sodium hypochlorite pumps shall be provided with pressure relief valves with a set pressure of 20 psig maximum. Set pressure shall be field adjustable.
 - 4. Pumps shall include an integral flow metering/pressure monitoring module.

Sodium Hypochlorite Metering Pumps (Disinfection – 12.5% solution strength)

Number of Units	2 (1 duty/1 standby)
Capacity (maximum)	15.85 gal/hr
Capacity (minimum)	0.02 gal/hr
Horsepower	1/3 hp
Maximum Pressure	20 psi
Model Used for Design:	Grundfos DDA 60-10

- B. The mechanically actuated disc diaphragm shall be constructed of a steel core, vulcanized into nylon-reinforced EPDM, with PTFE-faced fluid contact surface. The diaphragm shall be of a convex design fitting into a concave liquid end to minimize dead volume and promote flow of solids in suspension.
- C. Drives and Capacity Control (Motorized Pumps)
 - 1. Stroke frequency control for motorized pumps shall be done with an integral stepper motor and integral microprocessor controller to achieve a nearly continuous dosage.

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- D. Dual Pump Control Panel for Sodium Hypochlorite Pump Skid
1. The chemical metering skid control panel shall be configured with the following:
 - a. Nema 4X fiberglass enclosure, 3-point latch, piano hinge, lockable
 - b. Weatherproof duplex receptacle
 - c. Control power supplies
 - d. ProfiNet media converter
 - e. Overcurrent protective devices
 - f. Two analog inputs (4-20ma) speed command
 - g. Two digital inputs (on/off) run command
 - h. Two digital outputs (on/off) run status
 - i. Two digital outputs (on/off) alarm status
 - j. Two digital outputs (on/off) in-remote status
 - k. Two analog outputs (4-20ma) speed indication
 2. The panel shall be UL 508 rated and shall be fabricated by the chemical skid manufacturer and tested with the chemical feed skid prior to shipment to the site.
 3. Primary control for the metering system shall be accomplished via ProfiNet communications protocol with backup hardwired signals as described above. Remote operation accomplished by receiving a dry contact maintained enable signal and analog 4-20mA signal for 0 to 100 percent speed command. Remote status contacts for remote selected, running, alarm, and analog 4-20mA speed feedback proportional to pump speed. The pump feedback signal shall take into account the stroke length and decrease the max output of 20 mA proportionally to the setting.
 4. Alarm relay is triggered from, at a minimum, any one of the following:
 - a. Pump power failure, blown internal fuse, loss of analog signal, diaphragm failure, low flow, and internal motor monitor failure.

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2.03 SKID-MOUNTED FEED SYSTEM

- A. The skid mounting of the metering pumps shall conform to the following requirements:
1. The chemical feed system shall be completely assembled, mounted, calibrated, tested, and delivered to the site on a single skid. Components to be mounted on the skid are as indicated on the drawings and shall include the metering pumps, calibration column, piping, valves, piping accessories (pulsation dampeners, strainers, back pressure valves, pressure relief valves, etc.), and wiring integral to the skid. The chemical metering pump manufacturer shall be responsible for providing all equipment, valves and piping within the skid boundary. The metering pump skid shall be manufactured by Grundfos. No alternates will be approved.
 2. The skids shall be constructed of fusion welded polypropylene sheets with adequate supports for all equipment and piping and a ½-inch drip lip.
 3. The skids shall be designed in a primary/backup arrangement utilizing a common suction header and a common discharge header.
 4. All components of the skid-mounted system (pumps, piping, and controls) shall be tested as described in specification.
 5. Skid dimensions are anticipated to be 44-inch wide by 24-inch deep by 64-inch high. Final dimensions shall be determined during the submittal phase and shall be coordinated with the proposed layout by the CONTRACTOR. Any changes from the design drawings will be the responsibility of the CONTRACTOR.
- B. Skid-mounted accessories shall include the following, refer to the P&IDs for additional requirements:
1. Calibration Chamber
 - a. For each metering pump skid, as shown on the Drawings, a graduated calibration chamber of the size recommended by the pump manufacturer, shall be provided. The transparent chamber shall be chemical resistant glass and be compatible with the chemicals pumped. The calibration chamber design shall incorporate a vent that will be piped within the containment structure to discharge into the structure's sump.
 - b. The chamber shall be sized to give adequate capacity for a minimum 30 second draw down test.
 - c. The scale shall give direct readings in milliliters (mL) and gallons per hour (gph) without the need for calculations.
 - d. The calibration chamber shall be piped and valved so that each pump shall be able to utilize the calibration chamber without interfering with the operation of the other pumps.

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- e. The top of the chamber shall have a threaded fitting to allow for piping to a common vent.
- 2. Pulsation Dampeners
 - a. Shall be of the single diaphragm design, capable of arresting water hammer in the pump discharge lines created by the metering pumps.
 - b. Materials of construction of diaphragm and body shall be corrosion resistant to the chemical fluid pumped.
 - c. For each pump skid discharge assembly, a minimum of one pulsation dampener of suitable size, material, and pressure rating as recommended by the pump manufacturer shall be provided. Manufacturer shall provide a pulsation dampener on the discharge of each pump if one dampener on the discharge assembly is not adequate.
 - d. Pulsation dampeners shall be sized appropriately for each pump to remove a minimum of 95 percent of the pulsations. The manufacturer shall provide calculations to verify sizing if requested by the ENGINEER.
 - e. Shall be of vertical design and shall be hydro-pneumatic type, air-charged, bladder type and shall be provided with an air charging valve and a pressure gauge located on the air chamber. A pulsation dampener shall consist of two chambers, an upper pressure chamber and a lower process fluid chamber. Two chambers shall be separated by a flexible, elastomeric bladder, a PTFE bellow or a diaphragm.
 - f. Shall be designed at a minimum safety margin of 4:1 burst pressure to maximum working pressure. Pulsation dampener shall be capable of handling pump's maximum stroke volume. Pulsation dampeners shall have a minimum working volume of at least 15 times the maximum displacement of one pump stroke displacement. The pressure chamber shall be charged with compressed air to pump manufacturer's recommended charging pressure.
 - g. No threaded connections shall be allowed. Pulsation dampeners shall be Sentry series, as manufactured by Blacoh, and constructed of material suitable for intended service, as recommended by pump manufacturer.
 - h. One portable, manually operated, air pump suitable for charging the pulsation dampeners shall be provided. Pump shall be provided with discharge tubing and all required fittings and adapters.
- 3. Backpressure and Pressure Relief Valves
 - a. A backpressure valve shall be provided on the discharge of the chemical skid. A pressure relief valve shall be provided on the

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discharge and in parallel with each chemical pump. The pressure relief and backpressure valves shall be of the size and pressure setting recommended by the pump manufacturer and of a material suitable for intended service, as recommended by pump manufacturer. Pressure set points shall be field adjustable. Diaphragms shall be non-laminated two-piece PTFE/EPDM backing diaphragm with bayonet post. End connections shall be spigot-end suitable for thermal fusion or solvent welding to the chemical piping system, as appropriate. No threaded connections shall be allowed. Valves shall be by Griffco Valve or approved equal.

- b. Initial settings shall be as follows:
 - i. PRV setting: 30 psi
 - ii. BPV setting: 20 psi
- 4. Piping, Valves and Appurtenances:
 - a. Skid piping, valves and appurtenances shall be Schedule 80 PVC. PVC glue/cement shall be as recommended by the pipe manufacturer for the service outlined in this Section.
 - b. True-union ball valves shall be provided for isolation of major equipment. Seals shall be compatible with the chemical being pumped.
 - c. For each chemical metering system, a line sight glass flow indicator or other approved means of indication shall be provided on the pressure relief valve discharge line to indicate activation of the pressure relief valve.
 - d. Provide any other valves such as unions, check valves, ball valves, anti-siphon valves as shown on the drawings.
 - e. Vented ball valves shall be used on the sodium hypochlorite system skid.
- 5. Flow and Pressure Annunciations:
 - a. Vendor shall provide system instrumentation as required for annunciation of hypochlorite system flow rate and system discharge pressure.
 - b. Annunciation will be transmitted to hypochlorite remote I/O control panel DIO-1 and transmitted to main site PLC panel SCP-1.
 - i. A CIU500 module shall be provided as an integral unit for communication with local DIO-1 control panel via ProfiNet.
 - c. Field instruments shall be as indicated in Section 16950. Pressure indicating transmitter shall be provided by the Instrumentation System Supplier and installed in the field on the discharge of the hypochlorite feed system.
 - d. Calculated values are also acceptable to an accuracy of +/- 2%.

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2.04 CHEMICAL METERING ACCESSORIES

A. Pressure Gauges and Diaphragm Isolators

1. For each chemical metering skid, provide a pressure gauge and diaphragm type chemical isolation suitable for each chemical service. The gauge guard body shall be constructed of the same material as the applicable chemical piping system, as specified in Section 15064. The diaphragms shall be Teflon. No threaded connections shall be allowed. Range of pressure gauge to be suitable with each chemical service but at least a minimum operating pressure of 20 psi.
2. Pressure gauge shall have a 300 series stainless steel case and shall be approximately 2-½-inch nominal diameter with a type 316 stainless steel Bourdon tube and a 300 series stainless steel movement. The gauge dial shall be a white background with black markings and sealed to prevent entrance of moist air. The gauges shall be liquid filled with glycerin and shall be provided with a filler/breather cap. The socket shall be Type 316 stainless steel with bottom connection.
3. Each pressure gauge assembly shall be equipped with an isolation valve and diaphragm seal to protect the gauge from contact with fluid in the pipeline. The isolation valve shall be a ball valve. The valve and diaphragm seal housing shall be constructed of the same material as the applicable chemical piping system and shall have either socket weld, socket fuse or flanged process connection. The diaphragm shall be Teflon. Mineral oil fill between the diaphragm seal and the gauge shall be furnished with the unit.

B. For each diaphragm type metering pump, as shown on the Drawings, a suction line wye strainer shall be provided. Wye strainers shall have 1/32-inch perforations. Strainers shall be one size larger than the suction piping in which they are installed, and the piping shall be bushed up accordingly. Strainer material shall be a PVC body, solvent weld ends, PVC mesh, and FKM (Viton ®) O-ring.

1. Strainers shall be as manufactured by ASAHI, George Fischer, Hayward, or Micromold Products Inc.

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2.05 CHEMICAL FILL STATION CONTAINMENT PALLETS

- A. The chemical pump skid system MANUFACTURER shall provide chemical fill station containment pallet as shown on the Drawings. Each pallet shall provide a minimum effective storage volume of 50 gallons and shall be suitable for the continuous storage of the respective chemical solutions. Each container shall be constructed of high-density linear polyethylene (HDLPE). All gaskets and seals shall be chemically resistant to the respective chemical solutions and shall be of material recommended by the manufacturer. A manual drain and valve shall be provided on all chemical fill station containment pallets.
- B. Chemical fill station containment pallets shall be the Ultra-Spill Pallet P2, as manufactured by UltraTech International Inc., or equal. Pull over covers shall be provided for all chemical fill station containment pallets.

2.06 SODIUM HYPOCHLORITE FEED SYSTEM AND PIPING

- A. The suction side of the sodium hypochlorite feed system shall be equipped with an in-line wye-type strainer with bypass, constructed of materials suitable for intended service and as specified in Paragraph 2.04 F, as provided by Grundfos.
- B. Piping shall be supported at every fitting and as appropriate to properly support the pipe. Piping connections to the pump shall be flanged or socket welded with pipe unions.
- C. The sodium hypochlorite piping and pump liquid end shall be PVC with FKM (Viton®) seals. Ball valves for the sodium hypochlorite skids shall be vented or drilled in accordance with Section 15100.

2.07 SURFACE PREPARATION AND SHOP PRIME PAINTING

- A. Surface preparation and shop painting is included as a part of the work of this Section and shall be as specified under Division 9.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. The chemical feed and metering systems shall be installed in accordance with manufacturer's instructions and recommendations in locations shown on the drawings. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the

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recommendations of the manufacturer. Anchor bolts shall be set in accordance with the shop drawings.

- B. Piping shall be rigidly supported in accordance with Section 15090.

3.02 INSPECTION AND TESTING

- A. CONTRACTOR is responsible for assuring services, labor, and equipment of the manufacturer as specified herein. The equipment manufacturer shall furnish the services of a competent and experienced representative who has complete knowledge of proper operation and maintenance of the equipment to inspect the installed equipment, supervise the initial test run, and to provide instructions to the plant personnel. Two visits shall be provided by chemical metering skid manufacturer. The first visit shall be to conduct inspection of installation and shall be a minimum of one day. The second visit shall be a minimum of two days and shall complete start-up, operate, and supervise the preliminary test (no chemicals) and the full functional test and to instruct plant personnel in the operation and maintenance of the equipment. The final copies of operation and maintenance manuals specified in Section 01730 must have been delivered to the ENGINEER prior to scheduling the second visit for the instruction period with the OWNER.
- B. Testing
 - 1. Upon completion of installation, the MANUFACTURER, in the presence of the ENGINEER, shall perform a preliminary test (no chemicals) over the full range of each system to ensure the functioning of all component parts to the satisfaction of the ENGINEER. The test shall be over the full range of capacity. The manufacturer shall furnish all labor and equipment. Air and power shall be supplied by the CONTRACTOR. Approval of the preliminary test by the ENGINEER shall not constitute final acceptance of the equipment furnished.
 - 2. Full functional testing shall be performed in the presence of the ENGINEER and a qualified manufacturer's representative on the system. The manufacturer shall furnish all labor materials and equipment required for such tests and shall correct any deficiencies noted by repairing or replacing the defective component and retesting as required until the equipment meets the Specifications and the satisfaction of the ENGINEER. A performance check shall be made on each metering pump with the chemical it is intended to pump. Pumps shall be tested at 10%, 20%, 50%, 75%, and 100% of scale, as required. The total error based on the field determined instrument errors, shall not exceed plus or minus two percent of the actual flow for the pumps.

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C. Operator Training

1. The second visit shall be during startup and to instruct plant personnel in the operation and maintenance of the system(s). If, during running of the tests, one or more points appear to be out by more than the specified amount, the manufacturer's field engineer shall make such adjustments or alterations as are necessary to bring equipment up to specification performance. Following such adjustment, the tests shall be repeated for all specified points to ensure compliance. Thirty days will be allowed for any changes necessary to meet the specifications. Otherwise the OWNER reserves the right to have the rejected equipment removed from the site and replaced by satisfactory equipment that operates in accordance with the Specifications. Chemicals for the full operating test will be furnished by the CONTRACTOR.

END OF SECTION 11245

SECTION 11270

DUPLEX GRINDER PUMP STATION

PART 1 – GENERAL

1.01 GENERAL DESCRIPTION

- A. The MANUFACTURER shall furnish complete factory-built and tested one explosion proof duplex grinder pump station that meets Factory Mutual (FM) explosion proof equipment standards. The system shall consist of a grinder pump core suitably mounted on an integral stand of stainless steel, electrical quick disconnect (NEMA 6P), pump removal harness, discharge assembly and shut-off valve, anti-siphon valve and check valve assembly, electrical alarm assembly, and all necessary internal wiring and controls.

1.02 SUBMITTALS

- A. Submittals for the equipment specified herein shall be prepared and submitted to the ENGINEER in accordance with the provisions of Section 01300.
- B. The MANUFACTURER shall supply copies of the operation and maintenance manuals in accordance with section 01730.

1.03 QUALIFICATIONS

- A. The grinder pump station, complete with all appurtenances, form an integral system, and as such, shall be supplied by one grinder pump station manufacturer. The CONTRACTOR shall be responsible for the satisfactory operation of the entire system. The equipment specified shall be a product of a company experienced in the design and manufacture of grinder pumps for specific use in low pressure sewage systems. The company shall submit detailed installation and user instructions for its product, submit evidence of an established service program including complete parts and service manuals, and be responsible for maintaining a continuing inventory of grinder pump replacement parts. The MANUFACTURER shall provide a reference and contact list from ten of its largest contiguous grinder pump installations of the type of grinder pumps described within this specification.
- B. The MANUFACTURER of the grinder pump station shall be Flygt/Xylem, E-One, or ENGINEER approved equal.
- C. The equipment furnished hereunder shall be the product of a company experienced in the design and manufacture of grinder pumps specifically designed for use in low pressure systems. All manufacturers proposing equipment for this project shall have at least 10 years of experience in the design and manufacture of units of identical size(s) and performance to the specified units. All manufacturers proposing equipment for this project must also provide evidence of successful installations of low pressure sewer systems utilizing grinder pumps of like type to the grinder pumps specified herein.
- D. Attention is directed to the fact that the drawings and overall system design are based on a particular piece of equipment from a particular manufacturer. These specifications are intended to provide guidelines for standard equipment of a

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DUPLEX GRINDER PUMP STATION

recognized manufacturer who already meets all the requirements of this specification.

1.04 OPERATING CONDITIONS

- A. The pumps shall be capable of delivering a minimum of 12 GPM against a rated total dynamic head of 117.5 feet. The pump(s) must also be capable of operating at negative total dynamic head without overloading the motor. Under no conditions shall in-line piping or valving be allowed to create a false apparent head.

1.05 WARRANTY

- A. The grinder pump MANUFACTURER shall provide a part(s) and labor warranty on the complete station and accessories, including, but not limited to, panel and redundant check valve, for a period of 12 months after substantial completion. Any manufacturing defects found during the warranty period will be reported to the Manufacturer by the OWNER and will be corrected by the Manufacturer at no cost to the OWNER.
- 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 OWNER.
- C. The MANUFACTURER'S warranty period shall run concurrently with the CONTRACTOR'S warranty period. No exception to this provision shall be allowed.

PART 2 – PRODUCTS

2.01 PUMP

- A. Each pump shall be a custom-designed, integral, vertical rotor, motor driven, solids handling pump of the semi-positive displacement type with a single mechanical seal. The rotor shall be constructed of stainless steel. Plating on the rotor will not be acceptable due to its tendency to delaminate. The stator shall be of a specifically compounded ethylene-propylene synthetic elastomer. The material shall be suitable for domestic wastewater service. Its physical properties shall include high tear and abrasion resistance, grease resistance, water and detergent resistance, temperature stability, excellent aging properties, and outstanding wear resistance. Buna-N is not acceptable as a stator material because it does not exhibit the properties as outlined above and required for wastewater service.

2.02 GRINDER

- A. The grinder shall be placed immediately below the pumping elements and shall be direct-driven by a single, one-piece motor shaft. The grinder impeller assembly shall be securely fastened to the pump motor shaft by means of a threaded connection attaching the grinder impeller to the motor shaft. Attachment by means of pins or keys will not be acceptable. The grinder will be of the rotating type with a

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stationary hardened and ground stainless steel shredding ring spaced in close annular alignment with the driven impeller assembly, which shall carry two hardened type 400 series stainless steel cutter bars.

- B. This assembly shall be dynamically balanced and operate without objectionable noise or vibration over the entire range of recommended operating pressures. The grinder shall be constructed so as to eliminate clogging and jamming under all normal operating conditions including starting. Sufficient vortex action shall be created to scour the tank free of deposits or sludge banks which would impair the operation of the pump. These requirements shall be accomplished by the following, in conjunction with the pump:
 - 1. The grinder shall be positioned in such a way that solids are fed in an upward flow direction.
 - 2. The maximum flow rate through the cutting mechanism must not exceed four feet per second. This is a critical design element to prevent jamming and as such must be integral to the design.
 - 3. The inlet shroud shall have a diameter of no less than five inches. Inlet shrouds that are less than five inches in diameter will not be accepted due to their inability to maintain the specified four feet per second maximum inlet velocity which by design prevents unnecessary jamming of the cutter mechanism and eliminates blinding of the pump by large objects blocking the inlet shroud.
 - 4. The impeller mechanism must rotate at a nominal speed no greater than 1800 rpm.
- C. The grinder shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of "foreign objects," such as paper, wood, plastic, glass, rubber and the like, into finely divided particles which will pass freely through the passages of the pump and the 1-1/4-inch diameter discharge.

2.03 ELECTRIC MOTOR

- A. As a maximum, the motor shall be a maximum 2 HP, nominal 1800 RPM, 208 Volt 60 Hertz, three phase, capacitor start, ball bearing, air-cooled induction type with a low starting current not to exceed 30 amperes and high starting torque of 8.4 foot pounds. Inherent protection against running overloads or locked rotor conditions for the pump motor shall be provided by the use of an automatic reset, integral thermal overload protector incorporated into the motor. This motor protector combination shall have been specifically investigated and listed by Underwriters Laboratories, Inc., for the application. Non-capacitor start motors or permanent split capacitor motors will not be accepted because of their reduced starting torque and consequent diminished grinding capability. To reduce the potential of environmental concerns, the expense of handling and disposing oil, and the associated maintenance costs, oil-filled motors will not be accepted.
 - 1. Should a different voltage be required, it will be the CONTRACTOR's responsibility to coordinate and provide a transformer and related equipment to result in a functional system.

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2.04 MECHANICAL SEAL

- A. The pump/core shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump. The seal shall have a stationary ceramic seat and carbon rotating surface with faces precision lapped and held in position by a stainless steel spring.

2.05 WET WELL

- A. The wet well shall be made of fiberglass reinforced plastic (FRP) of a grade selected for environmental stress cracking resistance. Corrugated sections are to be made of a double wall construction with the internal wall being generally smooth to promote scouring. Corrugations of outside wall are to be of a minimum amplitude of 1 1/2-inch to provide necessary transverse stiffness.
- B. Any incidental sections of a single wall construction are to be a minimum 0.250 inch thick. All seams created during wet well construction are to be thermally welded and factory tested for leak tightness. Wet well wall and bottom must withstand the pressure exerted by saturated soil loading at maximum burial depth. All station components must function normally when exposed to maximum external soil and hydrostatic pressure. The wet well shall be bedding and backfilled in accordance with Division 2 and the geotechnical report.
- C. The wet well shall be furnished with field-installed EPDM inlet grommets to accept a 3-inch Sch 40 DWV pipe and a 1-1/4-inch Sch 80 PVC pipe from the sump pump discharge. These connection locations shall be coordinated between the CONTRACTOR per the drawings. Wet well dimensions and capacities shall be as shown on the Drawings.
- D. The wet well shall include a lockable cover assembly providing low profile mounting and watertight capability. Access way design and construction shall facilitate field adjustment of station height in increments of 4-inch or less without the use of any adhesives or sealants requiring cure time before installation can be completed.
- E. All penetrations shall be completely sealed and leak tested.

2.06 DISCHARGE HOSE AND DISCONNECT/ VALVE

- A. All discharge fittings and piping shall be constructed of 304 series stainless steel, polypropylene, EPDM or PVC. The discharge hose assembly shall include a shut-off valve rated for 200 psi WOG and a quick disconnect feature to simplify installation and pump removal. The bulkhead penetration shall be factory installed and warranted by the manufacturer to be watertight.

2.07 ANTI-SIPHON VALVE

- A. The pump discharge shall be equipped with a factory-installed, gravity-operated, flapper-type integral anti-siphon valve built into the discharge assembly. Moving

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parts will be made of 300 series stainless steel and fabric-reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength.

- B. A nonmetallic hinge shall be an integral part of the flapper assembly, providing a maximum degree of freedom to ensure proper operation even at a very low pressure. The valve body shall be injection-molded from a glass-filled thermoplastic resin. Holes or ports in the discharge piping are not acceptable anti-siphon devices due to their tendency to clog from the solids in the slurry being pumped.

2.08 CHECK VALVE

- A. The pump discharge shall be equipped with a factory-installed, gravity operated, flapper-type integral check valve built into the discharge assembly. The check valve will provide a full-ported passageway when open and shall introduce a friction loss of less than six inches of water at maximum rated flow. Moving parts will be made of a 300 series stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A nonmetallic hinge shall be an integral part of the flapper assembly providing a maximum degree of freedom to assure seating even at a very low back pressure. The valve body shall be an injection molded part made of glass filled PVC. Ball-type check valves are unacceptable due to their limited sealing capacity in slurry applications.
- B. The grinder pump installation shall also include one separate check valve of the type detailed in this section for installation in the 1¼-inch grinder pump station discharge pipe.

2.09 WET WELL VENT

- A. A vent shall be installed in the wet well cover. The vent shall consist of a 2-inch 316 SS threaded mounting flange, 2-inch 316 SS nipple, and a Wager 2100 mushroom check valve. The top shall be tapped and mounting flange connected to the lid per the wet well MANUFACTURER recommendations.

2.10 CORE UNIT

- A. The grinder pump station shall have an easily removable core assembly containing pump, motor, grinder, all motor controls, check valve, anti-siphon valve, electrical quick disconnect and wiring. The watertight integrity of the core unit shall be established by 100 percent factory test at a minimum of five PSIG.

2.11 CONTROLS

- A. All necessary controls, including motor and level controls, shall be located in the top housing of the core unit. The top housing will be attached with stainless steel fasteners.

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- B. Non-fouling wastewater level controls for controlling pump operation shall be accomplished by monitoring the pressure changes in an integral air column connected to a pressure switch. The level detection device shall have no moving parts in direct contact with the wastewater. High-level sensing will be accomplished in the manner detailed above by a separate air-bell sensor and pressure switch of the same type. Closure of the high-level sensing device will energize an alarm circuit as well as a redundant pump-on circuit. For increased reliability, pump ON/OFF and high-level alarm functions shall not be controlled by the same switch. Float switches of any kind, including float trees, will not be accepted due to the periodic need to maintain (rinsing, cleaning) such devices.
- C. To assure reliable operation of the pressure switches, each core shall be equipped with a breather assembly, complete with a suitable means to prevent accidental entry of water into the motor compartment. The grinder pump will be furnished with a 6-conductor, 12-gauge, type SJOW cable, pre-wired and watertight to meet UL requirements with a FACTORY-INSTALLED NEMA 6P EQD half attached to it.

2.12 CONTROL PANEL

- A. The grinder pump station shall include a corrosion-proof, thermoplastic polyester NEMA 4X, UL-listed control panel suitable for wall mounting. The control panel shall be designated as VCP-630. The enclosure shall include a hinged, lockable cover with padlock, preventing access to electrical components, and creating a secured safety front to allow access only to authorized personnel.
- B. The control panel shall contain two 15-amp, 3 pole circuit breakers for the pump core's power circuit and one 15-amp single-pole circuit breaker for the alarm circuit. The panel shall contain a push-to-run feature, an internal run indicator, and a complete alarm circuit. All circuit boards in the control panel are to be protected with a conformal coating on both sides and the AC power circuit shall include an auto resetting fuse.
- C. The control panel shall include the following features: external audible and visual alarm; push-to-run switch; push-to-silence switch; redundant pump start; and high-level alarm capability. When the pump and alarm breakers are on, the alarm sequence is to be as follows:
 - 1. When liquid level in the sewage wet well rises above the alarm level, audible and visual alarms are activated.
 - 2. The audible alarm may be silenced by means of the externally mounted, push-to-silence button.
 - 3. Visual alarm remains illuminated until the sewage level in the wet-well drops below the "off" setting of the alarm pressure switch.
 - 4. Service equipment/ main service disconnect breaker – A separate internal breaker, rated and approved for use as "service equipment," which also acts as a main service disconnect of the grinder pump station, shall be provided.
 - 5. Run-time/ hour Meter – A run-time or hour meter shall be provided to display the total run-time or operation time for the pump core.

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- D. The visual alarm lamp shall be inside a red, oblong lens at least 3.75-inch L x 2.38-inch W x 1.5-inch H. Visual alarm shall be mounted to the top of the enclosure in such a manner as to maintain the NEMA 4X rating. The audible alarm shall be externally mounted on the bottom of the enclosure, capable of 93 dB @ 2 feet. The audible alarm shall be capable of being deactivated by depressing a push-type switch that is encapsulated in a weatherproof silicone boot and mounted on the bottom of the enclosure (push-to-silence button).
- E. The entire control panel shall be listed by Underwriters Laboratories, Inc.
- F. Grinder pump run status, wet well levels, and system fault status shall be transmitted to the main control panel SCP-1.

2.13 SERVICEABILITY

- A. The grinder pump core unit shall have two lifting hooks, complete with nylon lift-out harness, to facilitate easy core removal when necessary. All mechanical and electrical connections must provide easy disconnect capability for core unit removal and installation. A push to run feature will be provided for field trouble shooting. All motor control components shall be mounted on a readily replaceable bracket for ease of field service.

2.14 OSHA CONFINED SPACE

- A. All maintenance tasks for the grinder pump station must be possible without entry into the grinder pump station (as per OSHA 1910.146 Permit-required confined spaces). *“Entry means the action by which a person passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant’s body breaks the plane of an opening into the space.”*

2.15 SAFETY

- A. The grinder pump shall be free from electrical and fire hazards as required in a residential environment. As evidence of compliance with this requirement, the completely assembled and wired grinder pump station in its tank shall be listed by Underwriters Laboratories, Inc., to be safe and appropriate for the intended use. UL listing of components of the station or third-party testing to UL standard will not be accepted.
- B. The grinder pump shall meet accepted standards for plumbing equipment for use in or near residences, shall be free from objectionable noise, odor, or health hazards, and shall have been tested by an independent laboratory to certify its capability to perform as specified in either individual or low pressure sewer system applications. As evidence of compliance with this requirement, the grinder pump shall bear the National Sanitation Foundation seal. Third-party testing to NSF standards will not be accepted.

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PART 3 – EXECUTION

3.01 FACTORY TEST

- A. The grinder pump shall be submerged and operated for five minutes (minimum). Included in this procedure will be the testing of all ancillary components such as, the anti-siphon valve, check valve, discharge line and each unit's dedicated level and motor controls. All factory tests shall incorporate each of the above listed items. Actual appurtenances and controls which will be installed in the field shall be particular to the tested pump only. A common set of appurtenances and controls for all pumps will not be acceptable. Certified test results shall be available upon request showing the operation of the grinder pump at two different points on its curve, with the maximum pressure no less than 60 psi.
- B. Completed wetwell shall be factory leak tested to assure the integrity of all joints, seams and penetrations.

3.02 DELIVERY

- A. The grinder pump unit shall be delivered to the job site, 100 percent completely assembled, including testing, ready for installation. Grinder pump station will be individually mounted on wooden pallet. Grinder pump core will be shipped in a separate container and is only required to be installed in the basin.

3.03 INSTALLATION

- A. Earth excavation and backfill are specified in Division 2 of these Specifications, but are also to be done as a part of the work under this section, including any necessary sheeting and bracing. The CONTRACTOR shall be responsible for handling ground water to provide a firm, dry subgrade for the structure, and shall guard against flotation or other damage resulting from general ground water or flooding. The grinder pump station shall not be set into the excavation until the installation procedures and excavation have been approved by the ENGINEER. Also refer to the geotechnical report.
- B. Remove packing material. User instructions MUST be given to the OWNER. Hardware supplied with the unit, if required, will be used at installation. The basin may not be dropped, rolled or laid on its side at any time for any reason.
- C. Installation shall be accomplished so that 1-inch to 6-inch of access way extends above the finished grade line. The finished grade shall slope away from the unit. The diameter of the hole must be large enough to allow for the concrete anchor.
- D. A 6-inch inch (minimum) layer of naturally rounded, clean and free-flowing aggregate, No. 57 stone, shall be used as bedding material under the unit. A concrete anti-flotation collar, sized according to the manufacturer's instructions, shall be required and shall be precast to the grinder pump or poured in place. The grinder pump station with its precast anti-flotation collar shall have a minimum of three lifting eyes for loading and unloading purposes. The unit shall be leveled, and

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DUPLEX GRINDER PUMP STATION

filled with water, to the bottom of the inlet, to help prevent the unit from shifting while the concrete is being poured and set. The concrete must be manually vibrated to ensure there are no voids. If it is necessary to pour the concrete to a level higher than the inlet piping, an 8-inch sleeve is required over the inlet prior to the concrete being poured.

- E. The electrical enclosure shall be furnished, pole-mounted adjacent to the station, and wired to the grinder pump station by the CONTRACTOR. An alarm device is required on the installation, there shall be NO EXCEPTIONS. The CONTRACTOR shall pole-mount the alarm device in a conspicuous location adjacent to the station, as per national and local codes. The alarm panel will be connected to the grinder pump station by a length of 6-conductor, 12-gauge, SJOW-type cable as shown on the Drawings. The power and alarm circuits must be on separate power circuits. The grinder pump station will be provided with a minimum of 25-feet of usable electrical supply cable outside the station, to connect to the alarm panel. This cable shall be provided with a FACTORY-INSTALLED EQD half to connect to the mating EQD half on the core.

3.04 START-UP AND FIELD TESTING

- A. The Manufacturer shall provide the services of qualified factory trained technician(s) who shall inspect the placement and wiring of each station, perform field tests as specified herein, and instruct the OWNER's personnel in the operation and maintenance of the equipment before the station is accepted by the OWNER. All equipment and materials necessary to perform testing shall be the responsibility of the CONTRACTOR. This will include, as a minimum, a portable generator (if temporary power is required) and water in the wet well.
- B. The services of a trained factory-authorized technician shall be provided for one working day of eight man-hours duration.
- C. Upon completion of the installation, the authorized factory technician will perform the following test on the station:
 - 1. Make certain the discharge shut-off valve is fully open. This valve must not be closed when the pump is operating.
 - 2. Turn ON the alarm power circuit.
 - 3. Fill the wet well with water to a depth sufficient to verify the high-level alarm is operating. Shut off water.
 - 4. Turn ON pump power circuit. Initiate pump operation to verify automatic "on/off" controls are operative. Pump should immediately turn ON. Within one-minute alarm light will turn OFF. Within three minutes the pump will turn OFF.
- D. Upon completion of the start-up and testing, the Manufacturer shall submit to the ENGINEER the start-up authorization form describing the results of the tests performed for the grinder pump station. Final acceptance of the system will not occur until authorization forms have been received for the pump station installed and any installation deficiencies corrected.

END OF SECTION 11270

SECTION 11280

SUMP PUMP

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The CONTRACTOR shall furnish, install, test, and place into operation the sump pump(s) as shown on the Drawings and specified herein. There is a total of one sump pump to be provided for the re-pump building trench.
- B. Furnish and install necessary and desirable accessory equipment and auxiliaries, whether specifically mentioned in this Section or not, as required for installation incorporating the highest standards for this type of service.
- C. Electric motors shall be furnished as part of the work of this Section and shall be in accordance with all applicable provisions of Section 16150.

1.02 RELATED WORK

- A. Valves, mechanical piping, and pipe hangers and supports are included in their respective Section of Division 15.
- B. Electrical provisions are included in Division 16.

1.03 SUBMITTALS

- A. Submit to the ENGINEER, in accordance with Section - 01300, copies of all materials required to establish compliance with this Section. Submittals shall include at least the following:
 - 1. Manufacturer's certified rating curves showing pump characteristics of head, brake horsepower, discharge, efficiency, and required minimum submergence. Catalog sheets showing a family of curves will not be acceptable.
 - 2. Certified shop and erection drawings showing all important details of construction, dimensions, and anchor bolt locations.
 - 3. Descriptive literature, bulletins, and/or catalogs of the equipment.
 - 4. The total weight of the equipment.
 - 5. A complete bill of materials.
 - 6. A list of the MANUFACTURER's recommended spare parts with the manufacturer's current price for each item. Include gaskets, packing, etc. on the list. List bearings by bearing manufacturer's numbers only.
 - 7. Complete data on motors in accordance with Section 16150.
 - 8. Description of surface preparation and shop painting.
- B. Test reports to be submitted:
 - 1. Description of test procedures and equipment.
 - 2. Copies of all test results, as specified in parts 2 and 3 of this Section.
- C. Complete operating and maintenance instructions shall be furnished for all equipment included under these specifications in accordance with Section 01730.

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SUMP PUMP

- D. Submit a Manufacturer's Certificate of Installation, Testing, and Instruction.

1.04 MANUFACTURER

- A. The sump pump station shall be manufactured by Hydromatic, Barnes, Flygt, KSB, Myers, or ENGINEER approved equal.

1.05 REFERENCE STANDARDS

- A. Design, manufacturing, and assembly of elements of the products herein specified shall be in accordance with the standards of the National Electrical Manufacturer's Association (NEMA).

1.06 QUALITY ASSURANCE

A. Qualifications

1. All the equipment to be used for similar service specified under this Section shall be furnished by a single manufacturer, and shall be standard units of proven ability as manufactured by a competent organization who is fully experienced, reputable, and qualified in the manufacture of the equipment to be furnished. The equipment shall be designed, constructed, and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed.
2. All equipment furnished under this Section shall be new and unused and shall be the standard products of manufacturers having a successful record of manufacturing and servicing the equipment and systems specified herein for a minimum of five (5) years.
3. These Specifications are intended to give a general description of what is required, but do not cover all details which may vary in accordance with the exact requirements of the equipment as offered. They are, however, intended to cover the furnishing, delivery, installation, field testing, and field calibration of all materials and apparatus as required. Any additional equipment necessary for the proper operation of the proposed installation not specifically mentioned in the Specifications or shown on the Drawings shall be furnished and installed at no chance in Contract Price or Time.
4. Pumps shall be manufactured in accordance with the standards of the Hydraulic Institute.
5. Should equipment which differs from this Section be offered and determined to be equal to that specified, such equipment shall be acceptable only on the basis that any revisions in the design and/or construction of the structure, piping, appurtenant equipment, electrical work, etc. required to accommodate such a substitution shall be made at no additional cost to the OWNER and shall be approved by the ENGINEER.

B. Services of the Manufacturer's Representative

1. The equipment manufacturer shall furnish the services of a competent and experienced factory representative who has complete knowledge of proper installation, operation, and maintenance of the equipment for a period of not less than 8-hour day (exclusive of travel time) to inspect the installed

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SUMP PUMP

- equipment, perform an initial test run, conduct final performance testing, and provide operating and maintenance instructions to the plant personnel.
2. If there are difficulties in operation of the equipment due to the manufacturer's fabrication or CONTRACTOR's installation, additional service shall be provided at no change in Contract Price or Time.

1.07 SUMP PUMP SYSTEM DESCRIPTION

- A. Sump pump shall be mounted in sump as shown on the Drawings. Sump pump water depth will be 6-inch or more.
- B. The sump pump shall have a capacity of 20 gpm at 10 ft of head.
- C. The sump pump shall be automatically controlled by the liquid level in the sump. The integral float/diaphragm switch supplied by the sump pump manufacturer will automatically start/stop the pump.
- D. The pump shall be supplied with a 115/120V, 1-phase, 60 Hz power supply, configured for connection to a NEMA 5-15R or 5-20R.

1.08 MAINTENANCE

- A. Spare Parts
 1. Furnish the following spare parts:
 - a. The manufacturer's recommended spare parts for the initial year of operation.
 2. Spare parts shall be properly bound and labeled for easy identification without opening the packaging and suitably protected for the long-term storage in a humid environment.
- B. Special Tools
 1. Furnish one set of all special tools required for normal operation and maintenance of the equipment.
 2. Tools shall be furnished in a suitable steel case, clearly and indelibly marked on the exterior to indicate the equipment for which the tools are intended.
- C. Furnish a 1-year supply of lubricants. Lubricants shall include summer and winter grades along with alternate references to equal products of other manufacturers including specifications such as AGMA numbers, viscosity, etc.

1.09 WARRANTY

- A. All equipment supplied under this section shall be warranted for a period of one (1) year by the MANUFACTURER from the date of substantial completion.
- B. The equipment shall be warranted to be free from defects in workmanship including normal wear and tear including mechanical seals, bearings, shafts, motor electrical cables, and motor stators.

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SUMP PUMP

PART 2 – PRODUCTS

2.01 PUMP

- A. Sump pumps shall be vertical, submerged, wet pit type, and capable of running dry for extended periods. The pumps shall be capable of passing small solids without clogging and undue wear. The pump body shall be cast iron or ductile iron.
- B. The pump discharge pipe shall be Schedule 80 PVC, unless otherwise noted on the Drawings.
- C. Sump pumps shall be complete with a submersible electric motor, floor-mounted discharge base and elbow, guide rails, motor electrical cable (minimum 50 feet in length) to connect at the demarcation box. No splicing is allowed, and all other appurtenances specified or required for proper operation.

2.02 SURFACE PREPARATION AND SHOP PRIME PAINTING

- A. Non-metallic components shall not require shop painting. The motor shall be primed and finish painted in the manufacturer's shop in accordance with requirement of Division 9.

2.03 SAFETY

- A. The sump pump shall be free from electrical and fire hazards as required in a residential environment. As evidence of compliance with this requirement, the completely assembled and wired pump shall be listed by Underwriters Laboratories, Inc., to be safe and appropriate for the intended use. UL listing of components of the station or third-party testing to UL standard will not be accepted.

PART 3 – EXECUTION

3.01 DELIVERY

- A. All sump pump units will be delivered to the job site, 100 percent completely assembled, including testing, ready for installation.

3.02 INSTALLATION

- A. Pump discharge shall be leveled, plumbed, and aligned into position to fit connecting piping. The discharge base shall be solidly secured to the floor using a 1-inch thick steel hold-down plate and appropriately sized 316 SS anchors, then grouted after initial fitting and alignment and before final bolting to the discharge piping. After final alignment and bolting, pump discharge base and all connections shall be inspected by JEA prior to any liquid being allowed into the sump.

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SUMP PUMP

3.03 START-UP AND FIELD TESTING

- A. The MANUFACTURER shall provide the services of qualified factory trained technician(s) who shall inspect the placement and wiring of each station, perform field tests as specified herein, and instruct the OWNER's personnel in the operation and maintenance of the equipment before the station is accepted by the OWNER. All equipment and materials necessary to perform testing shall be the responsibility of the CONTRACTOR.
- B. Upon completion of the installation, the authorized factory technician will perform the following test on the station:
 - 1. Turn ON the alarm power circuit.
 - 2. Fill the sump with water to a depth sufficient to verify the high-level alarm is operating. Shut off water.
 - 3. Turn ON pump power circuit. Initiate pump operation to verify automatic "on/off" controls are operative. Pump should immediately turn ON. Within one-minute alarm light will turn OFF. Within three minutes the pump will turn OFF.

END OF SECTION 11280

SECTION 11344

HIGH DENSITY CROSS-LINKED POLYETHYLENE CHEMICAL STORAGE TANK

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install single-walled high density cross-linked polyethylene storage tank for sodium hypochlorite as shown on the Drawings and specified herein.

1.02 RELATED WORK

- A. PVC pipe and fittings are included in Section 15064.
- B. Valves are included in Section 15100.
- C. Instrumentation is included in Division 16.
- D. Chemical metering system is included in Section 11245.

1.03 SUBMITTALS

- A. Submittals shall be in accordance with Section 01300.
- B. If proposed resin is different than that which is specified herein, submit with test data for the specified chemical and required characteristics, information on previous use and a minimum of three (3) previous installations with the specified chemical. Provide an owner contact name, telephone number and installation description for the previous installations.
- C. Submit shop drawings and product data showing layout and details of construction and at a minimum shall include the following:
 - 1. Dimensions of tank, fittings, and attachments.
 - 2. Wall thicknesses.
 - 3. Locations of fittings and attachments.
 - 4. Complete description of chemical resistance and estimated service life for all materials that will come in contact with materials stored.
 - 5. Weight of tank.
- D. Provide copies of all test records including at a minimum:
 - 1. Resin type, lot, and batch number.
 - 2. Thickness measurement test results.
 - 3. Low temperature impact test results.
 - a. Test specimens shall be conditioned at -40 degrees Fahrenheit for a minimum of 2 hours. The test specimens shall be impacted with

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HIGH DENSITY CROSS-LINKED POLYETHYLENE CHEMICAL STORAGE TANK

the standard methods as found in ASTM D1998. Test specimens less than ½-inch in thickness shall be tested at 200 ft-lb.

4. Manufacturers and rotomolders quality check sheet.
- E. Statement that fabrication is in accordance with these Specifications.
- F. Submit documentation of ANSI/NSF-61 Standard Certification for the complete tank system storing the specified chemicals. System shall include the tank, fittings, fasteners, and gaskets.
- G. Structural design calculations shall be furnished in accordance with Section 01300. At a minimum, calculations shall demonstrate that each tank will adequately transfer forces from the main vessel to the anchor bolts at the foundation. Calculations shall be stamped and signed by a professional ENGINEER registered in the State of Florida. Calculations shall account for the seismic and wind criteria listed on the structural drawings.
- H. Instructions for handling, storage, and installation of tanks in accordance with manufacturer's recommendations and Section 01600.
- I. Statement that all hydrostatic tests have been performed after installation of fittings.
- J. Tank fabricator qualifications and experience with storage tanks.
- K. Submit an equation and tabulated data that calculates and lists liquid volume as a function of depth. Provide the following information:
 1. Number of gallons per inch of depth.
 2. Number of gallons per foot of depth.
 3. Total tank gallons.
 4. Usable gallons between the bottom of the tank suction pipe and the bottom of the overflow pipe.
 5. Distance (in inches) between the bottom of tank suction pipe and bottom of overflow pipe.

1.04 REFERENCE STANDARDS

- A. American National Standards Institute (ANSI):
 1. ANSI B16.5 - Pipe Flanges and Flanged Fittings.
- B. American Society for Testing and Materials (ASTM):
 1. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.
 2. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.

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HIGH DENSITY CROSS-LINKED POLYETHYLENE CHEMICAL STORAGE TANK

3. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 4. ASTM D883 - Standard Terminology Relating to Plastics.
 5. ASTM D1505 - Standard Test Method for Density of Plastics by the Density-Gradient Technique.
 6. ASTM D1593 - Standard Specification for Non-rigid Vinyl Chloride Plastic Sheeting.
 7. ASTM D1998 - Standard Specification for Polyethylene Upright Storage Tanks.
 8. ASTM F412 – Standard Terminology Relating to Plastic Piping Systems
- C. Association of Rotational Molders (ARM):
1. ARM Standards - Low Temperature Impact Resistance (Falling Dart Test)
- D. Florida Building Code, latest edition.
- E. Occupational Safety and Health Administration (OSHA).
- F. Where reference is made to a standard of one of the above, or other organizations, the version of the standard in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

- A. The tank shall be constructed by a firm that has at least five years prior experience in construction of high-density cross-linked polyethylene tanks for sodium hypochlorite chemical service.
- B. The tank MANUFACTURER shall have quality control procedures adequate to ensure that all fabrications comply with these Specifications. Quality control shall include a final inspection by the MANUFACTURER and a written record of this final inspection. Service life of the tank shall be a minimum of 10 years.
- C. MANUFACTURER shall stamp tank with a unique serial number and shall maintain a record of all materials and resins used in fabrication of the tank. Records shall be maintained for no less than 7 years after Notice of Completion. During this period, MANUFACTURER shall retain a cutout from the tank.

1.06 SYSTEM DESCRIPTION

- A. The single walled storage tank shall be of the dimensions and capacities described below. Storage tank will be located outside with temperature ranging from 20 to 110 degrees F.

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- B. The single walled tank provided under this Section shall be suitable for use with the following chemicals as appropriate for the intended service.

1.	Formula	NaOCl
	Concentration	12.5 percent
	Specific gravity	1.2
	pH	12
a.	Number of Single Walled Tanks	1
b.	Min Diameter – nominal exterior	7-ft-10-inch
c.	Max Height- nominal	16-ft-1/4-inch
d.	Minimum nominal capacity	5,000 gallons
e.	Minimum usable capacity	4,700 gallons
f.	Top	Domed
g.	Bottom	Flat
h.	Outlet	Molded Full Drain
i.	Location	Outdoors/covered
j.	Mounted onto a flat concrete slab, notched as needed for the drain	

1.07 DELIVERY, STORAGE AND HANDLING

- A. Delivery, storage, and handling of the tank shall be in accordance with Section 01600 and as specified herein.
- B. MANUFACTURER shall assume responsibility for packaging to prevent normal transit and handling damage to each tank.
- C. Flange faces shall be protected from damage. All openings are to be securely covered to prevent entrance of dirt, water, and debris.
- D. The tank shall be mounted on skids or protective framework to provide for easy handling for forklift or similar device and/or be provided with lifting lugs or cleats, to permit handling by crane. Nozzles, manholes, or other fittings shall not be used for lifting.
- E. MANUFACTURER's instructions shall be provided for unloading and installation of the tank.
- F. MANUFACTURER shall be responsible for all transportation costs.

1.08 WARRANTY

- A. The MANUFACTURER shall provide a full warranty against defects in workmanship and material. The warranty shall be for a minimum of 5 years beginning at substantial completion and shall not be pro-rated.

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PART 2 – PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Tank manufacturers shall be Poly Processing LLC, Monroe, LA or Assmann Corporation of America, Garrett, IN.
- B. The use of a manufacturer's name is for the purpose of establishing the standard of quality and general configuration desired.
- C. Plastics technology used shall be in accordance with the definitions given in ASTM D883 (Standard Nomenclature Relating to Plastics).
- D. Tank shall be constructed by the rotational molding process and shall be seamless.
- E. Like items of materials and equipment shall be the end products of one manufacturer in order to provide standardization for appearance, operation, maintenance, spare parts and MANUFACTURER's service.
- F. Anchor bolts shall be Type 316 stainless steel. Anchor bolt design shall be specified and guaranteed by the tank MANUFACTURER and anchor bolts shall be provided by the CONTRACTOR as required by the calculations.

2.02 COMPONENTS

- A. General design, fabrication, testing, and inspection shall be in accordance with ASTM D1998.
- B. Tank shall be manufactured from high-density cross-linked polyethylene. Resin used shall be 100 percent virgin, UV-stabilized, Poly CL™, Schulink XL 350, or engineer approved equal. Raw material MANUFACTURER batch dates shall be defined and supported by the MANUFACTURER's records.
- C. High-density cross-linked polyethylene shall conform to the following minimum specification:

<u>PROPERTY</u>	<u>ASTM STANDARD</u>	<u>VALUE</u>
Density	D1505	0.943-0.946 g/cm ³
Tensile strength at yield	D638	3,290 psi
Elongation at break	D638	640 percent
Flexural modulus	D790	88,700 psi
Heat distortion temperature:		
66 psi load	D648	157 degrees F
Impact brittleness temperature	D746	<-75 degrees F
Dart impact (minus 40 degrees F)		
1/4-in thickness	ARM STD	71 ft. lb.

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Env. stress crack resistance D1693 >2,000 hrs.

- D. Plastic shall not contain fillers. Pigments may be added as designated by the MANUFACTURER, not to exceed 0.5 percent of dry blended or 2 percent if melt compounded of the total weight of the tank.
- E. Plastic shall contain a U.V. stabilizer: 0.25-percent minimum and 0.50-percent maximum.
- F. Tank wall thickness (at tank bottom) shall be designed with a hoop stress value of no greater than 600 psi at 100 degrees F, with a safety factor of no less than 2, using the Barlow formula for calculating wall thickness. A minimum liquid specific gravity of 1.9 shall be used for wall thickness calculations.
- G. The tank wall shall be heavy-duty, 16-lbs/gal rating. Wall thickness shall not be less than 0.360-inch.
- H. Manufacturer shall provide NSF 61 approval for the tank material. If tank material is not NSF 61 approved, manufacturer shall provide sodium hypochlorite tanks with a medium density OR1000 polyethylene with four times the antioxidant properties of standard polyethylene. The OR1000 resin shall be bonded to the interior surface during the rotational molding process.
- I. Finished surfaces shall be as free as commercially practical from visual defects, including foreign inclusions, air bubbles, pinholes and craters.

2.03 TANK CONNECTIONS AND APPURTENANCES

- A. Tank shall be equipped with the following connections and appurtenances:

<u>Connection</u>	<u>Size</u>	<u>Location</u>	<u>Type of Connection</u>
Minimum Outlet piping – Pump Suction	2-inch	Side (flush with bottom)	FDO/IMO Full Drain
Overflow	3-inch	Side (near top)	Threaded bulkhead
Fill connection	2-inch.	Top	Threaded bulkhead
Vent (not required if manway is vented)	6-inch	Top	Threaded bulkhead
Sight gauge/level element	2-inch	Top/outlet piping	Bulkhead
Air surge manway, minimum	22-inch	Top	Hinged

(All flanged connections shall be ANSI B16.5)

- B. Nozzles
 - 1. The tank outlet shall be an integrally molded flange outlet (IMFO) or a full drain outlet (FDO) and shall be located flush with the tank bottom to provide

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- full drainage through the sidewall of the tank. If an IMFO is utilized, it shall be molded from the same material as the tank. If a FDO is utilized, it shall be constructed using a metallic insert. Gaskets shall be Viton® or FKM.
2. All sodium hypochlorite tanks shall be provided with flange fittings constructed of compatible materials. The correct number of chemically compatible bolts will be welded to a common backing ring/plate or encapsulated bolt heads with compatible material. The internal flange assembly shall pass through the tank cross section and shall have one full face gasket to provide a single sealing surface against the interior/exterior tank wall. All materials shall be compatible with the chemical service and as indicated in the fitting schedule above. Gaskets shall be Viton® or FKM.
 3. Nozzle cutouts from the tank shall be identified by location and retained for shipment to the ENGINEER for inspection.
 4. Provide fill nozzle dip tubes for each tank.
- C. The tank shall be provided with a Kenco Magna-Site gauge. Tank shall be fabricated to accommodate the level gauge with a fitting on the top of the tank. The CONTRACTOR shall submit coordination drawings showing dimensions and installation of the level gauge with one connection to the tank discharge piping and one connection to the level gauge fitting on the top of the tank. Level gauge shall be provided with a support system and cannot be supported by the sodium hypochlorite storage tank. Sidewall penetrations on the storage tank shall not be allowed. Kenco Magna-Site gauge shall be installed with the Kenco Magnetostrictive level transmitter. Level gauge shall be calibrated for the volume of the tank with a permanent visual scale and numbers sized to be easily read from the ground. The level gauge shall read in both level in feet and volume in 250-gallon increments, minimum. Level gauge shall be provided with isolation ball valves.
- D. Provide flexible connections for the chemical storage tank to provide for expansion and contraction of the side walls and shall be flanged on both ends. Flexible connections shall be PTFE and shall be the standard product of the tank Manufacturer. All flexible connections shall meet the following minimum performance requirements:
1. Axial Compression ≥ 0.67 -inch
 2. Axial Extension ≥ 0.67 -inch
 3. Lateral Deflection ≥ 0.51 -inch
 4. Angular Deflection $\geq 14^\circ$
 5. Torsional Rotation $\geq 4^\circ$
- E. Manways shall be a minimum 22-inch diameter or greater and equipped with an emergency pressure relief device or SAFE-Surge™ Manway. The SAFE-Surge™ Manway shall relieve pressure at 6-inch water column to prevent over-pressurization. The SAFE-Surge manway shall be chemically compatible with the

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chemical being stored. Gaskets shall be closed cell, cross-linked polyethylene foam, Viton, or EPDM materials.

- F. Manufacturer shall provide a ladder for any tank with a height greater than 6-feet. Ladders shall be FRP. Ladder shall be the length required for access to the top of the tank. Manufacturer shall provide drawings showing the tank ladder is of adequate length for each application.

2.04 RESTRAINT SYSTEM

- A. The restraint system shall be a standard cable restraint system of the tank MANUFACTURER. Anchor bolts shall be Type 316 stainless steel.
- B. The restraint system shall be designed in accordance with the wind load requirements noted on the Structural Drawings and to meet the latest edition of the Florida Building Code. Detailed erection drawings and structural calculations shall be stamped by a professional ENGINEER licensed in the State of Florida.
- C. The restraint system and anchor bolts shall be specified by the tank MANUFACTURER.

2.05 SIGNAGE

- A. Affix permanently to the tank a fiberglass encapsulated or white phenolic label stamped with the following information:
 - 1. Number of gallons per inch of depth.
 - 2. Number of gallons per foot of depth.
 - 3. Total tank gallons.
 - 4. Usable gallons to the normal full level.
 - 5. Distance (in inches) between the center of tank outlet and bottom of overflow pipe.
- B. Furnish and install all precautionary labeling and hazardous material signage as recommended by the Manufacturing Chemists Association for the chemicals to be stored.
- C. Provide a fiberglass encapsulated identification or white phenolic label (3-inch high lettering) with tank designation "SODIUM HYPOCHLORITE TANK T-501."

2.06 SHOP TESTING

- A. Inspection records shall be made for each tank. Inspection records shall be forwarded to the ENGINEER 30 working days prior to the scheduled shipping date.

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- B. The tank MANUFACTURER shall perform the tests described below prior to shipping. Test samples shall be taken from the nozzle cut-out areas or where fittings are inserted in each tank. The ENGINEER or his/her representative shall have the option of witnessing these factory tests. Notification of these tests shall be forwarded to the ENGINEER at least 15 working days before the scheduled testing date.
 - 1. Impact Test: ASTM D746 Standard method shall be used. Sample shall not shatter at 120 ft lbs with sample at minus 20 degrees F for a ½-inch wall thickness. For a wall thickness less than ½-inch, the sample shall not shatter at 100 ft lbs and minus 20 degrees F.
 - 2. Hydrostatic Test: Each tank shall be filled with deionized water and checked for leaks no less than one hour after filling.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install the tank in accordance with the Drawings and the MANUFACTURER's instructions.
- B. Make all pipe connections to the tank as shown on the Drawings.
- C. Following the successful completion of field testing, tank and support members shall be anchored in their final position according to the MANUFACTURER's recommendations.

3.02 FIELD TESTING

- A. After installation, the tank shall be field tested by filling with potable water. The tank and fittings shall hold water without loss, evidence of weeping or capillary action for a period of 24 hours prior to acceptance.
- B. Should any defects become evident during inspection, testing, or within the guarantee period, the CONTRACTOR shall repair or replace the defective tank or fitting as approved by the ENGINEER and at no additional cost to the OWNER.

END OF SECTION 11344

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes metal building systems that consist of integrated sets of mutually dependent components including:
 - 1. Structural framing
 - 2. Secondary framing such as purlins, wind strut lintel beams and structural framed opening for building canopy/facades.
 - 3. Roof panels and wall panels, soffit panels, and accessories.
 - 4. Incidental building components, accessories and trim where applicable.
 - 5. It is the responsibility of the PEMB CONTRACTOR to supply all ancillary closure strips. Closure strips shall be supplied by the PEMB CONTRACTOR to close all edges of the PEMB envelope.
- B. Metal building systems shall be provided for the sodium hypochlorite storage and feed system.
- C. Related Sections include the following:
 - 1. Division 3 Section "Cast-in-Place Concrete" for concrete foundations, slabs, and anchor-bolt installation.
 - 2. Division 7 Section "Joint Sealants."
 - 3. Division 9 Painting Sections for finish painting of galvanized steel structural framing.
 - 4. Division 15 Mechanical.
- D. NO ALTERNATE SODIUM HYPOCHLORITE COLUMN OR FRAMING ORIENTATION/PATTERNS/CONFIGURATIONS WILL BE ALLOWED OR CONSIDERED. FRAMING, FRAMING ORIENTATION, FRAMING PATTERNS AND FRAMING CONFIGURATIONS SHALL BE AS SHOWN ON DRAWINGS S-12 AND S-13.

1.03 DEFINITIONS

- A. First five definitions below are from MBMA's "Metal Building Systems Manual," with additional clarification added in parentheses.
- B. Bay: Dimension between main frames measured normal to frame (at centerline of frame) for interior bays, and dimension from centerline of first interior main frame measured normal to end wall (outside face of end-wall girt) for end bays.
- C. Building Length: Dimension of the building measured perpendicular to main framing from end wall to end wall (outside face of girt to outside face of girt).

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- D. Building Width: Dimension of the building measured parallel to main framing from sidewall to sidewall (outside face of girt to outside face of girt).
- E. Clear Span: Distance between supports of beams, girders, or trusses (measured from lowest level of connecting area of a column and a rafter frame or knee).
- F. Eave Height: Vertical dimension from finished floor to eave (the line along the sidewall formed by intersection of the planes of the roof and wall).
- G. Clear Height under Structure: Vertical dimension from finished floor to lowest point of any part of primary or secondary structure, not including crane supports, located within clear span.
- H. Terminology Standard: Refer to MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in referenced standards.

1.04 SYSTEM DESCRIPTION

- A. General: Provide a complete, integrated set of metal building system manufacturer's standard mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior through the wall or roof panels. Include primary and secondary framing, metal roof panels, metal wall panels, and accessories complying with requirements indicated.
- B. The metal building system shall be designed to resist all applicable loads and shall be the lateral wind resisting system of the building. The metal building lap seam panel shall be a predominantly high rib profile, long span panel for the walls. The metal building standing seam roof panels shall be high major ribs formed at the panel side laps, formed for field seaming using electrically operated seaming machine.
- C. Provide metal building system of size and with spacings, slopes, and spans indicated.
- D. Primary Frame Type:
 - 1. Rigid Clear Span: Solid-member, structural-framing system without interior columns.
- E. End-Wall Framing: ENGINEER end walls to be non-expandable. Provide primary frame, capable of supporting applicable half-bay design loads, and end-wall columns. Provide load-bearing end-wall and corner columns, and rafters.
- F. Secondary Frame Type: Manufacturer's standard purlins and partially inset-framed and exterior-framed (bypass) girts as indicated on drawings.
- G. Eave Height: As indicated on drawings.

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- H. Bay Spacing: As indicated on drawings.
- I. Roof Slope: As indicated on drawings.
- J. Roof System: Manufacturer's standard lap-seam roof panels.
- K. Exterior Wall System: Manufacturer's standard field-assembled, metal wall panels shall be protected with "Kynar 500 FSF PVDF resin" or equal high-performance fluoropolymer resin coating system.
- L. Roof panels, exposed connectors and all exterior metal flashing and fascia metals shall be protected with "Kynar 500 FSF PVDF resin" or equal high-performance fluoropolymer resin coating system.

1.05 SYSTEM PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide the metal building system capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated in strict accordance with the latest edition of the Florida Building Code and the codes listed below:
 - 1. ENGINEER metal building systems according to procedures in MBMA's "Low Rise Building Systems Manual."
 - 2. Design Loads: Comply with load requirements of MBMA's "Low Rise Building Systems Manual" and as indicated on Drawings.
 - 3. Live Loads: Include vertical loads induced by the building occupancy indicated on Drawings. Include loads induced by maintenance workers, materials, and equipment for roof live loads.
 - 4. Roof Snow Loads: Include vertical loads induced by the weight of snow, as determined by 50-year mean-recurrence-interval ground snow load at Project site. Allow for unbalanced and drift loads.
 - 5. Wind Loads: Include horizontal and vertical loads induced by the basic wind speed as indicated on structural drawings.
 - 6. Seismic Loads: Include horizontal and vertical loads induced by the basic seismic loads as indicated on structural drawings.
 - 7. Collateral Loads: Include additional dead loads other than the weight of metal building system for permanent items such as sprinklers, mechanical systems, electrical systems, and ceilings as indicated on the Drawings.
 - 8. Load Combinations: Design metal building systems to withstand the most critical effects of load factors and load combinations.
 - 9. Deflection Limits: ENGINEER assemblies to withstand design loads with deflections no greater than that allowed by Code based on the function, serviceability and material types being used. In addition, the more critical criteria of deflection limits shown on the Drawings and that found in the Code Book shall be utilized.
 - 10. Design secondary framing system to accommodate deflection of primary building structure and construction tolerances, and to maintain clearances at openings.
- B. Seismic Performance: Design and ENGINEER metal building systems capable of withstanding the effects of earthquake motions determined according to ASCE 7,

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"Minimum Design Loads for Buildings and Other Structures": Section 11-15, "Earthquake Loads."

- C. Thermal Movements: Provide metal panel systems that allow for thermal movements resulting from the maximum change (range) in ambient and surface temperatures for this location by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Minimum Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces. If the 100-year average is greater than the minimum, use the 100-year average.
- D. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E 1646 at test-pressure difference of 2.86 lbf/sq. ft. (137 Pa).
- E. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E 331 at a minimum differential pressure of 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. (300 Pa) and not more than 12 lbf/sq. ft. (575 Pa).
- F. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL for Wind speed indicated.
 - 1. Wind Exposure C
- G. Serviceability Criteria:
 - 1. Roof Purlin Vertical Deflection Criteria: $L/180$ but not to exceed 2-inches.
 - 2. Main Frames Vertical Deflection Criteria: $L/180$ but not to exceed 2-inches.
 - 3. Girt Lateral Deflection Criteria: $L/120$ but not to exceed 2-inches.
 - 4. Main Frame Lateral Side Sway Criteria: $H/280$ but not to exceed 2-inches.

1.06 SUBMITTALS

- A. Provide all submittals in accordance with Section 01300.
- B. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of the following metal building system components:
 - 1. Structural-framing system.
 - 2. Metal roof panels.
 - 3. Metal wall panels.
 - 4. Sidewall/Endwall Wind strut lintel beams
 - 5. Endwall Framing
 - 6. Sidewall Overhangs
 - 7. Accessories and Incidentals
- C. Shop Drawings: For the following metal building system components. Include plans, elevations, sections, details, and attachments to other work.
 - 1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional

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- ENGINEER (licensed in the State of Florida) responsible for their preparation.
2. Anchor-Bolt Plans: Submit anchor-bolt plans before foundation work begins. Include location, diameter, and projection of anchor bolts required to attach metal building to foundation. Indicate column reactions at each location.
 3. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.
 4. Metal Roof and Wall Panel Layout Drawings: Show layouts of metal panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.
 5. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
 - a. Flashing and trim
 - b. Gutters
 - c. Downspouts
- D. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of the following products with factory-applied color finishes:
1. Wall panels
 2. Roof panels
 3. Trim and closures
 4. Accessories
 5. Canopies attached to other building components
- E. Samples for Verification: For each type of exposed finish required, prepare samples of sizes indicated below.
1. Metal Roof and Wall Panels: Nominal 12 inches (300 mm) long by actual panel width. Include fasteners, closures, and other exposed panel accessories.
 2. Flashing and Trim: Nominal 12 inches (300 mm) long. Include fasteners and other exposed accessories.
- F. Product Certificates: For each type of metal building system, signed by product manufacturer.
1. Letter of Design Certification: Signed and sealed by a qualified professional ENGINEER in the state of Florida. Include the following:
 - a. Name and location of project
 - b. Order number
 - c. Name of manufacturer
 - d. Name of CONTRACTOR
 - e. Building dimensions including width, length, height, and roof slope.
 - f. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.

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- g. Governing building code and year of edition
 - h. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
 - i. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
 - j. Building-Use Category: Indicate category of building use and its effect on load importance factors.
 - k. AISC Certification for Category MB: Include statement that metal building system and components were designed and produced in an AISC-Certified Facility by an AISC-Certified Manufacturer.
- G. Welding certificates. Copies of certificates for welding procedures and personnel.
- H. Erector Certificate: Signed by manufacturer certifying that erector complies with requirements.
- I. Manufacturer Certificate: Signed by manufacturer certifying that products comply with requirements.
- J. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- K. Material Test Reports: Signed by manufacturers certifying that the following products comply with requirements:
 - 1. Structural steel including chemical and physical properties.
 - 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 - 4. Shop primers.
 - 5. Non-shrink grout.
- L. Source quality-control test reports.
- M. Field quality-control test reports.
- N. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for insulation and vapor retarders. Include reports for thermal resistance, fire-test-response characteristics, water-vapor transmission, and water absorption.
- O. Maintenance Data: For metal panel finishes to include in maintenance manuals.
- P. Warranties: Special warranties specified in this Section and CONTRACTOR's Roofing Guarantee.

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1.07 QUALITY ASSURANCE

- A. Erector Qualifications: An experienced erector who has specialized in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
- B. Professional ENGINEER Qualifications: A professional ENGINEER who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal building systems that are similar to those indicated for this Project in material, design, and extent.
- C. Manufacturer Qualifications: A firm experienced in manufacturing metal building systems similar to those indicated for this Project and with a record of successful in-service performance.
 - 1. Manufacturer regularly engaged, for past 10 years, in manufacture of metal building systems of similar type to that specified.
 - 2. Primary manufacturer of frames, secondary steel, roof and wall sheeting and trim.
 - 3. AISC Certification for Category MB: An AISC-Certified Manufacturer that designs and produces metal building systems and components in an AISC-Certified Facility and/or accredited based IAS Accreditation Criteria AC472 and requirements in Florida Building Code (IBS), Chapter 17.
 - 4. Engineering Responsibility: Preparation of Shop Drawings, testing program development, test result interpretation, and comprehensive engineering analysis by a qualified professional ENGINEER.
- D. Source Limitations: Obtain primary metal building system components, including structural framing and metal panel assemblies, through one source from a single manufacturer.
- E. Product Options: Drawings indicate size, profiles, and dimensional requirements of metal building system and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- F. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- G. Structural Steel: Comply with AISC's "Specification for Structural Steel Buildings--Allowable Stress Design, Plastic Design," or AISC's "Load and Resistance Factor Design Specification for Structural Steel Buildings," for design requirements and allowable stresses. All steel framing, anchor bolts and base plates are to be hot dip galvanized coated.
- H. Cold-Formed Steel: Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members," or AISI's "Load and Resistance Factor Design

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Specification for Steel Structural Members," for design requirements and allowable stresses.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness and with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Refer to Section 01600 for additional details.

1.09 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements:
 - 1. Established Dimensions for Foundations: Comply with established dimensions on approved anchor-bolt plans, establishing foundation dimensions and proceeding with fabricating structural framing without field measurements. Coordinate anchor-bolt installation to ensure that actual anchorage dimensions correspond to established dimensions.
 - 2. Established Dimensions for Metal Panels: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal panels without field measurements or allow for field trimming metal panels. Coordinate construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.10 COORDINATION

- A. Coordinate size and location of concrete foundations and casting of anchor-bolt inserts into foundation walls and footings. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section Cast-in-Place Concrete.
- B. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

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1.11 WARRANTY

- A. Manufacturer shall warranty installed system for the periods described herein, starting from date of substantial completion against all the conditions indicated below. When notified in writing from OWNER, manufacturer/installer shall, promptly and without inconvenience and cost to OWNER, correct said deficiencies.
 - 1. Warranty Period: 5 years.
- B. Standing Seam Roof Premium Weathertight Endorsement
 - 1. Warranty Period: 20 years.
 - 2. Warranty coverage includes: Roof panels, stainless headed fasteners, Standard flashing and trim components, roof curbs and flexible pipe penetrations, the corrugated ("standing") seam or lap-joint that connects two like roof panels together in the side-to-side direction (width-wise), and the "panel splice lap" that splices two like roof panels together to extend a continuous panel in the ridge-to-eave direction (length-wise).
- C. Finish Warranty
 - 1. Finish coating shall not peel, blister, chip, crack or check in finish, and shall not chalk in excess of 8 numerical ratings when measured in accordance with ASTM D 4214.
 - 2. Finish coating shall not change color or fade in excess of 5 NBS units as determined by ASTM D 2244.
 - a. Panel finish: 25 years
- D. Performance Warranty: Furnish written warranty, stating sheet metal roofing system and flashing (flashing under premium warranty only) under this Section will be maintained in watertight condition and defects resulting from the following items will be corrected without cost to OWNER for a period of 20 years.
 - 1. Faulty workmanship.
 - 2. Defective materials including sealants and fasteners.
 - 3. Water infiltration.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. American Buildings Company.
 - 2. Butler Manufacturing Company.
 - 3. Gulf States Manufacturers, Inc.
 - 4. Star Building Systems
 - 5. Steelox Systems Inc
 - 6. Ceko Building Systems; Division of Robertson-Ceko Corporation.
 - 7. Metallic Metal Building Company; Division of NCI Building Systems, LLP.
 - 8. VP Buildings, Inc.; a United Dominion Company.

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2.02 STRUCTURAL-FRAMING MATERIALS (All structural steel shapes, steel framing members, cold formed purlins and girts, connectors and anchor bolts are to be hot dipped galvanized coated)

- A. W-Shapes: ASTM A 992/A 992M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.
- B. Channels, Angles, M-Shapes, and S-Shapes: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.
- C. Plate and Bar: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.
- D. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
- E. Hollow Structural Sections: ASTM A 500, Grade B or C, structural tubing.
- F. Structural-Steel Sheet: Hot-rolled, ASTM A 570/A 570M, Grade 50 or Grade 55; hot-rolled, ASTM 568/A 568M; or cold-rolled, ASTM A 611, structural-quality, matte (dull) finish.
- G. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grades 33 through 80 or High-Strength Low Alloy Steel (HSLAS), Grades 50 through 80; with G90 (Z180) coating designation; mill phosphatized.
- H. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - 1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grades 33 through 80 or High-Strength Low Alloy Steel (HSLAS), Grades 50 through 80; with G90 (Z275) coating designation.
 - 2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Structural Steel (SS), Grade 50 or 80; with Class AZ50 (AZM150) coating.
- I. Non-High-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), carbon-steel, hex-head bolts; ASTM A 563 (ASTM A 563M) carbon-steel hex nuts; and ASTM F 844 plain (flat) steel washers.
 - 1. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.
- J. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.
 - 1. Finish: Hot dipped galvanized.
 - 2. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex-head steel structural bolts with splined ends.
 - a. Finish: Hot dipped galvanized.
- K. High-Strength Bolts, Nuts, and Washers: ASTM A 490 (ASTM A 490M), Type 1, heavy hex steel structural bolts or tension-control, bolt-nut-washer assemblies with

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splined ends; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers, plain.

- L. Un-headed Anchor Rods: ASTM A 572/A 572M, Grade 50 (345).
 - 1. Configuration: Straight.
 - 2. Nuts: ASTM A 563 (ASTM A 563M) heavy hex carbon steel.
 - 3. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 4. Washers: ASTM F 436 (ASTM F 436M) hardened carbon steel.
 - 5. Finish: Hot dipped galvanized.
- M. Headed Anchor Rods ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), straight.
 - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy hex carbon steel.
 - 2. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 3. Washers: ASTM F 436 (ASTM F 436M) hardened carbon steel.
 - 4. Finish: Hot dipped galvanized.
- N. Threaded Rods: ASTM A 572/A 572M, Grade 50 (345).
 - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy hex carbon steel.
 - 2. Washers: ASTM F 436 (ASTM F 436M) hardened carbon steel.
 - 3. Finish: Hot dipped galvanized.
- O. Primer: All primary and secondary steel components shall be galvanized. Refer to Section 09900 for galvanizing requirements.

2.03 MATERIALS FOR FIELD-ASSEMBLED METAL PANELS

- A. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - 1. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Structural Steel (SS), Grade 50 or 80 (340 or 550); with Class AZ50 (AZM150) coating designation.
 - 2. Surface: Smooth, flat finish.
 - 3. Exposed Finishes: Apply the following coil coating, as specified, or indicated on Drawings:
 - a. High-Performance Organic Finish (Kynar 500 FSF PVDF resin" or equal high-performance fluoropolymer resin coating system). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions, except as modified below:
 - b. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored backer finish, consisting of prime coat and wash coat with a total minimum dry film thickness of 0.5 mil (0.013 mm).
 - c. Colors: Roof panels, gutters, fascia, downspouts, and miscellaneous connectors brackets and supports shall match in color.

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2.04 MISCELLANEOUS MATERIALS

- A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.
 - 1. Fasteners for Metal Roof Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM or neoprene sealing washer.
 - 2. Fasteners for Metal Wall Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with nylon or polypropylene washer. Avoid over tightening connectors such that metal panels are damaged and compressed.
 - 3. Fasteners for Metal Roof and Wall Panels: Self-drilling Type 410 stainless-steel or self-tapping Type 304 stainless-steel or zinc-alloy-steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal panels.
 - 4. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
 - 5. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
- B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
- C. Metal Panel Sealants:
 - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape of manufacturer's standard size.
 - 2. Joint Sealant: ASTM C 920; one-part elastomeric polyurethane, polysulfide, or silicone-rubber sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended by metal building system manufacturer.

2.05 FABRICATION, GENERAL

- A. General: Design components and field connections required for erection to permit easy assembly.
 - 1. Fabricate components in a manner that once assembled in the shop, they may be disassembled, repackaged, and reassembled in the field.
 - 2. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
 - 3. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.
- B. Tolerances: Comply with MBMA's "Metal Building Systems Manual": Chapter IV, Section 9, "Fabrication and Erection Tolerances."

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- C. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
 - 1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

2.06 STRUCTURAL FRAMING

- A. Refer to the tables for metal building structural systems at the end of the Evaluations for a list of manufacturers' products. Use these tables in combination with manufacturers' catalog or product data to insert series, type, model, and designations of other characteristics.
- B. General:
 - 1. Primary Framing: Shop fabricate framing components to indicated size and section with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
 - a. Make shop connections by welding or by using high-strength bolts.
 - b. Join flanges to webs of built-up members by a continuous submerged arc-welding process.
 - c. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
 - d. Weld clips to frames for attaching secondary framing members.
 - e. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary structural members with specified primer after fabrication.
 - 2. Secondary Framing: Shop fabricate framing components to indicated size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
 - a. Make shop connections by welding or by using non-high-strength bolts.
 - b. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary structural members with specified primer after fabrication.
- C. Primary Framing: Manufacturer's standard structural primary framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafter, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
 - 1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.

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- a. Slight variations in span and spacing may be acceptable if necessary to meet manufacturer's standard, as approved by Architect/ENGINEER of Record.
 2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
 3. Rigid Modular Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide interior columns fabricated from round steel pipe or tube, or shop-welded, built-up steel plates.
 4. Frame Configuration: As indicated.
 5. Exterior Column Type: As indicated.
 6. Rafter Type: As indicated.
- D. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:
1. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates.
 2. End-Wall Rafters: I-shaped sections fabricated from structural-steel shapes.
- E. Secondary Framing: Manufacturer's standard secondary framing members, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Fabricate framing from cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet prepainted with coil coating, unless otherwise indicated, to comply with the following:
1. Retain one of two purlins below or retain both if required.
 2. Purlins: C- or Z-shaped sections; fabricated from minimum 0.0598-inch thick steel sheet, built-up steel plates, or structural-steel shapes; minimum 2-1/2-inch wide flanges.
 - a. Depth: As required.
 3. Girts: C- or Z-shaped sections; fabricated from minimum 0.0598-inch thick steel sheet, built-up steel plates, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees to flange and with minimum 2-1/2-inch wide flanges.
 - a. Depth: As required.
 4. Eave Struts: Unequal-flange, C-shaped sections; fabricated from 0.0598-inch thick steel sheet, built-up steel plates, or structural-steel shapes; to provide adequate backup for metal panels.
 5. Flange Bracing: Minimum 2-by-2-by-1/8-inch structural-steel angles or 1-inch diameter, cold-formed structural tubing to stiffen primary frame flanges.
 6. Sag Bracing: Minimum 1-by-1-by-1/8-inch (25-by-25-by-3-mm) structural-steel angles.
 7. Base or Sill Angles: Minimum 3-by-2-by-0.0598-inch zinc-coated (galvanized) steel sheet.
 8. Purlin and Girt Clips: Minimum 0.0598-inch thick, steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.

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9. Secondary End-Wall Framing: Manufacturer's standard sections fabricated from minimum 0.0598-inch thick, structural-steel sheet.
 10. Framing for Openings: Channel shapes; fabricated from minimum 0.0598-inch thick, cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings, and head, jamb, and sill of other openings.
 11. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.
- F. Bracing: Bracing: Provide adjustable wind bracing as follows:
1. Rods: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade D; or ASTM A 529/A 529M, Grade 50; 1/2-inch diameter steel; threaded full length or threaded a minimum of 12 inches (300 mm) at each end.
 2. Cable: ASTM A 475, 1/4-inch diameter, extra-high-strength grade, Class B zinc-coated, seven-strand steel; with threaded end anchors.
 3. Rigid Portal Frames: Fabricate from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
 4. Diaphragm Action of Panels: Design metal building to resist wind forces through diaphragm action of roof and wall panels.
 5. Bracing: Provide wind bracing using the methods specified above, at manufacturer's option, with limitations shown on Drawings (i.e. no disruption of aesthetic and structural features of building).
- G. Bolts: Provide shop-painted bolts unless structural-framing components are in direct contact with roof and wall panels. Provide zinc-plated bolts when structural-framing components are in direct contact with roof panels.
- 2.07 ROOF AND WALL PANELS: Roof and wall panels shall be outlined below:
- A. Standing Seal Roof Panels: Fabricate from metallic-coated steel sheets pre-painted with coil coating, factory formed to provide 24-inch width coverage, and high ribs.
1. Material: Metallic-coated steel sheets "Kynar 500 FSF PVDF resin" or equal high-performance fluoropolymer resin coating system
 2. Metal Thickness: 24 gage minimum
 3. Panel Rib Height: 2-inch high rib- 3-inches including seam.
- B. Lap-Seam Wall Panels: Fabricate from metallic-coated steel sheets pre-painted with coil coating, factory formed to provide 36-inch width coverage, with raised trapezoidal major ribs. Comply with the following:
1. Material: Metallic-coated steel sheets "Kynar 500 FSF PVDF resin" or equal high-performance fluoropolymer resin coating system
 2. Metal Thickness: 24 gage minimum
 3. Panel Rib Height: 1.25 inches minimum
- C. Exterior Finish: Fluoropolymer, Basis of design "Kynar 500".

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- D. Color: As selected by OWNER from MANUFACTURER's full range.

2.08 PANEL ACCESSORIES

- A. Provide components required for a complete roof panel assembly including trim, copings, fasciae, mullions, sills, corner units, ridge closures, clips, seam covers, battens, flashings, gutters, sealants, gaskets, fillers, closure strips, and similar items. Match materials and finishes of roof panels, unless otherwise indicated.
- B. Closures: Provide closures at eave and ridge, fabricated of same metal as roof panels.
- C. Clips: Minimum 0.0625-inch thick, stainless-steel panel clips designed to withstand negative-load requirements.
- D. Cleats: Mechanically seamed cleats formed from minimum 0.0250-inch thick, stainless-steel or nylon-coated aluminum sheet.
- E. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

2.09 ACCESSORIES

- A. General: Provide accessories as standard with metal building system manufacturer, and complying with the following:
- B. Provide sheet metal accessories of same material and in same finish as roof and wall panels, unless otherwise indicated.
- C. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of roof or wall sheets by means of plastic caps or factory-applied coating. Comply with the following:
- D. Fasteners for Roof and Wall Panels: Self-drilling or self-tapping 410 stainless or zinc-alloy steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of panels. Note: must be coordinated with overall roof panel systems attachment.
- E. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
- F. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
- G. Flashing and Trim: Form from 0.0179-inch thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and

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trim with same finish system as adjacent metal roof panels, basis of design "Kynar 500" fluoropolymer coating system.

- H. Gutters: Form from 0.0179-inch thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch long sections, sized according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced 36 inches o.c., fabricated from same metal as gutters. Provide bronze, copper, or aluminum wire ball strainers at outlets. Downspout finish to be selected by Architect. Finish flashing and trim with same finish system as adjacent metal roof panels, basis of design "Kynar 500" fluoropolymer coating system.
- I. Downspouts: Form from 0.0179-inch thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; in 10-foot long sections, complete with formed elbows and offsets. Finish downspouts to match wall panels. Finish flashing and trim with same finish system as adjacent metal roof panels, basis of design "Kynar 500" fluoropolymer coating system.
- J. Closures: Closed-cell, laminated polyethylene; minimum 1-inch thick, flexible closure strips; cut or premolded to match roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- K. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

2.10 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 - 1. For the record, prepare written report, endorsed by Erector, listing conditions detrimental to performance of work.
- B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other

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embedments to receive structural framing, with Erector present, for compliance with requirements and metal building system manufacturer's tolerances.

- C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.
- B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place, unless otherwise indicated.

3.03 ERECTION OF STRUCTURAL FRAMING

- A. Erect metal building system according to manufacturer's written erection instructions and erection drawings. Be advised that bracing during construction is of the utmost importance due to possibly high wind conditions and is the sole responsibility of the erector. All manufacturer's erection instructions shall be strictly followed.
- B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional ENGINEER.
- C. Set structural framing accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.

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2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.
- F. Primary Framing and End Walls: Erect framing true to line, level, plumb, rigid, and secure. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist cure grout for not less than seven days after placement.
 1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - a. Joint Type: Snug tightened or pretensioned.
- G. Secondary Framing: Erect framing true to line, level, plumb, rigid, and secure. Fasten secondary framing to primary framing using clips with field connections using non-high-strength bolts.
 1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
 2. Locate and space wall girts to suit openings such as doors and windows.
 3. Locate canopy framing as indicated.
 4. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.
- H. Bracing: Install bracing, bracing per this specification per section 2.6E, in roof and sidewalls where indicated on erection drawings.
 1. Tighten rod and cable bracing to avoid sag.
 2. Locate interior end-bay bracing only where indicated.
- I. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.
- J. Erection Tolerances: Maintain erection tolerances of structural framing within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.04 METAL PANEL INSTALLATION, GENERAL

- A. Examination: Examine primary and secondary framing to verify that structural panel support members and anchorages have been installed within alignment tolerances required by manufacturer.
 1. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before metal panel installation.
- B. General: Anchor metal panels and other components of the work securely in place, with provisions for thermal and structural movement.
 1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.

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- a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
 2. Install metal panels perpendicular to structural supports, unless otherwise indicated.
 3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Locate metal panel splices over, but not attached to, structural supports with end laps in alignment. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 6. Lap metal flashing over metal panels to allow moisture to run over and off the material.
- C. Lap-Seam Metal Panels: Install screw fasteners with power tools having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw threads, or metal panels. Install screws in predrilled holes.
1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
- D. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
- E. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal panel manufacturer.
1. Seal metal panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal panel manufacturer.
 2. Prepare joints and apply sealants to comply with requirements in Division 7 Section Joint Sealants.

3.05 METAL ROOF PANEL INSTALLATION

- A. General: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended by MANUFACTURER.
1. Install clips to supports with self-tapping fasteners.
 2. Install pressure plates at locations indicated in MANUFACTURER's written installation instructions.
 3. Seamed Joint: Crimp standing seams with MANUFACTURER-approved motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
- B. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Flash and seal metal panels with weather closures

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where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

- C. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed tolerance of 1/8 inch in 20 feet on slope and location lines as indicated and within 1/16-inch offset of adjoining faces and of alignment of matching profiles.

3.06 METAL WALL PANEL INSTALLATION

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the work securely in place, with provisions for thermal and structural movement.
 - 1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
 - 2. Shim or otherwise plumb substrates receiving metal wall panels.
 - 3. When two rows of metal panels are required, lap panels 4 inches minimum.
 - 4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
 - 5. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
 - 6. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
 - 7. Install screw fasteners in predrilled holes.
 - 8. Install flashing and trim as metal wall panel work proceeds.
 - 9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated, or if not indicated, as necessary for waterproofing.
 - 10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws.
 - 11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
- B. Field-Assembled, Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.
- C. Installation Tolerances: Shim and align metal wall panels within installed tolerance of 1/8 inch in 20 feet, nonaccumulative, on level, plumb, and location lines as indicated and within 1/16-inch offset of adjoining faces and of alignment of matching profiles.

3.07 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Install gutters, downspouts, ventilators, louvers, and other applicable accessories according to manufacturer's written instructions, with positive anchorage to building and weathertight mounting. Coordinate installation with flashings and other components.

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1. Install components required for a complete metal roof panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 2. Install components for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 3. Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- C. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 4 feet o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
1. Provide elbows at base of downspouts to direct water away from building.
 2. Tie downspouts to underground drainage system indicated.

3.08 FIELD QUALITY CONTROL

- A. Testing Agency: CONTRACTOR will engage a qualified testing and inspecting agency to perform the following tests and inspections and to submit reports.
- B. Tests and Inspections:
1. High-Strength, Field-Bolted Connections: Connections shall be tested and inspected during installation according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

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2. Welded Connections: Field-welded connections shall be visually tested.
- C. Correct deficiencies in Work that test reports and inspections indicate do not comply with the Contract Documents.
- D. The metal building manufacturer's erection specialist shall be required to inspect the installation of all components at intervals it deems necessary and issue a letter of certification as follows:
 1. "[Metal Building Manufacturing Name] has inspected the erection of all metal building components and certifies that the installation complies with the manufacturer's standards and the specification requirements of the contract documents."

3.09 CLEANING AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.
 1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or SSPC-SP 3, "Power Tool Cleaning."
 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- C. Touchup Painting: Cleaning and touchup painting are specified in Division 9 painting sections.
- D. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
 1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 13419

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PART 1 – GENERAL

1.01 SUMMARY

- A. Description of scope and intent:
1. CONTRACTOR shall provide all material, labor, and tools required to complete the installation of specified system.
 2. Any omission of reference to items required completing the full operational and functional system specified in the section does not relieve the CONTRACTOR of the obligation to provide same.
 3. To provide installation of all items, including delivery, dispersing to the proper locations within the building, and affixing in place.
 4. Installation shall be accomplished by workers skilled in their craft that will perform their work in a professional manner and will leave the premises safe, orderly, and clean in accordance with Section 01710 – Cleaning.
 5. Drawings and general provisions of Contract, including JEA Conditions and Division 1 Specification Sections, apply to this Section.
 6. CONTRACTOR is responsible for coordination of work included in this specification with all other specification sections related to furnishing of all materials, labor, permits, fees and services necessary for completion of work in this section.
 7. In the event of a conflict between the design drawings, referenced standards and these Specifications, the more stringent shall govern unless directed otherwise by the ENGINEER. CONTRACTOR shall strictly adhere to OSHA requirements and local codes or those of any regulatory agency or body with jurisdiction.
 8. All materials shall be new and the completed system shall be essentially the product of one crane manufacturer regularly engaged in the production of such equipment for at least a ten (10) year period. Approved top running bridge crane suppliers: RJ Mack Company, Material Handling Systems, and Kone Cranes.
 9. All steel framing supporting the overhead crane system between elevations 52.00 ft and 66.35 ft as shown on sheets S-6, S-8, S-9, and S-11, including the anchor bolts in the top of the pedestals shall be per the structural contract documents as shown on sheets S-6, S-8, S-9, and S-11. No alternative design options for the structural steel framing or steel framing sizes will be considered during the shop drawing development process.
 10. The top running bridge crane suppliers are responsible for the design of all bridge crane components between elevation 52.00 ft and the top of the bridge crane system and elevation 66.35 ft and the top of bridge crane system, design of all electrical components for the bridge crane system, design of all hoists and trolleys and all mechanized systems for the bridge crane system. The lateral bridge beam between the runway rails shall be designed to ensure allowable stresses are not exceeded per the applicable AISC code and meets beam design meets or exceeds the L/600 vertical deflection limits and L/400 lateral deflection limits.

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11. The top running bridge crane suppliers shall supply all bridge crane components of the bridge crane system (including but not limited to all structural components, all electrical components, all hoist and trolley components, all lifting components and all lateral and longitudinal traveling components).
- B. Work includes providing one electric top running bridge for bridge crane, (with one electric hoist as specified in Section 14910), including the design, manufacture, testing, inspection/testing, and delivery and all required accessories with the following requirements.
- C. Equipment supplied by manufacturer in this Specification shall include, but not be limited to, the following:
 1. Motorized bridge with hoist and trolley
 2. Electrical control system, radio controlled
 3. Inspection and testing of installed crane at factory
 4. Electric hoist as specified in Section 14910
 5. Bridge beam
 6. Bridge crane runway girders and bridge crane runway columns
 7. Crane rails, clips and wheel stops
 8. Electrification by 4-bar electrification and festooning. Controls by festooning.
- D. The CONTRACTOR shall provide the following:
 1. Unloading of all materials.
 2. Connection, as required, to all utilities.
 3. Runway steel for installation of crane rails and related accessories that are not provided by manufacturer.
- E. The supplier shall be responsible for the installation of all crane equipment and the specified hoist.
 1. Work shall include the location and installation of all limit switches required to provide the safe passage of the crane around building components situated in the crane way.
 2. Manufacturer shall furnish inspection and testing including functional start-up of this crane system and related hoist. After the functional start-up the Supplier shall conduct the load certification.
 3. The Supplier shall provide training, and documentation of OWNER selected personnel in the inspection, operation, maintenance and safe use of the system.
- G. Related Sections include the following:
 1. Division 01300: Submittals
 2. Division 01730: Operation and Maintenance Data

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3. Division 09900: Painting Sections for finish painting of steel structural framing.
4. Division 14910: Electric Chain Hoist with Motorized Trolley
5. Division 16: Electrical supply, conduit, wiring, and other electrical components for powering crane.

1.02 SUBMITTALS

- A. Manufacturer's drawings shall be submitted for approval in accordance with Section 01300. Drawings shall include the following information:
 1. Outline and clearance dimensions of crane relative to architectural and structural drawings.
 2. Bridge girder, truck, trolley and hoist data.
 3. Unit weight and shipping weight.
 4. The top running bridge crane manufacturer shall provide general arrangement drawings showing plan, elevation, and sectional views along with all other pertinent data.
 5. Panel layout and schematic wiring diagrams shall be provided, showing all electrical devices, numbered terminal strips and wiring.
 6. Datasheets and catalog information for electrical components, motors, and control systems.
- B. Submit operation instructions, maintenance manuals and spare parts information as per Section 01730.
- C. Provide signed and sealed calculations by a licensed structural ENGINEER in the state of Florida for the **bridge crane bridge beam** certified to the loads and deflections indicated on the drawings and herein. Design of the **bridge crane bridge beam** design shall meet the 14th Edition of the American Institute of Steel Construction (AISC) Code. Refer to Paragraph 1.01 for the designated design responsibilities for the top running bridge crane suppliers.
- D. Operating and maintenance manuals shall include key component breakaway pictures for ease of parts ordering, catalog cut pages, part numbers, sub-assembly details, and periodic inspection and maintenance requirements recommendations.

1.03 QUALITY ASSURANCE

- A. Industry Standards: Design and fabrication shall be in accordance with the state and local codes, ordinances, and regulations of Duval County, Florida, and the latest edition of the following codes and standards, where applicable.
 1. Crane Manufacturers Association Of America
CMAA Specification No. 70 For Electric Overhead Traveling Cranes
CMAA Specification No. 74 For Top Running and Under Running
Single Girder Electric Overhead Traveling Cranes

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2. American National Standard
ANSI B-20.2.0 Overhead Crane & Gantry Cranes
ANSI B-30.16 Overhead Hoists
ANSI B-30.17 Single Girder Top running Cranes
3. Occupational Safety And Health Administration (OSHA): Par. 1910.179
Overhead & Gantry Cranes
4. Hoist Manufacturers Institute: HMI 100-74 Specifications for Electric Wire
Rope Hoist
5. National Electric Code: NEC (Article 610 Cranes and Hoists)
6. Anti-Friction Bearing Manufacturers Association (AFBMA).
7. American Gear Manufacturers Association (AGMA).
8. American Institute of Steel Construction (AISC).
9. American Society of Mechanical Engineers (ASME).
10. American Society for Testing and Materials (ASTM).
11. American Welding Society (AWS).
12. Institute of Electrical and Electronic Engineers (IEEE).
13. National Electrical Manufacturers Association (NEMA).
14. Underwriters' Laboratories, Inc. (UL).

- B. If these Specifications require compliance with two or more industry standards, which establish different or conflicting requirements, the more restrictive standard shall apply.

1.04 DESCRIPTION OF WORK

- A. Top running bridge crane: Located and dimensioned as shown on structural drawings and as below:
1. Single Girder Crane 3-Ton top running, dual motor, single girder overhead crane with 3-Ton electric chain hoist with 3-Ton motorized trolley, CMAA Crane Classification B, Division 1. Electrification by electric bus bar with crane control and electrification by festooning on bridge, NEMA 12 (all electrical). Bridge crane shall have VFD operation from zero (0) fpm to one hundred and twenty five (125) fpm.
 2. Overall Length of Runway from centerline of outside column to centerline of outside column: ± 66 -foot-8-inch (field verify).
 3. Span of the bridge crane beam between the crane runways: 33-foot-4-inch (field verify).
 4. Distance from Floor to the top of the 40 pound crane rail: ± 14.35 foot.
 5. End Trucks: Rotating axle end trucks with VFD with a two-step setting up to 125 fpm
 6. Trolley: Two (2) speed trolley, VFD; NEMA 12 (all electrical), all remote radio controlled two-speed VF trolley drive, provide festooned system. Trolley speed shall be zero (0) to forty (40) fpm VFD.
 7. Electrification: Two c-tracks for the festooning of the hoist and the independent festoon of the hoist. 4-bar electrification, including brackets,

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hangers, conductor bars, splice covers, power feeds, end covers and hardware.

8. Electric Chain Hoist: Motorized, Two (2) speed lift, VFD, Radio Controlled, all Electrical NEMA 12 (See Section 14910). Speeds of electric chain hoist shall be zero (0) fpm to fifteen (15) fpm VFD for top running bridge crane hoist. Motor winding shall have Class F insulation. A chain container shall be provided.
9. Material to be handled: Lifting heavy equipment, such as pumps and valves, for repair and replacement, etc.

1.05 WARRANTY

- A. The MANUFACTURER shall warrant the equipment supplied by the crane manufacturer for a period of five (5) years.

PART 2 – PRODUCTS

2.01 SOURCE QUALITY CONTROL

- A. Testing/Inspections:
 1. Comply fully with all requirements, test, inspections, reports, documentation, and approvals contained in this Section and/or standards implemented by this Specification. Make available on request a copy of any part of the manufacturer's quality assurance records. The manufacturer's tests, inspections, reports, and documentation, as well as those of subcontractors used in the work, shall be subject to inspection by the ENGINEER and independent Consultant.
 2. Notify the ENGINEER not less than ten (10) working days prior to the start of fabrication.
 3. Maintain records of all inspections and tests. Records shall indicate the nature and number of deficiencies found, the quantities approved and rejected, and the nature of corrective actions taken. Forward copies of the inspection and test data to the ENGINEER prior to or at time of shipment.
 4. Notify the ENGINEER not less than five (5) working days prior to conducting inspection or testing required by this Specification and/or standards implemented by this Specification.

2.02 GIRDER MATERIALS

- A. Crane girders shall be wide flange beams as shown in the structural drawings.
- B. Sections of girders shall be supplied in single sections between supporting posts and shall not be spliced.
- C. Girder steel shall be per ASTM A992, latest edition.

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2.03 EQUIPMENT

A. Hoist:

1. As specified under Section 14910 and as modified by this Section of the Specifications. Where there are discrepancies between Section 14800 and Section 14910, the more stringent requirements shall apply.

B. Crane Design:

1. Design Factors: Standard capacity ratings shall represent the net rated load at the hook of any type of hoist with the same load rating installed on the crane having a hoist trolley weight within the established limits. The crane shall be so designed that the load carrying parts, except structural members and hoisting ropes and gearing, shall be designed so that the calculated static stress in the material, based on the rated load, shall not exceed 20 percent of the published average ultimate strength of the material. This limitation of stress provides a margin to allow for variations in the properties of materials, manufacturing and operating conditions, and design assumptions. However, under no condition shall the crane be loaded beyond its rated capacity.
2. Beam: Bridge beam shall be designed in accordance with latest specifications of the Crane Manufacturers Association of America and shall be constructed in accordance with AISC specifications. Under full load the beam deflection shall not exceed 1/800 of the span. Bridge beam shall provide level and straight tread surfaces for the hoist trolleys. Crane shall be reinforced with outrigger to provide squareness with the end truck, adequate lateral stiffness with a minimum lateral moment of inertia of 1/20 that of the vertical moment of inertia. Outrigger shall furnish support for squaring shaft and the crane drive motor and gear reducer assembly.
3. End Trucks: End trucks shall be built of structural shapes and welded to a stable assembly to comply with general strength requirements previously stated. They shall provide proper wheel and bearing alignment for crane wheels and drives during the life of the crane. The crane end trucks shall contain diaphragm members welded to truck frames to maintain alignment and distribute truckloads uniformly on inner and outer truck members. A wheel and wheel gear protecting guard shall be part of the end truck. The truck shall be designed so that, in case of a wheel axle or wheel failure, the drop of the truck will be limited to one inch. Attachment of end trucks to bridge beams shall be with fitted bolts which will ensure alignment in assembly and convenient erection. The design of the end truck shall allow easy wheel removal and exchange. The dual anti-friction bearings supporting the axle shall have a minimum B-10 bearing life in accordance with the crane classification specified. Wheels shall be rolled or forged steel, or cast nodular iron, carbon or alloy steel. Wheels shall be designed

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to carry the wheel loads without undue wear. End trucks shall be fitted with shock absorbing bumpers capable of deceleration and stopping the crane within the limits stated by OSHA and CMAA. End trucks shall be bolted to form a rigid connection. Bolts in shear or welded connections shall not be permitted.

4. Crane Wheels: Provide multiple wheel equalizing bridge trucks. Crane wheels shall be double-flange alloy steel and have tread surfaces hardened to 375 to 425 Brinell. Each wheel shall be supported on tapered roller bearings mounted on stationary axles suitable to take radial and thrust loads. The wheels shall be lubricated at the factory with sodium-base grease and provided with a suitable reservoir of lubricant to eliminate the need for field lubrication. Wheel axles must have mounting nuts for bearing adjustment. Wheel mounting shall be designed so that axles and wheels can be removed without disturbing other truck elements of their alignment. Wheel treads shall be smooth, true and uniform within .010 inch tread diameter on all wheels.
5. Welding: Welding shall be done by certified welders and shall be in accordance with the American Welding Society standards. All welds shall be ductile, shall have good weld penetration free of cracks and undercuts, and the welds shall manifest workmanlike appearance.
6. Crane Drive: The crane drive motor shall be fully enclosed 30 minute duty cycle rated, with Class F insulation, and thermally protected, complying with performance specifications. The motor and fully enclosed gearing shall be integral with a fully enclosed oil splash lubricated gear reduction. The motor and the gear reduction shafts shall be supported by permanently lubricated precision ball or roller bearings. The drive shaft shall provide synchronous drive from the gear reduction to both end trucks. The crane drive shall include an integrally mounted spring set electrically released D.C. rectified disc brake. The crane shall have soft start and stop circuits and shall not be measurably affected by variation of live load or by location of live load on bridge span. The crane shall have variable speed operation. All gears shall be heat-treated and shall run on anti-friction bearings with constant oil bath lubrication. Crane drives shall have quick disconnects on junction boxes to reduce maintenance and down time.
7. Drive Shaft: The drive shaft of the crane shall be supported on lubricated precision ball bearing pillow blocks based on ten-foot maximum centers. These pillow blocks shall be lubricated through pressure grease fittings. The crane drive shaft shall be steel designed to limit torsional shaft stress to 6,000 psi. Maximum torsional twist angle in the drive shaft shall not exceed one degree of the wheel rotation under maximum rated load regardless of load location.
8. Bearing Life: All bearings in the crane wheels, those supporting the squaring shafts and the gear reduction shafts, shall be designed for 5,000 hours B-10 bearing life minimum.

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9. Gearing: All gears shall be cut from solid blanks with 20-degree pressure angle involutes shape for high strength and shall comply with AGMA specifications for load ratings. All gears operating at higher than 200 FPM pitchline speed shall be fully enclosed in oil tight housings and lubricated by splash principle.
10. Bridge Bumpers: The bridge shall be provided with bumpers capable of stopping the crane (not including the lifted load) at a rate of deceleration not to exceed three feet per second when traveling in either direction at 20 percent of rated speed. The bumpers shall have sufficient energy absorbing capacity to stop the crane when traveling at a speed of at least 40 percent of the rated load speed. Companion rubber bumpers (wheel stops) shall be provided by the manufacturer. The rubber bumpers will be fixed to the crane rail at each end on both sides.
11. Rail Sweeps: Bridge trucks shall be equipped with sweeps, which extend below the top of the rail and project in front of the crane wheels.

C. Crane Rails:

1. Bridge crane manufacturer shall provide the runway rails as required. The runway rails shall be straight, parallel, level, and at the same elevation.
2. Ensure the center to center of crane rails do not exceed +/-0.25 inch from the dimensions shown on drawings adjusted to 68 degrees F. Do not allow horizontal misalignment of crane rails to exceed 0.25 inch per 50 feet of runway length with a maximum of 0.50-inch total deviation from the location.
3. Ensure vertical misalignment of crane rails measured at centerline of columns does not exceed 0.25 inch per 50 feet of runway length.
4. Center rails on crane runway girders wherever possible. Do not allow rail eccentricity to exceed 75 percent of the girder web thickness.
5. Fabricate crane rails with bolted joints.
6. Arrange rails so that joints in opposite sides of crane runway will be staggered with respect to each other and with respect to wheelbase of the crane.
7. Ensure rail joints do not occur closer than four feet from crane girder joints.
8. Use odd crane lengths, not less than ten (10) feet. long, to complete a run or necessary stager.
9. Space clamps a maximum of two (2) feet on centers. Space clamps closer if recommended by manufacturer or Consultant/Supplier. Do not stagger clamps, but use in pairs.
10. Finish rail ends to ensure a close fit.
11. Joint Bars: ASTM A5 (painted)
12. Joint Bar Bolts and Nuts: ASTM A325 (painted)
13. Rail clamps shall be Gantrex. – Weldlok 15/60

D. Motors and Controls:

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1. Markings on the crane, visible from the floor, shall indicate the direction of bridge and trolley travel corresponding to the W, X, Y and Z designations on the radio crane control transmitter. Designations on the transmitter shall be as selected by OWNER.
2. Motors shall be squirrel cage with variable speed drives, Class "F" insulation, and shall be thermally protected. All travel speeds shall be radio controlled.
3. Provide electrical equipment suitable for the specified service conditions stated in the Schedule at the end of this specification that conforms to the requirements of the National Electric Code (NEC) and to requirements of the National Electrical Manufacturers Association (NEMA).
4. Motors shall be 460 volts, 3 phases. Supply motors as designed, manufactured, and tested in accordance with NEMA MG-1.
5. Supply area motors as UL labeled.
6. Size motors of 30 horsepower or less to be "non-overloading" for any condition attainable by the equipment. Size motors 40 horsepower and larger to be "non-overloading" up to 150 percent of the design capacity of the equipment.
7. Variable frequency motor starters and controls shall be provided as part of supplied equipment and main crane control panel.
8. Supply electric drive motors as totally enclosed non-ventilated with a 30-minute service duty.
9. Crane Electrification: Crane electrification shall be rigid dual conductor bar system, bottom entry. Conductor bar shall be rolled formed copper sections, rated at a minimum of 90 amps continuous. Insulation cover shall be heavy neoprene, self-extinguishing, with a maximum operating temperature of 400 degrees F. Conductors are to be complete with mounting clips, end caps, splices with covers and power feeds. Current collectors shall be the sliding shoe type, spring loaded and designed so that sparking and loss of contact shall be minimized. Separate conductors shall be provided for each phase. More than one conductor in a single enclosure shall not be permitted. Provide cleaning shoe due to high dust and moisture.
10. Trolley Electrical and Controls: Electrical controls shall be multi speed VFD to suit speed required. Controls shall include a mainline contactor, manually operated fused mainline disconnect with lockout provision, branch circuit fuses, reversing hoist control and transformer with fused secondary. Controls shall be in NEMA 12 enclosure suitable for the area classification actuated from a pendant push button station from the hoist and integrated with the required remote controls provided.
11. Trolley Conductors and Wiring: Flat wire festoon tag line bridge conductor shall be provided with the trolley equipment to provide fully insulated electrification. All festooned wiring of the equipment shall be in accordance with the National Electrical Code.

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12. Limit Switches: Zone limit switches, 2 zone, double circuits, shall be provided to stop the operation of the crane, in either direction, when approaching the elevated portions of the building with any load carried by the hoist that would pose the possibility of impact to any component of the interior rooms. In addition, limit switches shall be provided to the upper and lower limit of travel of hoist and shall interrupt motor and brake power circuits.
13. Positioning Accuracy: The control system shall be so designed that the hoist jogging accuracy shall be within 1/4 inch under full load.
 - a. Controls shall be designed to fail-safe and cause the brakes to set automatically in case of control malfunction or upon loss of power.
 - b. All control circuits shall be three (3) motion remote radio-controlled. All hoists and travel motions shall be independently operable and capable of simultaneous usage. All controls shall conform to NEMA 12 Industrial Control Standards for Overhead Traveling Cranes, except as modified by these Specifications.
 - c. All controls shall be housed in a single NEMA 12 control panel for protection against dust, moisture, and corrosion and provided with a vertical hinged door to facilitate inspection of all components.
14. The complete control panels are to be factory mounted and wired. All wires within the panel are to be marked and terminated on coded terminal strips.
15. Hoist, trolley and crane travel shall provide variable speed in both directions. The travel of the trolley and crane shall employ soft start and soft stop circuits in all cases.
16. Hoist Travel:
 - a. Lowering: No lowering of the load shall occur unless power is supplied to the hoist motor in the lowering direction.
 - b. Hoisting: When hoisting the load shall not sag when "inching" in the hoisting direction.

E. Trolley

1. Single girder trolley, three (3) ton capacity, four (4) wheel, with bumper protection. See above for trolley electrical and controls.
2. Trolley wheels shall be cast and machined from spheroidal graphitic nodular material for better wear characteristics. They shall be single or double flanged to match the running surface.
3. The maximum width between the trolley with the motor width included from centerline of runway toward inside face of CMU shall be 9 inches.
4. The trolley motor/gearbox assembly to be mounted with the gearbox offset facing inwards toward the center of the building or the other crane rail. The motor gearbox shall be mounted on the inside face of the end truck assembly.

2.04 ACCESSORIES

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- A. Special Tools: Submit a detailed list of special tools and devices required to install, adjust, repair, test, or operate the equipment. Identify and price separately items which are not furnished by the manufacturer with the equipment.

2.05 FABRICATION/SHOP ASSEMBLY

- A. Completely shop assemble all hoisting units and check for fit and alignment before shipment.
- B. Finish: Paint all exposed carbon steel surfaces per manufacturer's standards. Paint requirements shall be per specification 09900.

PART 3 – EXECUTION

3.01 DELIVERY, STORAGE AND HANDLING

- A. Cleaning:
 - 1. Perform final cleaning of all internal and external surfaces after all manufacturing and testing operations have been completed.
 - 2. Dry internals and remove all foreign materials.
 - 3. Cleaning procedures shall be the manufacturer's responsibility.
- B. Deliver, store, and handle products/equipment in accordance with the following:
 - 1. Use methods which prevent damage, deterioration, and other loss during shipping and temporary on-site storage.
 - 2. Plug, cap, or cover with plywood (or other suitable material) all exposed openings.
 - 3. Furnish instructions for proper unpacking.
- C. Convey products to project site by means that minimize risk of loss and deterioration during transit.
- D. Deliver separate loose parts boxed in a plywood container and ship as a unit with the equipment.
- D. Identify all shipping boxes by the CONTRACTOR's name, OWNER's name, Project name, Project location, equipment number, and description of the contents with ink, paint, or other indelible material markings. Securely affix a copy of the completed packing list to each separate shipping package.

3.02 EXAMINATION

- A. Joint Meeting at Building: ENGINEER, Supplier, and CONTRACTOR shall examine substrates under which equipment of this section are to be installed and

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verify that work may properly commence. Do not proceed with the installation until unsatisfactory conditions have been resolved.

3.03 INSTALLATION, LOAD TESTING, AND TRAINING

- A. System shall be fully installed in facility, and an initial no-load running test of controls and drive machinery shall be performed to ensure proper operation. Load testing as required by the ENGINEER shall be performed until satisfactory test results are achieved.
- B. Testing shall take place in the presence of ENGINEER, Supplier, CONTRACTOR and OWNER and shall be paid for by the crane manufacturer. The results of testing shall be recorded by the Supplier and reported to the ENGINEER and OWNER.
 - 1. Comply fully with all requirements, test, inspections, reports, documentation, and approvals obtained from factory and standards required by this Specification. Request a copy of any part of the factory's quality assurance records, including the factory tests, inspections, reports, and other documentation.
 - 2. Maintain records of all inspections and tests. The records are to indicate the nature and number of deficiencies found, the quantities approved and rejected, and the nature of corrective actions taken.
 - 3. Forward copies of the inspection and test data to the ENGINEER.
 - 4. Notify the ENGINEER not less than ten (10) working days prior to conducting inspection or testing required by this Specification and/or standards implemented by this Specification.
- C. Training in the use of the system, inspection, maintenance, and safety procedures to follow shall be performed by the Supplier in accordance with all Manufacturer's Manuals, ASME B30.11, published safety standards for top running bridge cranes, OSHA Regulations, ANSI/NFPA 70, ANSI Z244.1, and applicable parts of ASME B30 and in accordance with Sections 01465 and 01730.

END OF SECTION 14800

SECTION 14910

ELECTRIC CHAIN HOIST WITH MOTORIZED TROLLEY

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Scope
 - 1. The CONTRACTOR shall furnish and install one (1) electric chain hoist with motorized trolley mounted on the bottom flange of the single girder bridge beam. Installation/testing and all required accessories necessary to provide a complete functioning system are required. All components shall be fully compatible to provide a fully functional lifting system.
- B. Related Sections
 - 1. Division 01300: Submittals
 - 2. Division 01730: Operation and Maintenance Manuals
 - 3. Division 09900 Painting Sections for finish painting of galvanized steel structural framing
 - 4. Division 14800: Top Running Bridge Crane
 - 5. Division 16: Electrical supply, conduit, wiring, and other electrical components for powering crane.
- C. Work includes the following:
 - 1. Furnish and install one (1) complete lifting system, including hoist, trolley, controls and all appurtenances specified herein or required.
 - 2. Shop drawings.
 - 3. Shop testing and inspection.
 - 4. Operation and maintenance manuals, documentation and schedules.

1.02 REFERENCES

- A. Equipment furnished under this section shall meet or exceed in all respects the applicable requirements of the following standards:
 - 1. OSHA - Occupational Safety and Health Administration, Part 1926.554 - Overhead Hoists
 - 2. ANSI / ASME - American National Standards Institute / American Society of Mechanical Engineers ANSI / ASME HST-1 Performance Standard for Electric Chain Hoists ANSI / ASME B30.16 – latest edition Overhead Hoists (Under hung)
 - 3. CMAA - Crane Manufacturers Association of America, Inc.
 - 4. MHI – Material Handling Institute, Inc.
 - 5. All other industry and safety standard applications

SECTION 14910

ELECTRIC CHAIN HOIST WITH MOTORIZED TROLLEY

1.03 SUBMITTALS

- A. Submit shop drawings and equipment data:
 - 1. MANUFACTURER's project specific data for hoist/trolley and controls describing capacities, operation and performance.
 - 2. MANUFACTURER's project specific dimensional shop drawings and details showing configuration, dimensions, construction and installation details for all components of the complete system.
 - 3. MANUFACTURER's project specific cable reel electrification system.
 - 4. MANUFACTURER's project specific schematic wiring diagrams with description of operation.
 - 5. Submit type, manufacturer and dry film thickness (DFT) of primer paint and finish coatings of paint to be furnished on hoist and trolley.
 - 6. Copy of warranty required by Paragraph 1.05 for review by ENGINEER/OWNER.
- B. Submit Operations and Maintenance Manuals as per Section 01730.
 - 1. Equipment function, normal operating characteristics, and limiting conditions.
 - 2. Assembly, installation, alignment, and maintenance instructions.
 - 3. Copies of all warranties
 - 4. Lubrication and maintenance schedule instructions.
 - 5. Guide to "troubleshooting".
 - 6. Parts list including recommended spare parts inventory.
 - 7. Factory test results.
 - 8. Name plate / equipment data for each component
 - 9. Local area representative contact information for parts and service.
 - 10. One (1) pint, minimum, each of primer and top coat epoxy paint
 - 11. All items included in section 1.03, A, above are to be included in the operation and maintenance manual.

1.04 APPLICABLE STANDARDS

- A. CONTRACTOR shall comply with all OSHA, state, and local safety guidelines, laws, rules, and regulations.
- B. CONTRACTOR shall conform to all applicable ANSI/ASME, CMMA and MHI specifications and/or standards for fabrication, testing, installation and operation of the lifting system.

1.05 WARRANTIES

- A. Provide MANUFACTURERs standard one year warranty from substantial completion for all items.

SECTION 14910

ELECTRIC CHAIN HOIST WITH MOTORIZED TROLLEY

PART 2 – PRODUCTS

2.01 ACCEPTABLE PRODUCTS

- A. Acceptable hoist and trolley suppliers: RJ Mack Company, Material Handling Systems, and Kone Cranes or ENGINEER approved equal.

2.02 ELECTRIC CHAIN HOIST WITH MOTORIZED TROLLEY

- A. A chain hoist and trolley shall be provided as described further below. Hoist/trolley shall be electrically operated with motorized trolleys and shall have a 3-ton capacity.
 - 1. Mounted on bridge crane “bridge” beam
 - a. Electric chain hoist with electric motorized trolley
 - b. Mounting: Bridge crane “bridge beam”
 - c. Service: Weather resistant, indoor rated, municipal water exposure
 - d. Working Capacity: 3.0 tons (6,000 lbs)
 - e. Lift height: 14.0 feet
 - f. Chain Container: yes
 - g. Control Enclosure: NEMA 12 painted steel
 - h. Controls: Pendant and Remote
 - i. Power: 460v – 3ph – 60Hz
 - j. Quantity: 1
 - k. Chain: zinc coated
 - l. Hoist includes two (2) speed lift with two (2) speed trolley
 - m. Two c-tracks for the festooning of the hoist and the independent festoon of the hoist.
 - n. Hoist and trolley shall utilize VFDs for soft start / stop operation.

2.03 FINISHES

- A. Booms, bridge cranes, masts and support systems shall be painted in accordance with Section 09900 – Painting. Blast clean all components prior to painting to SSPC- SP10/NACE 2 near white. One shop coat of primer and two (2) finish coats shall be per Section 09900-Painting, brilliant yellow applied per the manufactures’ recommendations. Load capacities shall be stenciled on both sides of the hoist/trolley and bridge crane “bridge” beam” with black block lettering.
- B. Hoist and trolleys shall be factory finished with a primer and finish coats as recommended by specification section 09900.
- C. All chains shall be electro - zinc plated for corrosion resistance.

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ELECTRIC CHAIN HOIST WITH MOTORIZED TROLLEY

2.04 EQUIPMENT

- A. Identification plates: Provide MANUFACTURER installed identification plates of non-corrosive metal showing, in clearly legible permanent lettering, the manufacturer's name, model number, capacity rating in pounds, electrical nameplate ratings information, and other essential information.
- B. Hoist/Trolley
 - 1. The hoist and trolley shall be capable of all weather (-18 to 38 degrees C 0 to 100 degrees F) working conditions.
 - 2. Hoist and trolley shall be one complete unit to minimize head room.
 - 3. The hoist shall be equipped with electro-zinc plated load chain specially designed for chain hoist use. The weld on the chain shall face away from the load sprocket of the hoist.
 - 4. The hoist shall be equipped with a chain container resistant to oil, dirt, weather and corrosive environments and that completely encloses the chain exit area of the hoist. The chain container shall have a drain hole in the bottom to allow rain water to drain out.
 - 5. The hoist shall be equipped with a chain stop assembly attached to the load chain to reduce the possibility of the dead end of the load chain from running out of the hoist.
 - 6. Equip hoists with adjustable upper and lower limit stops for chain to prevent over- travel in both the raising and lowering directions.
 - 7. The standard load hook shall be forged alloy steel (34CrMo4 or StE355). The hook is to be equipped with a spring-loaded safety latch and supported on a swivel thrust bearing to allow the hook to rotate 360° easily even under full load.
 - 8. Capacity plates shall be affixed to each side of the block and to the hoist body clearly identifying the rated capacity of the hoist.
- C. Electrification
 - 1. Provide flat wire festoon tag line bridge conductor with the trolley equipment to provide fully insulated electrification. All festooned wiring of the equipment shall be in accordance with the National Electrical Code.
 - 2. Trolley Electrical and Controls: Electrical controls shall be multi speed VFD to suit speed required. Controls shall include a mainline contactor, manually operated fused mainline disconnect with lockout provision, branch circuit fuses, reversing hoist control and transformer with fused secondary. Controls shall be in NEMA 12 enclosure suitable for the area classification actuated from a pendant push button station from the hoist and integrated with the required remote controls provided.

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ELECTRIC CHAIN HOIST WITH MOTORIZED TROLLEY

- D. Controls
 - 1. Drop pendant controls
 - a. Supply MANUFACTURER standard drop pendant controls secured and suspended from the hoist with 14-foot cable. Provide main power disconnect on wall for all trolleys.
 - 2. Remote controls
 - a. Supply MANUFACTURER standard remote controls with paired transmitter and receiver units capable of transmitting a minimum of 200 feet and rated for installation location conditions. Receiver unit shall be integral to the main crane, trolley, hoist control panel.

PART 3 – EXECUTION

3.01 INSTALLATION AND INSPECTION

- A. Inspect system for conformance with reviewed shop drawings and contract documents prior to fabrication and installation of equipment. Bring nonconforming work to the attention of the OWNER prior to proceeding with installation. Nonconforming installation must be corrected prior to testing of system. Costs of delays or additional work due to nonconformance will NOT be reimbursed by the OWNER.
- B. Provide all necessary accessories to make the system complete, usable, and capable of meeting the operating requirements specified in the operating requirements. Test, adjust and clean equipment for acceptance by OWNER.
- C. Trade Coordination: The CONTRACTOR is responsible for the coordination of his work with the work of all trades involved and as it relates to the building structure. Verify all building dimensions that relate to fabrication of the crane system and notify the OWNER's representative and ENGINEER of record of any discrepancy prior to ordering the crane.

3.02 TESTING

- A. After installation, hoist equipment shall be operated through a complete lift and lowering cycle, under load, to determine that the equipment shall perform smoothly and safely. Any defects shall be corrected by the CONTRACTOR without any expense to the OWNER.

3.03 USE BY CONTRACTOR

- A. If the crane hoists and trolley systems are used by the CONTRACTOR, it shall be repaired, repainted, and otherwise refurbished to like new condition at the expense of the CONTRACTOR prior to its acceptance by the OWNER. The

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ELECTRIC CHAIN HOIST WITH MOTORIZED TROLLEY

CONTRACTOR assumes all responsibility for operation and maintenance until the system has been accepted by OWNER.

3.04 CLEANUP

- A. Upon completion of work, area shall be cleaned according to Section 01710 - Cleaning.

END OF SECTION 14910

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HANGERS AND SUPPORTS – HVAC AND PLUMBING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. CONTRACTOR shall provide all hangers, supporting devices and appurtenances shown, specified or required for pipes, fittings, valves and other in-line equipment.
- B. Included in this classification are rod hangers; clevis hangers, spring hangers; stanchion, roller and pipe pole supports and saddle stands; supports of structural steel; concrete saddles, concrete anchor blocks and bases, and all necessary guides, restraints, fastening devices, anchor bolts, pipe anchors and appurtenances.
- C. CONTRACTOR shall provide all temporary pipe supports required during construction.
- D. CONTRACTOR shall design all piping support systems in accordance with the requirements of this Specification unless otherwise shown or specified.

1.02 RELATED SPECIFICATIONS

- A. Specification 03300 - Cast-in-Place Concrete
- B. Specification 05500 - Metal Fabrications
- C. Specification 09900 - Painting

1.03 REFERENCES

- A. The Manufacturers Standardization Society of the Valve and Fitting Industry:
 - 1. MSS SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture.
 - 2. MSS SP-69 - Pipe Hangers and Supports - Selection and Application.
 - 3. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
 - 4. MSS SP-90 - Guidelines on Terminology for Pipe Hangers and Supports.
- B. Federal Specification, FS W-H-171 - Hangers and Support, Pipe.
- C. Underwriter's Laboratories, Inc., Standard UL-203 - Pipe Hanger Equipment.
- D. ASTM A 36 - Standard Specification for Carbon Structural Steel.
- E. ASTM A 48 - Standard Specification for Gray Iron Castings.
- F. ASTM A 276 - Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes.

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HANGERS AND SUPPORTS – HVAC AND PLUMBING

- G. ASTM A283 - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes and Bars.
- H. ASTM A778 - Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.
- I. ASME - B31.1 - Power Piping.
- J. IBC - International Building Code, Latest Edition. Section 1621
- K. EJMA - Expansion Joint Manufacturers Association.
- L. NFPA 13 - Installation of Sprinkler Systems.
- M. ASCE 7, latest edition - Section 9.6.

1.04 DESIGN REQUIREMENTS

- A. CONTRACTOR shall provide hangers and supports of sufficient strength to maintain the pipelines and appurtenances in proper position and alignment under all operating conditions.
- B. All hangers and supports shall conform to the applicable requirements of ASME B31.1, MSS SP-58, SP-59, SP-69 and SP-90, except as modified herein, and be of standard manufacture wherever possible, and best suited for the service required.
- C. Unless otherwise approved, all hangers, supports and concrete inserts shall be listed with Underwriters' Laboratory, Inc.
- D. General Requirements:
 - 1. Where practicable, piping shall be run in groups and parallel to building walls. A minimum clearance of one inch shall be provided between pipe and other work.
 - 2. Hangers or supports shall be provided at all locations where piping changes direction.
 - 3. Hangers and supports shall be capable of adjustment after placement of piping.
 - 4. Types of hangers and supports shall be kept to a minimum.
 - 5. Suspended or supported ductile iron pipe shall have a hanger or support adjacent to each hub or flanged end.
 - 6. Vertical piping shall be supported at each floor and between floors by stays or braces to prevent rattling and vibration.
 - 7. Hanger rods shall be straight and vertical. Chain, wire, strap or perforated bar hangers shall not be used. Hangers shall not be suspended from piping.
 - 8. Contact between dissimilar metals shall be prevented by use of copper plated, rubber or vinyl coated hangers or supports.
 - 9. Hangers and supports shall provide for expansion and contraction throughout the full operating temperature range.

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HANGERS AND SUPPORTS – HVAC AND PLUMBING

10. Any required pipe supports, for which the supports called for in this Specification are not applicable, shall be fabricated or constructed from standard stainless steel shapes, concrete and anchor hardware, and shall be subject to the approval of ENGINEER.
11. Where hanger or support spacing does not correspond with joist or rib spacing, structural steel channels shall be attached to joists or ribs, and the pipes suspended therefrom.
12. All hanger rods shall be double nutted at each hanger or support.
13. All threaded assemblies shall be double nutted or provided with pinned nuts. Alternately, tack welding of bolted assemblies may be acceptable unless provisions for vertical adjustment is required.
14. Except where otherwise shown or required, horizontally valves 6-inches and larger shall be supported on each side of the valve, by pipe hangers or supports.
15. At all flexible couplings, supports shall be placed on each side and as close to the coupling as possible. Supports shall be the guide type which prevent axial movement from resulting in pipe deflection and misalignment.
16. Supports, anchorage and guidance for grooved end pipe shall be in accordance with the applicable sections of these specifications and the recommendations of the manufacturer.

1.05 SUBMITTALS

- A. Submittals shall be in accordance with the requirements Section 01300.
- B. CONTRACTOR shall submit the following for approval:
 1. Detailed working drawings showing all hangers and supports for each piping system. Working drawings shall show location, installation, material, loads, forces, stresses and deflections of all hangers and supports. Reaction forces imparted to structures to which hangers and supports are attached shall be shown.
- C. CONTRACTOR shall submit the following product information for approval:
 1. Manufacturer's catalogues and engineering data on all hangers and supports.
 2. Load ratings.
 3. Materials.
 4. Installation details.
- D. CONTRACTOR shall provide detailed drawings of each pipe support. Each drawing shall contain enough information to verify the pipe support design and to allow the manufacture of the device. At a minimum, the CONTRACTOR shall submit:
 1. Scaled details of the device with dimensions.
 2. A table of applied forces and moments.
 3. A complete bill of materials.
 4. An isometric showing the applied forces and moments.
 5. Detailed connections to existing structure.
 6. Shop and field welds.

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- E. Each submittal shall have the following:
 - 1. A unique identification number and revision level.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Section 01600.
 - 1. Equipment and materials shall be delivered to the site to insure uninterrupted progress of the Work. Pipe hanger inserts which are to be embedded in cast-in-place concrete shall be delivered in ample time not to delay the Work.
 - 2. Equipment and materials shall be stored to permit easy access for inspection and identification, and shall be kept in covered storage off the ground, using pallets, platforms or other supports. They shall be protected from condensation, corrosion and deterioration.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Pipe hangers, supports and appurtenances shall be standard products of the manufacturers listed in the Specifications.
- B. Each type of hanger and support shall be the product of a single manufacturer.

2.02 MATERIALS

- A. Materials for hangers and supports of metallic construction shall conform to ASME B31.1 and to the following standards:
 - 1. Structural Steel, ASTM A 36 and A 283.
 - 2. Iron Castings, ASTM A 48 (Class No. 35).
 - 3. Stainless Steel, ASTM A 276
 - a. Type 316 stainless steel for non-welded items.
 - b. Type 316L stainless steel for welded or fabricated items.
 - c. Tensile Strength 70,000 psi minimum.
 - d. Yield Strength 25,000 psi minimum.
 - e. Elongation in 2 inches 35%.
 - f. Reduction of area 45%.
 - 4. Stainless Steel Pipe and Tube, ASTM A 778, Type 316L stainless steel.
- B. Pipe supports, hangers, concrete inserts, brackets, guides, restraints, rods, bolts, nuts and anchors shall be Type 316 stainless steel.
- C. Pipe rolls, including stands and bases, shall be Type 316 stainless steel.
- D. Only new materials shall be provided.
- E. Hangers and supports shall conform to MSS-SP-58, Table 2.

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- F. Proprietary fiberglass reinforced plastic supports and hangers for use with small diameter chemical and thermoplastic pipe shall be as specified in the Specifications and approved by the ENGINEER.
- G. Expansion anchors for use in concrete structure shall be made of Type 316 stainless steel.

2.03 HANGERS AND SUPPORTS

- A. Hangers and supports shall comply with MSS SP-58.
- B. All hangers and supports shall allow minimum 3-inches of vertical adjustment.
- C. Hangers and Supports shall be of the following types:
 - 1. Hangers for Single Pipes:
 - a. Single pipes shall be supported by hangers suspended by rods from structural steel members, inserts in concrete ceilings and beams, bottom of trapeze hangers and wall mounted steel angle brackets. The strength of the rod shall be based on its root diameter.
 - b. Except for piping subject to thermal expansion and contraction or as otherwise specified in the Specifications, pipe hangers shall be adjustable clevis type MSS SP-58 Type-1.
 - c. Piping subject to thermal expansion and contraction shall be supported on rollers.
 - 2. Hangers or Supports for Multiple Pipes:
 - a. Multiple pipes, running parallel in the same horizontal plane, and adjacent to each other, shall be suspended by trapeze type hangers or supported on wall brackets. Trapeze hangers shall consist of channel sections supported from threaded rods or attached to concrete walls, columns or structural steel support members.
 - b. Except as otherwise specified herein, pipe anchors used for attaching pipe to trapeze or multiple pipe wall brackets, shall be anchor or pipe chairs as required.
 - 3. Supports for Single Pipe:
 - a. Single pipes located in a horizontal plane close to the floor shall be supported by one of the methods specified herein or as shown on the Contract Drawings.
 - b. Pipes shall be supported by adjustable stanchions, pipe saddle or roll supports with "U" bolts. Stanchions shall provide at least 4-inches adjustment and be flanged-mounted to floor.
 - c. Stanchions and saddle stands shall be Type 316L stainless steel.
 - d. Pipe pole supports for pipe runs above ground, out-of-doors, and where otherwise required, shall consist of a suitable length of stainless steel pipe set upright in at least four feet of concrete; two stainless steel angles secured to the top of the pipe, at right angle and on each side; a stainless steel plate welded to the top of the angles to serve as a horizontal support for the pipes. Supports shall be provided with attachments in the form of stands, clamps, rolls, rods or similar devices of the screw adjustable type in the vertical direction.

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- e. Where specified or shown, column supports of built-up welded stainless steel shall be provided, as approved by the ENGINEER.
- f. Pipe rollers shall be cast ductile iron, unless otherwise shown or specified in the Specifications. Hardware and appurtenances shall be stainless steel.
- 4. Wall Supported Pipes: Single or multiple pipes located adjacent to walls, columns or other structural members, and an excessive distance from ceilings or underside of beams, shall be supported using stainless steel wall brackets, MSS SP-58 Type 32 or 33. Where pipes rest on top of bracket pipe supports, attachments shall meet the requirements specified under Paragraph 2.b above.
- 5. Supports for Base Elbows: Where pipes change direction from horizontal to vertical through a bend, a welded or cast base anchor support shall be installed at the bend to carry the load.
- 6. Supports for Vertical Pipes: Pipe riser clamps shall be used to support all vertical pipes extending through floor slabs. Riser clamps shall be MSS SP-58 Type 42 or 8. Insulation shall be removed from insulated pipes prior to installing riser clamps.
- 7. Supports for Pipelines with Thermal Expansion:
 - a. Pipe rolls for single rod hangers: Stainless steel frame construction, ductile iron roller and stainless steel roller rod provided with threaded nuts; vertical adjustment permitted; for pipe sizes 6 inches or less unless otherwise approved.
 - b. Pipe rolls for double rod hangers: Ductile iron roller, stainless steel roller rod, malleable iron threaded sockets which permit vertical adjustment.
- 8. Supports for Thermoplastic Pipes: All thermoplastic pipe attachments shall have a continuous bearing cradle or saddle on the lower 120 degrees of pipe circumference and a minimum length of one quarter pipe diameter, but not less than 6 inches nor more than 12 inches.
- 9. Supports for Copper and Brass Pipes: All copper and brass pipe supports shall be specifically manufactured for use with copper and brass pipe. Hangers shall be provided with a copper finish.

2.04 ACCESSORIES

- A. Hanger Rods:
 - 1. Material shall be Type 316 stainless steel. Maximum allowable working stress shall be 5,800 psi, calculated based on the root diameter.
 - 2. Rods shall have a square head nut on top and running thread on bottom end.
 - 3. Hanger rods for pipe hangers shall be sized in accordance with the table located in 3.02, HANGERS AND SUPPORTS INSTALLATION.
- B. Concrete Inserts, Attachment Plates and Clamps:
 - 1. Hanger rods up to 7/8-inch diameter shall be attached to new concrete structures using concrete inserts MSS SP-58, Type 18. Inserts shall be Type 316 stainless steel. The use of steel inserts is prohibited. Design of the inserts shall permit the rods to be adjusted laterally in one plane and to lock the rod nut or head to the body. The inserts shall be provided with

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openings or recesses to receive reinforcing rods. To facilitate installation, slots shall be provided in the exposed flanges of the insert. Inserts shall be rated to safely carry the maximum load which can be supported by the hanger rod.

2. Hanger rods larger than 7/8-inch diameter shall be attached to new concrete by means of approved hook anchors as shown on the Contract Drawings.
3. Hanger rods shall be attached to concrete structures using stainless steel expansion anchors as specified in Specification 05501.
4. Steel beam clamps shall be malleable iron and conform to MSS SP-58 Type 28 or 29 for wide flange or I-beams, and Type 20 for channel sections or where it is necessary to locate the hanger rod off the beam centerline.
5. Steel U-shape beam attachments welded to the underside of beams, and welded steel brackets fastened to structural steel columns, shall be subject to specific approval of the Structural Steel and Pipe Supports Working Drawings.

2.05 PIPE INSULATION PROTECTION

- A. CONTRACTOR shall furnish steel protection saddles on all supports for insulated pipe.
 1. For pipe sizes less than 12 inches in diameter, provide saddles of No. 14 U.S. gauge stainless steel curved 180 degrees for use with roller hangers or structural trapeze hangers and of No. 16 U.S. gauge stainless steel curved 120 degrees for use in clevis hangers. Saddles shall be at least 12-inches long. Saddle gripping side edges shall be turned up at least to the thickness of insulation.

2.06 SADDLES

- A. Before placing the saddles, saddles shall be filled with either insulating cement or high density insulation cut to fit. For vapor barrier insulation, the barrier must be maintained; contact between hanger and support and bare pipe will not be permitted.
- B. Anchors and sway braces shall be provided when required to hold the pipelines and equipment in position or alignment. Pipe anchors and braces for rigid fastening to the structures shall be attached to stainless steel anchor plates and anchor bolts set into the forms when placing concrete of new structures. Brackets and braces shall be attached to existing concrete structures with through bolts or expansion anchors.
- C. Anchors, guides, and restraints shall be provided for the proper operation of pipeline expansion joints.
- D. Cast iron anchors shall be provided with stainless steel straps on piping, except where anchors form an integral part of pipe fittings and couplings or where an anchor of special design is required or shown on the Contract Drawings.

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- E. All pipe anchors, guides and restraints shall be designed to conform to ASME B31.1.

2.07 INSPECTION

- A. The OWNER may elect to conduct shop inspections. The inspections may include but not be limited to: mechanical and chemical testing, material sampling, material certifications, traceability of parts, blasting and painting, visual and dimensional inspection, and free iron contamination check on stainless steel parts.

PART 3 - EXECUTION

3.01 GENERAL

- A. Hangers, supports, and accessories shall be located within maximum span lengths specified to support continuous pipeline runs unaffected by concentrated loadings.
- B. Hangers or supports shall be provided at all locations where piping changes direction.
- C. Hangers and supports shall be located to prevent vibration or swaying and to provide for expansion and contraction.
- D. Hangers rods shall be straight and vertical. Chain, wire, strap or perforated bar hangers shall not be used. Hangers shall not be suspended from piping.
- E. Concrete embedded items shall be installed before concrete placement.
- F. Embedded items shall be fastened securely to prevent movement during concrete placement.
- G. Hanger and support units installation methods shall be in accordance with manufacturer's recommendations.
- H. Hangers and supports shall be adjusted and grout placed to bring pipelines to specified elevations.

3.02 HANGERS AND SUPPORTS INSTALLATION

- A. Supports and Hangers for Horizontal Pipes:
 - 1. Supports and hangers for all piping shall be placed no farther apart than the table shown below, unless otherwise shown or specified. Tables are based on MSS SP-69 Tables 3 and 4. Spacing and capacities are based on water filled pipe plus 50 lbs. /ft. dead load. Closer hanger spacing may be required where additional valves and fittings increase the load.

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Recommended Hanger Spacing and Rod Size for Copper Tubing		
Nominal Tubing Size (inches)	Maximum Span* (Feet)	Recommended Hanger Rod Sizes (inches)
1/2"	5	3/8"
3/4"	5	3/8"
1"	6	3/8"
1 1/4"	7	3/8"
1 1/2"	8	3/8"
2"	8	3/8"
2 1/2"	9	1/2"
3"	10	1/2"
3 1/2"	11	1/2"
4"	12	1/2"
5"	13	1/2"
6"	14	5/8"
8"	16	3/4"

*For hanger spacing greater than 10'-0-inch, many codes require pipe hangers to be spaced a maximum of every 10' (3.048 meters) regardless of size. CONTRACTOR shall check with local codes and comply as applicable.

2. Additional spacing requirements:
 - a. Thermoplastic Pipe:
 - 1) Pipes up to 1-inch: 2 feet-6 inches center to center.
 - 2) Pipes 1-1/2-inch to 3-inch: 4 feet-0 inches center to center.
 - 3) Pipe 4-inch to 8-inch: 6 feet-0 inches center to center.
 - 4) Pipes larger than 8-inch: 8 feet-0 inches center to center.
 - b. Tubing less than 1-inch diameter: In accordance with best piping practice and ASME B31.1, and as approved by the ENGINEER.
 3. Additional supports shall be placed immediately adjacent to any change in piping direction, at equipment, and on both sides of valves, expansion joints and couplings.
- B. Supports for Vertical Piping:
1. Riser clamp shall be placed under hub, fitting or coupling with approved solid bearing on steel sleeve.
 2. Where riser clamps are used with plastic piping they shall be modified so as not to exert any compressive forces on the pipe.
 3. Vertical piping shall be supported at each floor and between floors by stays or braces to prevent rattling and vibration. Maximum spacing shall not exceed 25 feet.

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HANGERS AND SUPPORTS – HVAC AND PLUMBING

4. Base elbows or welded equivalent shall be provided at vertical piping bases.
 5. Top support shall have a horizontal connection, and provide for pipe expansion.
- C. Pipelines installed under plumbing work shall be spaced in conformity with the requirements of the International Building Code or as specified in the Specifications.

3.03 PAINTING AND COATING

- A. Painting shall be in conformity with Specification 09900 - Painting.
- B. Surfaces of hangers and supports in contact with aluminum, brass, plastic and copper pipelines or pipeline equipment shall be protected with an approved plastic coating to prevent abrasion. Touch-up shall be provided in the field, as required. Coating shall be applied in accordance with the manufacturer's recommendations, and shall be free from spots and brush marks, to the satisfaction of the ENGINEER.

3.04 TESTING

- A. All pipe support and restraining systems shall be installed and secured prior to the testing or activation of the pipeline on which they are installed.
- B. All pipe support systems shall be tested for compliance with the Specifications. After installation, each pipe support system shall be tested in conjunction with the respective piping pressure tests. Tests shall include cycling the piping system to duplicate operating conditions. If any part of the pipe support system proves to be defective or inadequate, as evidenced by vibration or excessive movement, it shall be repaired or augmented at no additional cost to the OWNER.

END OF SECTION 15060

SECTION 15064

PLASTIC PIPE AND FITTINGS

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install in the locations as shown on the drawings, the plastic piping, fittings and appurtenances as specified herein.
- B. All buried piping on the project with a diameter 4-inches and greater shall be restrained joint type. Locate wire shall be installed for all buried pipe with nominal diameter greater than 6-inches. Refer to JEA standards Section 350 for additional information.
- C. Follow JEA latest standards section for installation of the pump station PVC piping.

1.02 RELATED WORK

- A. Excavation and backfill for yard piping is included in Section 02221.
- B. Painting is included in Section 09900.
- C. Pipe support systems are included in Section 15090.
- D. Valves and appurtenances are included in Section 15100.

1.03 DESCRIPTION OF SYSTEM

- A. Piping shall be installed in the locations as shown on the Drawings.

1.04 QUALITY ASSURANCE

- A. All plastic pipe, fittings and appurtenances shall be furnished by a single manufacturer who is fully experienced, reputable, and qualified in the manufacture of the items to be furnished. The pipe shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these specifications.
- B. All pipe shall be stored out of the sunlight. Temporary shading shall be provided. The pipe shall be stored at ambient outdoor temperatures. Gaskets shall be stored in a cool, dark location, and shall not come into contact with petroleum products.
- C. Inspections of the pipe or storage methods may be made by the ENGINEER or OWNER and may be subject to rejection at any time on account of failure to meet the requirements. Rejected pipe shall be marked and removed from the site.

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PLASTIC PIPE AND FITTINGS

- D. Dimensions shown on Contract Drawings are approximate only. CONTRACTOR shall verify all piping geometry in the field and shall be responsible for insuring proper alignment and fit of all piping consistent with the intent of the Contract Drawings.

1.05 SUBMITTALS

- A. Shop drawings shall be submitted to the ENGINEER for approval in accordance with Section 01300 and shall include dimensioning and technical specification for all piping to be furnished.
- B. Submit shop drawings and schedules for all pipe and fittings supplied for each piping system. Pipe laying schedule and assembly drawings which indicate overall dimensions, piping elevations, lengths of pipe, the specific number of each pipe and fitting and the location and direction of lay of each pipe identified by mark number. Pipe laying schedules shall be submitted for all piping systems regardless of pipe size.
- C. Submit procedures and certified test reports confirming that pipe has been manufactured in accordance with ASTM and AWWA standards specified herein.

1.06 TOOLS

- A. Special tools, solvents, lubricants, and caulking compounds required for normal installation shall be furnished with the pipe.

PART 2 – PRODUCTS

2.01 GENERAL

- A. All pipe shall be bundled or packaged in such a manner as to provide adequate protection for the ends, threaded, or flanged, during transportation from the manufacturer.
- B. Any plumbing piping shall be as per the plumbing sheets and as per Section 15140. Coordinate any transitions as necessary.
- C. All piping for potable water shall be blue, all piping for drain or sewer shall be green, and all piping for reclaimed water shall be purple.

2.02 POLYVINYL CHLORIDE (PVC) PIPE

- A. All PVC pipe less than 4-inch in diameter shall be suitable for field cutting, welding, bending and coupling and shall be Schedule 80 unless otherwise shown on the Drawings and of the sizes as shown on the Drawings. Pipe supports shall be provided where shown on the drawings.
- B. PVC pipe 16-inch and larger shall conform to ASTM D3034 and have a dimension

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ratio (DR) of 25. PVC pipe less than 16-inch shall be C900 and have a dimension ratio (DR) of 14 or 18 and as indicated in the Drawings. The pipe shall be made of PVC compounds Class 12454-A or 12454-B as defined in ASTM D1784. Each pipe shall be marked with the manufacturers name, trademark, size, material code, pressure class, AWWA designation number. When used for potable water service, a seal of the testing agency confirming compliance with all applicable standards.

- C. Fittings for pipe less than 4 inches shall be the socket type for solvent welded joints as designated in ASTM D-2467, except where threaded as shown on the Drawings, and as designated in ASTM D-2464, or flanged as shown on the Drawings, and shall be compatible with the pipe material where installed. Flanges shall be furnished with 1/8-inch thick full-faced Teflon, EPDM, or ENGINEER approved equal gaskets. Flange bolts and nuts shall be ASTM A276, Type 316 stainless steel.
- D. Fittings for pipe 4 inches and larger shall be ductile iron with restrained push-on or mechanically restrained configurations compatible with the type PVC utilized.
- E. Caulking for plastic pipe in wall sleeve shall be by a mechanical, modular, rubber sealing element placed in between the sleeve and pipe and expanded to make a tight fit or other method approved by the ENGINEER.
- F. Expansion joints shall have integral duck and rubber flanges. They shall have individual solid steel ring reinforcement with a carcass of highest grade woven cotton or acceptable synthetic fiber. Joints shall be constructed of pipeline size and to meet working pressure and corrosive conditions similar to the line where installed. They shall be of a filled arch-type construction with a minimum of three arches per joint. All joints must be finish-coated with Hypalon paint to prevent ozone attack. They shall be Style 500 as manufactured by Mercer Rubber Co. of Trenton, New Jersey, or equal.
- G. All PVC pipe and materials coming into contact with for raw or potable water service shall be certified NSF 14 and 61 certified.

2.03 HIGH DENSITY POLYETHYLENE (HDPE)

- A. All HDPE pipe shall conform to ASTM D2447, and all fittings shall conform to ASTM D3261. The rating for all HDPE that is 4 inches and greater shall be DIPS DR 13.5 unless otherwise explicitly stated or identified on the Drawings. If less than 4 inches, HDPE shall be IPS DR 13.5 unless otherwise explicitly stated or identified on the Drawings.
- B. Pipe shall be manufactured from HDPE base resin conforming to grade 34 (PPI PE 3406) or better in accordance with ASTM D2447. The pipe shall have a minimum hydrostatic design stress of 630 psi at 73 degrees F and be suitable for field cutting and heat fusion joining.

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- C. Joints for HDPE shall be butt heat fusion made in accordance with D2657. Mechanical connections to valves and piping shall be made in accordance with the manufacturer's recommendations.

2.04 PLASTIC TUBING

- A. Plastic tubing shall be clear, flexible, non-cracking with a wall thickness that is adequate for the pressures involved and of the sizes as shown on the Drawings.
- B. All plastic tubing shall be chemically inert, resistant, and compatible for the chemical intended for its use.

2.05 MARKING TAPE

- A. Utility marking tape shall be 3-inch wide and 4-mil thick per ASTM D2103 with a 2,750 psi tensile strength per ASTM D882. Tape shall have adhesive backing and industrial standard repeatable message and installed in the 12 o'clock position.

2.06 LOCATE WIRE

- A. Locate wire shall be 12-gauge copper wire, single strand, UF rated for direct bury with 30 mil HDPE thickness insulation and minimum OD of 0.141 inches. The rated break load shall be 250 lbs, 30-volt, 21 percent IACS.
- B. External color of locate wire shall be blue for potable water, green for sewer, and pantone purple 522C for reuse.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. The installation of plastic pipe shall be strictly in accordance with the manufacturer's technical data and printed instructions.
- B. Joints for plastic pipe shall be solvent welded except flanged or threaded where required. In making solvent welded connections, clean dirt and moisture from pipe and fittings, bevel pipe ends slightly with emery cloth, if necessary, and apply solvent cement of the proper grade. Expansion joints shall be installed every 50 feet on long runs and in every straight run longer than 15 feet.
- C. Installation of valves and fittings shall be strictly in accordance with manufacturer's instructions. Particular care shall be taken not to overstress threaded connections at sleeves. In making solvent weld connections the solvent shall not be spilled on valves or allowed to run from joints.
- D. All piping have a sufficient number of unions to allow convenient removal of piping and shall be as approved by the ENGINEER.

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- E. Where plastic pipe passes through wall sleeves, joints shall be sealed with a mechanical sealing element as shown on the drawings.
- F. All plastic pipe to metal pipe connections shall be made using flanged connections. Metal piping shall not be threaded into plastic fittings, valves, or couplings, nor shall plastic piping be threaded into metal valves, fittings, or couplings.
- G. Concrete inserts for hangers and supports shall be furnished and installed in the concrete as it is placed. The inserts shall be set in accordance with the requirements of the piping layout and the CONTRACTOR shall verify their locations from approved piping layout drawings and the structural drawings. Pipe hangers and supports are specified in Section 15090 and as detailed on the Drawings.

3.02 INSPECTION AND TESTING

- A. All water, sewer, and reclaimed water mains greater than 12-inch I.D. shall be flushed and hydraulically cleaned (swabbed) as per JEA standards.
- B. All pipelines shall remain undisturbed for 24 hours to develop complete strength at all joints. All pipelines shall be subjected to a hydrostatic pressure test for 4 hours at full working pressure. All leaks shall be repaired and pipelines retested as approved by the ENGINEER. Prior to testing, the pipelines shall be supported in an approved manner to prevent movement during tests.
- C. The test pressures and temperatures for the various pipe lines shall be as follows:
 - 1. Drain and gravity sewer piping: 20 psi at ambient temperature
 - 2. Potable water piping: 150 psi (raw and finished water)
 - 3. Reclaimed water piping: 150 psi
- D. Locate wire testing shall be per JEA Water and Wastewater Standards Section 350.III.6.4.1.

END OF SECTION 15064

SECTION 15072

DUCTILE IRON PIPE AND FITTINGS

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. The work under this Section of the specifications shall include all materials, equipment and labor for furnishing, laying, installing, testing, and disinfecting the piping work and appurtenances herein under described and as shown on the Contract Drawings.
- B. The CONTRACTOR shall furnish ductile iron pipe, fittings, accessories and appurtenances necessary for installation, including but not limited to gaskets, nuts and bolts for flanged joints; pipe supports; tie rods; and flexible couplings. All piping shall be furnished by the CONTRACTOR.
- C. All ductile iron piping on the project shall be minimum pressure class 200 regardless of size. This requirement governs over the JEA Standards for the minimum pressure class as stated in Section 350.

1.02 RELATED WORK

- A. Mechanical equipment, pipe supports, sleeves, couplings, valves, and appurtenances are included in respective sections of Division 11.
- B. Piping shall also be in accordance with JEA standards latest edition unless as otherwise specified herein.
- C. Painting, except as specified herein, is included in Division 9.

1.03 QUALITY ASSURANCE

- A. Dimensions shown on Contract Drawings are approximate only. CONTRACTOR shall verify all piping geometry in the field and shall be responsible for insuring proper alignment and fit of all piping consistent with the intent of the Contract Drawings.
- B. All ductile iron pipe, fittings and appurtenances shall be furnished by a single manufacturer who is fully experienced, reputable, and qualified in the manufacture of the items to be furnished. The pipe shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these specifications.

1.04 SUBMITTALS

- A. Shop drawings and manufacturer's literature shall be promptly submitted to the ENGINEER for approval in accordance with Section 01300 - Submittals.
- B. The following items shall be submitted before delivery of pipe or fittings:

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DUCTILE IRON PIPE AND FITTINGS

1. Certification by the manufacturer or supplier that the pipe furnished for this project meets all pertinent AWWA Standards, latest editions.
2. Certifications of compliance with applicable standards for all piping.
3. Pipe laying schedule and assembly drawings which indicate overall dimensions, piping elevations, lengths of restrained joint pipe, the specific number of each pipe and fitting and the location and direction of lay of each pipe identified by mark number. Pipe laying schedules shall be submitted for all piping systems.
4. Catalog cuts and installation instructions for all restrained joints including boltless restrained joint pipe and grooved end joint pipe for ductile iron pipe.
5. Certification that all bolts to be furnished conform to the referenced standards and are manufactured in the United States of America.
6. Shop drawings and schedules completely detailing and locating wall pipes shall be submitted for approval prior to their fabrication and well in advance of the concrete work.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. The Manufacturer shall legibly mark all pipe and specials in accordance with the approved laying schedules and marking diagram. Each pipe shall be numbered in sequence and said number shall appear on the laying schedule and marking diagram in its proper location for installation.
- B. The CONTRACTOR shall carefully examine all material for defects. Material which is known, or thought, to be defective shall not be installed.
- C. The ENGINEER reserves the right to inspect all material and to reject all defective material shipped to the job site or stored on the site. Failure of the ENGINEER to detect damaged material shall not relieve the CONTRACTOR from his total responsibility for the completed work if it leaks or breaks after installation. Lay all defective material aside for final inspection by the ENGINEER to determine if corrective repairs may be made, or if the material is to be rejected. The ENGINEER shall determine the extent of the repairs.
- D. CONTRACTOR shall classify defective pipe prior to ENGINEER's inspection as follows:
 1. Damage to interior and/or exterior paint seal coats.
 2. Damage to interior cement-mortar lining.
 3. Insufficient cement-mortar lining thickness.
 4. Poor quality interior paint seal coat.
 5. Pipe out of round.
 6. Damaged pipe barrel area to a point where pipe class thickness is reduced.
 7. Denting or gouges in plain end of pipe.
- E. The CONTRACTOR shall be solely responsible for the safe storage of all material until it has been incorporated in the completed project and accepted by the ENGINEER.
- F. Pipe fittings and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such

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DUCTILE IRON PIPE AND FITTINGS

materials be dropped. Pipe handled on skidways shall not be skidded or rolled against other pipe. Handling of this material is to be in accordance with AWWA C600.

- G. The CONTRACTOR is cautioned to exercise care in handling, loading, unloading, and storing ductile iron pipe and fittings. All ductile iron pipe and fittings shall be stored under cover before use and shall be transported in a vehicle with a bed long enough to allow the length of pipe to lay flat so as not to be subject to undue bending or concentrated external load at any point.

PART 2 – PRODUCTS

2.01 DUCTILE IRON PIPE

A. General

1. Ductile iron pipe and fittings 3-inch and larger shall be manufactured by U.S. Pipe and Foundry, American Ductile Iron Pipe Company, Griffin Pipe Products Company, Clow Corporation, or McWane Pipe Company.
2. Ductile iron pipe shall conform to the latest specifications as adopted by the American National Standards Institute, Inc., (ANSI) and the American Water Works Association (AWWA). Specifically, ductile iron pipe shall conform to ANSI/AWWA C151/A21.51.
3. The pipe shall be coated outside with a bituminous coating in accordance with ANSI/AWWA C151/A21.51. The pipe interior shall be cement mortar lined and seal coated in compliance with the latest revision of ANSI/AWWA C104/A21.4.
4. Each length of pipe shall be subjected to a hydrostatic proof test by the manufacturer as required by ANSI/AWWA C151/A21.51.

B. Mechanical Joint Pipe

1. Push-on and mechanical joints shall conform to ANSI/AWWA C111/A21.11. All pipe installed on this project shall be furnished with restrained joints.
2. The pipe class of non-flanged pipe shall be as a minimum pressure Class 250. Where indicated on the Drawings, thicker classes shall be furnished.

C. Flanged Pipe

1. Flanged joints for piping shall conform to ANSI/AWWA C110/A21.10 for fittings and ANSI/AWWA C115/A21.15 for pipe. Flanged joints shall not be used in underground installations except where specifically shown on the Drawings.
2. All flanged pipe shall be a minimum of thickness Class 125, unless otherwise indicated on the Contract Drawings.

2.02 DUCTILE IRON FITTINGS

A. General

1. Fittings shall be ductile iron conforming to ANSI/AWWA C110/A21.10, C111/A21.11, C115/A21.15, and/or C153/A21.53. Fittings shall also be certified by ISO 9000 by an accredited ENGINEER.
2. Fittings shall have a minimum working pressure of 250 psi.

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DUCTILE IRON PIPE AND FITTINGS

3. Fittings to be buried shall be coated with an asphaltic coating in accordance with ANSI/AWWA C110/A21.10 and lined inside with cement mortar and seal coated in accordance with ANSI/AWWA C104/A21.4.
 4. All fittings shall be supplied by one manufacturer.
- B. Mechanical Joint Ductile Iron Fittings
1. Mechanical and push-on joints including accessories shall conform to ANSI/AWWA C111/A21.11.
- C. Flanged Ductile Iron Fittings
1. Flanges for fittings shall meet the requirements of ANSI/AWWA C110/A21.10 and C153/A21.51.
- D. Restrained Joint Fittings
1. Restrained joints may be restrained by utilizing a joint restraint gasket which includes a stainless steel locking segments vulcanized into the rubber gasket. The gasket shall be rated for operating pressures up to 250 psi based on the performance requirements of ANSI/AWWA C111/A21.11.

2.03 DUCTILE IRON PIPE MARKING

- A. All ductile iron pipe below ground shall be marked with a minimum 3-inch wide, non-detectable utility marking tape. The utility marking tape shall be installed on the pipe at the 12 o'clock position. Tape shall be 4 mils ASTM D2103 thickness and constructed for prolonged use underground, meet industry standard (APWA) color code, tensile strength of 2750 psi (ASTM D882), and industrial standard repeatable message.
- B. All ductile iron piping above ground shall be color labeled "Water," "Sewer," or "Reclaimed Water" stenciled in the center of each joint of pipe utilizing oil paint. Stenciled lettering shall be a minimum of 4-inches and be blue, green, or purple in color.

2.05 LOCATE WIRE

- A. Locate wire shall be 12-gauge copper wire, single strand, UF rated for direct bury with 30 mil HDPE thickness insulation and minimum OD of 0.141 inches. The rated break load shall be 250 lbs, 30-volt, 21 percent IACS.
- B. External color of locate wire shall be blue for potable water, green for sewer, and pantone purple 522C for reuse.

2.04 RETAINING RINGS

- A. The CONTRACTOR shall maintain, on-site, a suitable supply of field installed retaining rings for ductile iron boltless restrained joints for pipe installations which may require unavoidable field cutting, as approved by the ENGINEER. Field installed retaining rings shall be furnished by the same manufacturer as the pipe and shall have the same pressure rating as factory installed rings.

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2.05 RETAINER GLANDS

- A. All mechanical joint fittings and valves shall be provided with ductile iron retainer glands. Retainer glands shall be "Megalug" Series 1100 as manufactured by EBAA Iron or equal. Retainer glands shall be supplied complete with torque limiting twist off nuts. Also, all fittings shall be provided with concrete thrust blocks.

PART 3 – EXECUTION

3.01 INSTALLATION - GENERAL REQUIREMENTS

- A. All pipe shall be laid and maintained to the required lines and depths. Fittings and valves shall be at the required locations with joints centered, spigots home and all valve and hydrant stems plumb and otherwise in strict accordance with the Specifications.
- B. All buried steel lugs, rods, brackets and flanged joint bolts and nuts shall be low alloy steel in accordance with ANSI C111 and given one (1) coat of Koppers #50 coal tar coating prior to backfilling.
- C. No deviation shall be made from the required alignment, depth or grade except with the written consent of the ENGINEER.
- D. All pipe shall be laid to the depth specified. The depth shall be measured from the final surface grade to the top of the pipe barrel. The minimum pipe cover shall be as shown on the Drawings or as specified in the Specifications.
- E. Do not lay pipe in a wet trench, on subgrade containing frost, and when trench conditions are unsuitable for such work. If all efforts fail to obtain a stable dry trench bottom and the ENGINEER determines that the trench bottom is unsuitable for trench foundation, he will order in writing the kind of stabilization to be constructed.
- F. Thoroughly clean the pipes and fittings before they are installed and this material shall be kept clean until the acceptance of the completed work. Lay pipe with the bell ends facing in the direction of laying, unless otherwise shown on the Drawings, or directed by the ENGINEER. Exercise care to ensure that each length abuts against the next in such manner that no shoulder or unevenness of any kind occurs in the pipe line.
- G. No wedging or blocking is permitted in laying pipe unless by written order of ENGINEER.
- H. Before joints are made, bed each section of pipe the full length of the barrel with recesses excavated so pipe invert forms continuous grade with invert of pipe previously laid. Do not bring succeeding pipe into position until the preceding length is embedded and securely in place.
- I. Dig bell holes sufficiently large to permit proper joint making and to insure pipe is firmly bedded full length of its barrel.

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- J. During "pushing home" of any style piping, timber shall be placed between the jacking device (backhoe, bucket, pipe jacket, etc.) and the pipe being driven home.
- K. Walking or working on completed pipeline, except as necessary in tamping and backfilling, is not permitted until trench is backfilled one-foot deep over top of pipes.
- L. Take up and relay pipe that is out of alignment or grade, or pipe having disturbed joints after laying.
- M. Take up and replace with new, such in-place pipe sections found to be defective. Replacement work at CONTRACTOR's expense.
- N. Take necessary precautions to prevent the floating of the pipeline by the accumulation of water in the trench, or the collapse of the pipeline from any cause. Should floating or collapse occur, restoration will be at the CONTRACTOR's expense.
- O. Bedding and backfilling materials for buried pipe shall be as specified previously in Division 2, as specified in subsequent paragraphs, and in accordance with the Contract Drawings.
- P. Take every precaution to prevent foreign material from entering the pipe while it is being placed. During laying operations, do not place debris, tools, clothing, or other materials in the pipe.
- Q. Close all openings in the pipeline with watertight plugs when pipe laying is stopped at the close of the day's work or for other reasons, such as rest breaks or meal periods.
- R. Place enough backfill over the center sections of the pipe to prevent floating.
- S. Carry out the cutting of pipe only with equipment specifically designed for that purpose such as an abrasive wheel, rotary wheel cutter, a guillotine pipe saw or a milling wheel saw. The use of chisels will not be permitted. Cut ends and rough edges should be ground smooth and for push-on connections, the cut end should be beveled slightly.
- T. In distributing material at the project site, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. Each length of pipe shall be adequately blocked to prevent movement. Stockpiled pipe shall be adequately blocked to prevent movement. No pipe, material, or any other object shall be placed on private property, obstruct walkways or driveways, or in any manner interfere with the normal flow of traffic.

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- U. In the case of ductile iron pipe, special care shall be exercised, during handling temporary storage or construction to avoid damage to the bells, spigots or flanged ends. If damaged pipe cannot be repaired to the ENGINEER's satisfaction, it shall be replaced at the CONTRACTOR's expense.
- V. The CONTRACTOR shall be responsible for maintaining the minimum required distance between the water line and other utility lines in strict accordance with all Federal, State and local requirements and all right-of-way limitations.
- W. The maximum allowable deflection at the joints for push-on- joint pipe, regardless of pipe material shall be no more than 75 percent of the manufacturer's recommendation.
- X. In case the curve is too sharp for the allowable deflection, short lengths of pipe may be used upon approval of the ENGINEER and at no additional cost to the OWNER.
- Y. Particular care shall be exercised to that no high points are established where air can accumulate in the pipelines.
- Z. Locate wire testing shall be per JEA Water and Wastewater Standards Section 350.III.6.4.1.
- AA. All water, sewer, and reclaimed water mains greater than 12-inch I.D. shall be flushed and hydraulically cleaned (swabbed) as per JEA standards.

3.02 CONSTRUCTION METHODS TO AVOID CONTAMINATION

- A. Heavy particulates generally contain bacteria and prevent even very high chlorine concentrations from contacting and killing such organisms. It is essential that the procedures of this section be observed to assure that a water main and its appurtenances are thoroughly clean for the final disinfection by chlorination.
- B. Precautions shall be taken to protect the interiors of pipes, fittings, and valves against contamination. Pipe delivered for construction shall be strung so as to minimize entrance of foreign material. All openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped at the close of the day's work or for other reasons, such as rest breaks or meal periods. Rodent-proof plugs may be used where it is determined that watertight plugs are not practical and where thorough cleaning will be performed.
- C. Delay in placement of delivered pipe invites contamination. The more closely the rate of delivery is correlated to the rate of pipe laying, the less likelihood of contamination.
- D. Joints of all pipe in the trench shall be completed before work is stopped. If water accumulates in the trench, the plugs shall remain in place until the trench is dry.
- E. Yarning or packing material shall consist of molded or tubular rubber rings, or rope of treated paper or other approved materials. Materials such as jute, asbestos or

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hemp shall not be used. Packing material shall be handled in a manner that avoids contamination.

- F. No contaminated material or any material capable of supporting prolific growth of microorganisms shall be used for sealing joints. Sealing material or gaskets shall be handled in a manner that avoids contamination. The lubricant used in the installation of sealing gaskets shall be suitable for use in reclaimed water. It shall be delivered to the job in closed containers and shall be kept clean.
- G. If dirt enters the pipe, and in the opinion of the ENGINEER the dirt will not be removed by the flushing operation, the interior of the pipe shall be cleaned by mechanical means and then shall be swabbed with a 1 percent hypochlorite disinfecting solution. Cleaning with the use of a pig, swab or "go-devil" should be undertaken only when the ENGINEER has specified such and has determined that such operation will not force mud or debris into pipe joint spaces.

3.03 DUCTILE IRON PIPE INSTALLATION

- A. The installation of buried iron piping, except as otherwise shown or specified, shall conform to AWWA C-600, "Standard for Installation of Ductile Iron Water Mains and Appurtenances". Boltless restrained joint pipe shall also be installed in accordance with manufacturer's recommended instructions.
- B. Assembly of push-on pipe and mechanical joints valves shall be in accordance with the manufacturer's printed instructions and AWWA C-600. Installation of retainer glands shall be in accordance with the manufacturer's printed instructions. Torque wrenches shall be used for installation of mechanical and retainer glands.
- C. The bell, plain end, and gasket shall be thoroughly cleaned and lubricated immediately before assembling the joint. The gasket shall then be inserted into the groove in the bell. Before starting joint assembly, a liberal coating of special lubricant shall be applied to the gasket and spigot end. With the spigot end centered in the bell, the spigot end is pushed home. Bolts for mechanical joints shall be tightened in an alternating top-to-bottom and side-to-side sequence in order to bring the gland up to the bell face evenly. If effective sealing is not achieved at the maximum torques listed AWWA C-600, the joint shall be disassembled, thoroughly cleaned, and reassembled. Over stressing of bolts to compensate for poor joint assembly will not be permitted.
- D. All flanges, unless otherwise required, shall have standard drillings. Flanges shall be firmly bolted with machine, stud or bolts of the proper size bar steel, with good, true threads, and shall be so tightened as to evenly distribute the stress in the bolts and bring the pipe into uniform alignment.
- E. In general, no flanges shall be permitted underground except as directed by the ENGINEER, or as indicated on the Drawings.
- F. Where required, flanges shall be tapped for stud bolts.

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3.04 PRESSURE TESTS

- A. The CONTRACTOR shall provide all labor, materials, equipment, gauges, air, water and all else necessary to pressure test all ductile iron piping systems installed under this Contract. Except as otherwise shown or specified, testing shall be in accordance with AWWA C-600, Section 4.
- B. The general method of testing pipelines designed to convey liquids shall be as follows:
1. A hydrostatic test pressure shall be maintained in the pipeline for a minimum period of two (2) hours. At the end of the test period, if the test pressure has remained constant, the pipeline shall have passed the test. If the pressure has dropped, it shall be brought back to the test pressure by pumping a known volume of water (by pumping from a graduated container or by metering) back into the pipeline. The volume of water thus used, representing leakage from the pipeline, shall be recorded. If the leakage is less than the allowable leakage specified below, the pipeline shall have passed the test. If the leakage exceeds the allowable specified, the CONTRACTOR shall locate the leak, permanently repair the section of piping where the leak is occurring to the satisfaction of the ENGINEER, and retest the pipeline as specified above. This process shall be repeated until the pipeline has successfully passed the pressure test.
 2. CONTRACTOR shall make certain that all air is expelled from a pipeline before it is tested. All caps, plugs and fittings shall be adequately braced and anchored to withstand the test pressures. The test pressure specified by the ENGINEER shall be obtained and measured at the highest elevation in the pipeline under test.
 3. CONTRACTOR shall take special note of piping configurations as shown on the Drawings, especially where piping begins or terminates with fittings which will be difficult to seal, plug and anchor. In these cases, it may be necessary to perform the testing after special anchorage systems have been installed.
 4. Allowable Leakage: Allowable leakage shall be computed by the following formula:

$$L = \frac{SDP^{1/2}}{148,000}$$

L = allowable leakage, gallons per hour

S = length of pipe tested in feet

D = nominal pipe diameter, in inches

P = average test pressure, psi

5. The test pressures for process piping shall be as follows:
 - a. All pump suction and discharge – 100 psi
 - b. Drain piping – 20 psi
 - c. Water and reclaimed water mains – 150 psi

SECTION 15072

DUCTILE IRON PIPE AND FITTINGS

3.05 BACTERIOLOGICAL TESTING

- A. After final flushing and before the piping is placed in service, samples will be collected by the OWNER and tested by the OWNER for bacteriological quality in accordance with Standard Methods for the Examination of Water and Wastewater.
- B. Bacteriological tests must show complete absence of coliforms. If tests show presence of coliform CONTRACTOR will be required to perform additional flushing and disinfection of the pipeline until such time acceptable tests are obtained, all at no cost to the OWNER.

3.06 DISINFECTION

- A. Upon completion of installation, the interior of all piping shall be thoroughly cleaned and flushed.
- B. After cleaning and flushing, and following pressure testing, all lines carrying water shall be disinfected in accordance with AWWA (C651) American Water Works Association Standard for Disinfection of Water Mains. Following chlorination and after the entire length is ready for service, all treated water shall be flushed thoroughly from the pipeline. The CONTRACTOR shall coordinate with the OWNER to take sample at the beginning and end of the new system and which will provide chemical and bacteriological tests on the samples. The tests shall prove that the entire piping system is free of pathogenic organisms.
- C. Should the initial treatment prove ineffective, the disinfection procedure shall be repeated until satisfactory results are obtained.

3.07 DISPOSAL OF HEAVILY CHLORINATED WATER

- A. After the applicable retention period, heavily chlorinated water should not remain in contact with the pipe for more than 48 hours. In order to prevent damage to the pipe lining or corrosion damage to the pipe itself, the heavily chlorinated water shall be flushed from the main until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the distribution system, or is acceptable for domestic use.
- B. The chlorine residual of water being disposed shall be neutralized by treating with one of the chemicals listed in **Table 1**. The proposed disposal site to which chlorinated water is to be discharged shall be approved by the OWNER. A reducing agent shall be applied to the chlorinated water to be wasted to completely neutralize the chlorine residual remaining in the water. Where necessary, federal, state and local regulatory agencies should be contacted to determine special provisions for the disposal of heavily chlorinated water.
- C. Pounds of chemicals required to neutralize various residuals chlorine concentrations in 100,00 gallons of water

SECTION 15072

DUCTILE IRON PIPE AND FITTINGS

Table 15072-1

Residual Chlorine Concentration Mg/L	Sulfur Dioxide	Sodium Bisulfite	Sodium Sulfite	Sodium Thiosulfate
1	0.8	1.2	1.4	1.2
2	1.7	2.5	2.9	2.4
10	8.3	12.5	14.6	12.0
50	41.7	62.6	73.0	60.0

END OF SECTION 15072

SPECIFICATION 15076

DUCTWORK AND EQUIPMENT IDENTIFICATION

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Furnish and install all components of the system for identification of ductwork and equipment. The system includes the placing of identification signs and direction-of-flow arrows on all visible plant ductwork, the placing of nameplates on plant equipment and structures, and painting in color of all equipment and ducts, except stainless steel or aluminum surfaces, as shown on the CONTRACTOR's working drawings submitted under the related Specifications sections for equipment, ductwork, and as required for a complete job.

1.02 RELATED SPECIFICATION

- A. Specification 09900 - Painting

1.03 PAYMENT

- A. No direct payment will be made for these signs, flow charts or appurtenances; the cost must be included in the price bid for the equipment and ductwork systems as specified in the Specifications.

1.04 REFERENCES

- A. ASTM D523 - Standard Test Method for Specular Gloss
- B. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents
- C. ASTM D638 - Standard Test Method for Tensile Properties of Plastics
- D. ASTM D646 - Standard Test Method for Grammage of Paper and Paperboard (Mass per Unit Area)
- E. ASTM D709 - Standard Specification for Laminated Thermosetting Materials
- F. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
- G. ASTM D792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
- H. ASTM D5420 - Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact)

1.05 MANUFACTURER'S GUARANTEE

- A. Provide the specified items from firms regularly engaged in the manufacture of identification devices of types and sizes required, with at least five (5) years'

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DUCTWORK AND EQUIPMENT IDENTIFICATION

experience in manufacturing signs. In addition, the manufacturer shall guarantee the sign, in writing, against color fading, chipping, corroding or any other manufacturing defects for a period of ten (10) years.

1.06 SPARE PARTS AND ACCESSORIES

- A. Furnish the following spare parts and accessories:
 - 1. One set banding tools and banding accessories
 - 2. One stainless steel banding strap, approximately 1000 ft.
 - 3. One complete nameplate mounting assembly for every 20 nameplates installed
 - 4. One stainless steel cable and splice for every 20 valve identification tags
- B. Provide all spare parts and accessories suitably boxed and marked for storage and reordering.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Construct fiberglass reinforced plastic identification signs and nameplates of 70 mils thick fiberglass reinforced plastic conforming to ASTM D709.
- B. Provide fiberglass reinforced plastic process with a blemish free, low gloss surface of superior permanence and durability in the colors selected. Provide each identification sign and nameplate in two colors and with the legend specified. Provide the backside of the sign in black or some other uniform color.
- C. Provide lettering made by silk screening or other permanent embedment of subsurface printed graphics in the material so as to produce a clear, legible sign. Do not place lettering, symbols or markings containing the name of the manufacturer on the signs. The contract number and the year of the contract as given on the Contract Drawings may be placed in small lettering on the front of the sign, if approved by the ENGINEER.
- D. Construct all signs and nameplates in conformity with ASTM D523, D638, D646, D790, D792 and D5420.

2.02 DIMENSIONS OF SIGNS AND TAGS

- A. Provide identification signs and nameplates rectangular in shape and of the dimensions specified below. A dimensioned tolerance of plus or minus 1/16 inch is permissible.

Type of Sign	Sign Dimensions (Width x Length)
NAMEPLATES - 1. Equipment and structures	3-1/2 x 12 inches

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DUCTWORK AND EQUIPMENT IDENTIFICATION

2.03 LETTERING OF SIGNS

- A. Perform all lettering and numbering on identification signs and nameplates in block style in size and spacing to suit the size of sign, as approved by the ENGINEER.
- B. Unless otherwise approved, limit the legend on equipment nameplates to two lines and a maximum of 35 letters and spaces.
- C. Submit samples of the lettering to be used for fiberglass reinforced plastic signs to the ENGINEER for approval before manufacturing begins. Such samples must show the height, width and spacing of letters and numbers for any three (3) legends of ten or more letters and spaces as listed in Paragraph 2.06.

2.04 CHEMICAL RESISTANCE

- A. Provide fiberglass reinforced plastic signs resistant to abrasion, impact, corrosion, and the following acids, alkalis, salts and solvents in accordance with ASTM D543:
 - 1. 10% citric acid
 - 2. 5% acetic acid
 - 3. 3-30% sulfuric acid
 - 4. 10% ammonium hydroxide
 - 5. 10% sodium chloride
 - 6. Turpentine
 - 7. Mineral spirits
 - 8. Heptane
 - 9. Kerosene
 - 10. Ethyl alcohol
 - 11. Ethyl acetate
 - 12. Transformer oil
 - 13. Heavy duty detergents
 - 14. Water
- B. Submit certification on acid resistance to the ENGINEER prior to installation.

2.05 COLORS

- A. Code equipment nameplates and finish coats of paint for equipment in basic colors.
- B. Provide brilliant colors, distinctive shades matching as closely as possible (without custom color blending) the following basic colors as specified by the Munsell Color System (MN):

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DUCTWORK AND EQUIPMENT IDENTIFICATION

Table of Standard Colors	
Color	Munsell Number
White	MN - N8.8/
Yellow	MN - 4Y7.5/12.8
Orange	MN - 0.5 YR 4.6/12.2
Red	MN - 7R 3.6/12.7
Brown	MN - 2.5 YR 4.2/4.3
Gray	MN - 2.5PB 5.8/1.7
*Charcoal	MN - 6B 5/0.4
Black	MN - N1/
Blue	MN - 3PB 3.3/7.4
Green	MN - 8G 4.4/6.2
* Provide color "Charcoal" for paints equivalent to MN - N 3.75.	

- C. Provide identification signs for mechanical equipment in the color combinations specified below under "General Color Code".

General Color Code		
Service Line	Colors	
	Letters	Background
1. HEATING, VENTILATING AND CONDITIONING AIR (Equipment and Ductwork)	Green	Charcoal

2.06 NAMEPLATES

- A. Provide nameplates for equipment and structures in the same color combination as the medium they service. Legends for nameplates must follow the terminology shown. Provide numbering system as described in the Operation and Maintenance Manual.
- B. The following is a representative list, not necessarily complete, of nameplate legends with appropriate color combinations to which the equipment identification number must be added:

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DUCTWORK AND EQUIPMENT IDENTIFICATION

Nameplates			
Legend		Color Code	
First Line ⁽¹⁾	Second Line ⁽²⁾	Lettering	Background
Air conditioning	Unit **	White	Charcoal
Condenser	Air cooled **	Yellow*	Blue*
Exhaust fan	**	White	Charcoal
⁽¹⁾ Nominal limit of 18 letters, numerals and spaces. ⁽²⁾ Nominal limit of 17 letters, numerals and spaces. *Where equipment is mounted on roofs or where exposed to the public view, such as in lobby or office areas, the color will be selected by the Architect. **The legend on these nameplates also includes the appropriate six-digit numeral and letter designation for such equipment and structures as specified by the Operation and Maintenance Manual. ** The legend on these nameplates also includes the appropriate tag number as specified by the Operation and Maintenance Manual.			

2.07 ADDITIONAL SIGNS AND NAMEPLATES

- A. In addition to the legends specified above, the ENGINEER may order the CONTRACTOR to furnish and install additional identification signs, arrows and nameplates at no additional cost to the owner. Such additional signs may be requested near completion of the work and will be limited to no more than five (5) signs for each of the five types specified in Paragraph 2.02. Conform legends and color combinations for additional signs to the requirements specified.

2.08 DUCTWORK

- A. All ductwork shall be identified by plastic markers not less than 4 inches high in a color in contrast to the surface on which it is mounted. The markers shall be fastened to the ductwork with sheet metal screws or machine screws and hex nuts. Markers shall indicate system title function. Duct markers shall indicate area served, function, i.e., supply, return or exhaust and direction of flow.
- B. Duct markers shall be located not more than 50 feet apart on all mains and branches. Markers shall be placed on ducts on each side of the wall or floor through which they pass. Markers shall also be placed adjacent to access panels. All markers shall be so located as to be clearly visible to a person standing on the floor.

PART 3 – EXECUTION

3.01 LOCATION

- A. Locate nameplates on equipment bases and on structures at readily visible levels in such positions relative to the equipment and structures so as to prevent damage to the nameplate.

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DUCTWORK AND EQUIPMENT IDENTIFICATION

3.02 MOUNTING

- A. Provide mounting assembly "Steelbinder" strapping unit as manufactured by A.J. Gerrard & Co., Des Plaines, Illinois, Independent Metal Strap Co., Inc., Roslyn, N.Y. or approved equal.
- B. Mount nameplates in a manner specifically approved by the ENGINEER after the installation of equipment or construction of structures. Submit details of the method of fastening to the ENGINEER for approval. Provide fastening devices for nameplates and valves of stainless steel construction.
- C. Mount valve identification signs with approved stainless steel brackets or approved stainless steel strapping in such a fashion that sharp corners or edges on signs, brackets, bolts, chain or strapping will not constitute a hazard to personnel operating the valves. Since it is impractical to detail each means of attachment in the Specifications or on the Contract Drawings, each means of attachment will receive approval only on its own merits. Submit for approval sketches of each type proposed.
- D. Do not attach identification tags or signs to handwheels. Use of flange bolts or bonnet bolts as a means of attachment of brackets will receive consideration. Provide all attachment devices and bolting of Type 316 stainless steel.

END OF SECTION 15076

SECTION 15081

PIPING INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This Section includes insulation and jacketing requirements for typical piping systems, including piping, valves and accessories. The CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified or required to furnish and install the piping insulation work.

1.02 RELATED SPECIFICATIONS

- A. Specification 09900 - Painting
- B. Specification 15060 - Hangers and Supports - HVAC

1.03 REFERENCES

- A. ASTM C 195 - Standard Specification for Mineral Fiber Thermal Insulating Cement
- B. ASTM C 240 - Standard Test Methods of Testing Cellular Glass Insulation Block
- C. ASTM C 411 - Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation
- D. ASTM C 534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
- E. ASTM C 552 - Standard Specification for Cellular Glass Thermal Insulation
- F. ASTM C 547 - Standard Specification for Mineral Fiber Pipe Insulation
- G. ASTM C 1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
- H. ASTM D 1056 - Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
- I. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- J. ASTM E 96 - Standard Test Method for Water Vapor Transmission of Materials
- K. International Building Code
- L. International Energy Conservation Code
- M. NFPA 255 - Surface Burning Characteristics of Building Materials

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PIPING INSULATION

1.04 SUBMITTALS

- A. General: The CONTRACTOR shall provide all submittals in accordance with Section 01300.
- B. Product Data:
 - 1. Insulation and related materials: Submit the manufacturer's technical product data, insulation materials, densities, fire ratings, flame-spread ratings, smoke-developed ratings, fuel contributed ratings, material safety data sheets and installation instructions for each type of piping insulation and related materials. Submit a schedule showing the manufacturer's product number, k-value, thickness, and furnished accessories for each piping system requiring insulation.
 - 2. Aluminum jacketing: Submit the manufacturer's technical data for jacketing and related materials.
- C. Installation Drawings: Complete assembly, layout and installation drawings with clearly marked dimensions.

1.05 QUALITY ASSURANCE AND QUALIFICATIONS

- A. Manufacturer's Qualifications: Provide insulation from firms regularly engaged in manufacture of piping insulation products, of the types and sizes required, whose products have been in satisfactory use in similar services for not less than 3 years.
- B. Installer's Qualifications: Use a single firm with at least 5 years successful installation experience on projects with insulations similar to that required for this project.

1.06 DELIVERY, STORAGE AND HANDLING

- A. General: Deliver, store and handle all products and materials as specified in Section 01600.
- B. Labeling: Deliver the insulation, coverings, cements, adhesives, and coatings to the site in containers with the manufacturer's stamp or label, affixed showing the fire hazard indexes of products.
- C. Protection: Protect the insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation. Remove damaged materials from the project site.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. General: Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted for approval.

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PIPING INSULATION

- B. Style A Insulation
 - 1. Johns Manville Corp.
 - 2. Owens-Corning Fiberglass Corp.
- C. Style B Insulation
 - 1. Armstrong World Industries, Inc.
 - 2. Rubatex Corp.
- D. Style C Insulation
 - 1. Pittsburgh Corning Corp.
- E. Aluminum Jacketing
 - 1. Childers Product Company, Lock-On
- F. Thermal Hanger Shields
 - 1. Pipe Shields Inc

2.02 FLAME/SMOKE RATINGS

- A. Piping insulation shall have a composite (insulation, jackets, coverings, sealers, mastics and adhesives) flame-spread index of 25 or less, fuel-contributed rating of 50 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method. Any treatments of jackets or facings to impart flame and smoke safety shall be permanent. The use of water-soluble treatments shall be prohibited.

2.03 BUILDING CODE COMPLIANCE

- A. Piping insulation products shall comply with the latest editions of the International Building Code and the International Energy Conservation Code.

2.04 MATERIALS

- A. Style A Insulation - Molded Fiberglass Pipe Insulation
 - 1. Style A insulation shall be heavy-duty, bonded fibrous glass sectional pipe insulation with a thermal conductivity not exceeding 0.26 BTU per hour per square foot per degree F per inch thickness at 50 degrees F mean temperature and not exceeding 0.3 BTU per hour per square foot per degree F per inch thickness at 200 degrees F mean temperature. Insulation shall be provided with factory-applied vapor retarder. The vapor retarder shall be an ASJ (all-service jacket) type meeting the requirements of ASTM C 1136 Type 1 and consisting of laminated white kraft paper, reinforcing scrim and foil. The insulation shall meet the requirements of ASTM C 547, Type 1. Insulation shall be rated for use at temperatures up to 850 degrees F.
 - 2. Joints and Seams: Provide joints and seams meeting one of the following requirements
 - a. Field cemented joints: All joints and seams shall be sealed with approved adhesive, and the joints covered with joint sealing tape at least 3 inches in width, permanently adhered.

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PIPING INSULATION

- b. Sealing strips: All longitudinal joints shall be sealed with integral adhesive sealing strip, and butt joints shall be covered with 3-inch width of vapor barrier butt joint strip tape.
 - 3. Fittings, flanges and valves: Provide insulation meeting one of the following requirements
 - a. Fittings, flanges and valves shall be insulated with fiber glass molded or segmented insulation, and wrapped with joint sealing tape of matching color.
 - b. Alternatively, fittings, flanges and valves may be insulated with factory cut glass blanket.
- B. Style B Insulation - Flexible Elastomeric Cellular Insulation
 - 1. Style B insulation shall be flexible elastomeric type, closed cell, cylindrical or sheet type as required by the application. Flexible elastomeric insulation shall have a thermal conductivity not exceeding 0.27 BTU per hour per square foot per degree F per inch thickness at 75 degrees F mean temperature. Water absorption shall be less than 5% (ASTM D 1056). Water vapor permeability shall not exceed 0.10 perms per inch in accordance with ASTM E 96 Procedure A. The insulation shall meet the requirements of ASTM C534 and ASTM D 1056.
 - 2. Joints and Seams: All joints shall be cut straight and butted with no gaps. Seal all joints with the manufacturer's recommended adhesive.
 - 3. Fittings, flanges and valves:
 - a. Seams and mitered joints shall be adhered using the manufacturer's recommended adhesive. Screwed fittings shall be sleeved and adhered with a minimum one-inch overlap onto the adjacent insulation.
 - b. Flanges, strainers, couplings and valves shall be insulated using donuts, then covered with sheet or oversize tubular insulation.
 - 4. Coating
 - a. Where insulation is installed outdoors, coatings shall be provided to protect the insulation from ultraviolet radiation. Coatings shall be as recommended by the insulation manufacturer and approved by the ENGINEER.
- C. Style C Insulation - Cellular Glass
 - 1. Cellular glass insulation shall have a water absorption not exceeding 0.2 percent (ASTM C 240), have 0.20 perms-inch water vapor permeability (ASTM E 96), service temperature range of at least 0 to 220 degrees F, a minimum density of 8.0 lbs per cubic foot, compressive strength of 100 psi, and maximum thermal conductivity of 0.32 BTU per hour per square foot per degree F per inch thickness at 75 degrees F average temperature. Where field-applied aluminum jacketing is not required over the insulation, the insulation shall be provided with a factory-applied facing of aluminum foil laminated to glass fiber reinforced white vinyl facing. The insulation shall meet the requirements of ASTM C 552.
 - 2. Joints and Seams:
 - a. Insulation joints shall be sealed with the insulation manufacturer's recommended vapor-resistant joint sealant.
 - b. Factory-applied facing shall have its longitudinal seams sealed with vapor resistant adhesive and butt joints shall be wrapped with 3 inch

SECTION 15081

PIPING INSULATION

width joint sealing tape, all as recommended by the insulation manufacturer and approved by the ENGINEER.

3. Fittings, flanges and valves: Fittings, flanges and valves shall be insulated with preformed cellular glass insulation. Fitted insulation segments shall be used on sizes for which preformed shapes are not manufactured, of the same material and thickness and applied in the same manner as for pipe insulation.
4. Where indicated on the Contract Drawings or in the Specifications, the interior bore of the insulation shall be coated to prevent abrasion of the pipe. For pipe operating near ambient temperature, the coating shall be a gypsum cement molding plaster such as U. S. Gypsum Hydrocal B-11, or equal, as recommended by the insulation manufacturer.

D. Aluminum Jacketing

1. Aluminum jacketing shall be constructed of aluminum (alloy 3105/3003), not less than 0.016 inch thick. It shall have a modified Pittsburgh Z-lock on the longitudinal seam. Jacketing shall be provided with an integrally bonded moisture barrier. Adjacent sections shall butt together and shall be secured with a weather-proof butt strap. Jacketing shall be secured with 3/4-inch wide, 0.015-inch thick stainless steel bands at a maximum spacing of twelve inches. All edges of strapping shall be factory de-burred. All insulated fittings shall be finished in the same manner, using 0.024-inch thick aluminum (alloy 1100) preformed fitting covers and fabricated covers made from the same material for valves, flanges, tees, in-line accessories, and other pipeline appurtenances. Aluminum end caps shall be provided at the ends of the pipelines.

E. Accessories

1. Provide staples, bands, wires and cement as recommended by the insulation manufacturer and approved by the ENGINEER for the applications indicated.
2. Provide adhesives, sealers, and protective finishes as recommended by the insulation manufacturer and approved by the ENGINEER for the applications indicated.

F. Thermal Hanger Shields

1. Provide insulated pipe protectors consisting of a 360-degree high density, 100 psi, waterproofed calcium silicate inserts encased in 360-degree sheet metal. On cold water pipes provide protectors with insulation extended 1-inch beyond the sheet metal shield. On heat-traced pipe, protectors shall be provided with grooves to accommodate the heat tracing.
2. Provide the thickness of the insulation insert to be the same as the adjoining pipe insulation, and sheet metal gauge in accordance with the manufacturer's recommendations.
3. Provide metal components manufactured of galvanized steel. Pipe hangers and supports provided in conjunction with the thermal hanger shields shall meet the requirements of Specification 15060.

SECTION 15081

PIPING INSULATION

PART 3 - EXECUTION

3.01 INSPECTION

- A. General: Examine areas and conditions under which piping insulation is to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable for insulation installation, as determined by the ENGINEER.

3.02 INSTALLATION

- A. General: Install piping insulation products in accordance with the manufacturer's recommendations and approved shop drawings, and as specified in Division 1. Install piping insulation products in accordance with the latest edition of the International Building Code. Install all products in accordance with the recognized industry practices so that insulation serves its intended purpose. Insulated thermal hangers shields shall be installed at all support points, except where otherwise indicated.
- B. Piping Insulation:
 - 1. Order of Installation: Install insulation on pipe systems subsequent to the installation of heat tracing, painting, testing, and acceptance tests. Piping shall be field tested and approved by the ENGINEER prior to installation of insulation.
 - 2. Cleaning and Drying: Pipe surfaces shall be cleaned and dried prior to insulating.
 - 3. Insulation Surfaces: Install the insulation materials with smooth, even and flush adjoining surfaces. Butt insulation joints firmly together to form a complete and tight fit over the surfaces to be covered. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete the run. Do not use cut pieces or scraps abutting each other.
 - 4. Vapor Barrier: Maintain integrity of the vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage. Vapor barrier materials shall be applied to form a complete, unbroken vapor seal over the entire insulated piping system.
 - 5. Insulating Fittings: Cover valves, fittings and similar items in each piping system with an equivalent thickness and composition of insulation as applied to the adjoining pipe run. Install factory molded, precut or job fabricated units except where a specific form or type is indicated.
 - a. Unless indicated otherwise, piping insulation shall be extended without interruption through interior walls, floors and similar piping penetrations. Annular spaces between pipe and pipe sleeves shall be thoroughly packed with fibrous glass blanket and caulked with mastic so as to be soundproof and vermin-tight. Provide fibrous glass blanket with properties equivalent to the insulation Style installed on the piping.
 - b. Do not extend insulation through walls or floors that are fire rated or are required to be gas-tight.
 - 6. Pipe Hangers:
 - a. Butt pipe insulation against pipe hanger insulation inserts.

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PIPING INSULATION

- b. For hot pipes, apply a 3-inch wide vapor barrier tape or band over the butt joints.
 - c. For cold piping apply a wet coat of the vapor barrier lap cement on butt joints and seal the joints with a 3-inch wide vapor barrier tape or band. Pipe hangers and supports shall be installed outside of the vapor seal.
- 7. Removable Items: Install removable insulation sections on the following:
 - a. Devices that require access for maintenance of equipment
 - b. Items that can be removed, such as unions, screwed joints, flanges, strainers, etc.
- C. Aluminum Jacketing: Provide aluminum jacketing over all insulated piping systems. Install jacketing in accordance with the manufacturer's recommendations and approved shop drawings.
- D. Pipe exposed to weather:
 - 1. Pipe hangers and supports shall be on the outside of the aluminum jackets, and shall not penetrate the jacketing.
 - 2. Do not install thermal hanger shields on pipelines using cellular glass insulation. At each such location, a preformed Type 316 stainless steel insulation shield shall be provided. The insulation shield shall envelope at least the lower half of the insulated pipe and shall limit the compressive load on the insulation to 33 psi or less.
- E. All jacket openings - such as at overlaps of jackets with thermal hanger shields, around valve stems and similar projections - shall be sealed with nonhardening, waterproof, clear or white sealing compound so that upon completion the insulation is essentially watertight.

3.03 PROTECTION AND REPLACEMENT

- A. Protection: Insulation shall be protected against dirt, water, chemical or mechanical damage before, during and after installation. Follow methods which are required for protection of the insulation work during the remainder of construction period, to avoid damage and deterioration.
- B. Replacement: Any insulation or covering damaged prior to final acceptance of the work shall be satisfactorily repaired or replaced, including units with vapor barrier damage and moisture saturated units.

3.04 PAINTING AND CLEANING

- A. The CONTRACTOR shall remove all debris, waste materials and loose foreign matter resulting from installation.

3.05 CONTRACT PIPING SYSTEM INSULATION THICKNESS SCHEDULE

- A. General: The CONTRACTOR shall provide piping insulation on the following mechanical piping systems and as indicated in the Specifications.

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PIPING INSULATION

- B. Thickness: The CONTRACTOR shall provide the following minimum insulation thicknesses as shown in the table below.

Fluid Temperature Range	Insulation Conductivity		Nominal Pipe Size (inches)				
	Conductivity BTU x in. / (h x ft ² x °F)	Mean Rating Temperature, °F	<1	1 to < 1-1/2	1-1/2 to < 4	4 to < 8	≥8
> 350	0.32 – 0.34	250	4.5	5.0	5.0	5.0	5.0
251 – 350	0.29 – 0.32	200	3.0	4.0	4.5	4.5	4.5
201 – 250	0.27 – 0.30	150	2.5	2.5	3.0	3.0	3.0
141 - 200	0.25 – 0.29	125	1.5	1.5	2.0	2.0	2.0
105 – 140	0.22 – 0.28	100	1.0	1.0	1.5	1.5	1.5
40 – 60	0.21 – 0.27	75	0.5	0.5	1.0	1.0	1.0
< 40	0.20 – 0.26	50	0.5	1.0	1.0	1.0	1.5

3.06 HVAC CONTRACT PIPING SYSTEM INSULATION SCHEDULE

- A. Sub-Freezing Piping (0 to 39 degrees F) HVAC Piping Systems
1. Style: Insulation shall be Style B
 2. Thickness:
 - a. As per table 3.05, B above.
 3. Install on the following for the purpose of eliminating sweating:
 - a. Refrigerant suction lines systems between evaporators and compressors.
- B. Cold Piping (40 degrees F to ambient) HVAC Piping Systems
1. Style: Insulation shall be Style B
 2. Thickness:
 - a. As per table 3.05, B above.
 3. Install on the following for the purpose of eliminating sweating:
 - a. Air conditioner condensate drain piping systems.
- C. Hot Low Pressure (to 250 degrees F) HVAC Piping Systems
1. Style: Insulation shall be Style B
 2. Thickness:
 - a. As per table 3.05, B above.
 3. Install on the following for the purpose of reducing heat loss and preventing injury to workers:
 - a. Hot gas refrigerant piping systems

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PIPING INSULATION

- D. Insulation Omitted: Omit insulation on hot piping within radiation enclosures or unit cabinets, on cold piping within unit cabinets provided that the piping is located over a drain pan and on heating piping beyond a control valve, located within heated space.
- E. Refer to Paragraph 3.08 in this section for installation requirements.

3.07 PLUMBING CONTRACT PIPING SYSTEM INSULATION SCHEDULE

- A. General: In addition to the requirements above, the CONTRACTOR shall provide insulation for plumbing piping systems as indicated below and as indicated in the Specifications.
- B. Cold Plumbing Piping Systems
 - 1. Style: Insulation shall be Style A
 - 2. Thickness:
 - a. As per table 3.05, B above.
 - 3. Install on the following for the purpose of eliminating sweating:
 - a. Potable cold water piping systems
 - b. Plumbing vents within 6 lineal feet of a roof opening
 - c. Drain piping systems from drip pans
 - d. City water systems
- C. Hot Plumbing Piping Systems
 - 1. Style: Insulation shall be Style A
 - 2. Thickness:
 - a. As per table 3.05, B above.
 - 3. Install on the following for the purpose of reducing heat loss and preventing injury to workers:
 - a. Potable hot water piping systems
 - b. Potable hot water recirculating piping systems
 - c. Hot drain piping systems
 - d. Tempered water piping systems
- D. Insulation Omitted: Omit the insulation on chrome-plated exposed piping (except for handicapped fixtures), air chambers, unions, strainers, check valves, balance cocks, flow regulators, drain lines from water coolers, drainage piping located in crawl spaces or tunnels, buried piping, fire protection piping, and pre-insulated equipment.

3.08 HVAC INSULATION INSTALLATION

- A. General
 - 1. The HVAC insulation shall be applied on clean dry surfaces only. It shall be continuous through wall and ceiling openings and sleeves. All removable or openable parts such as casing and access doors shall be insulated so that the item can be opened or removed without damage to the insulation or finish.
 - 2. Insulation on all cold surfaces shall be applied with a continuous, unbroken vapor seal.

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PIPING INSULATION

3. The insulation shall pass through the hanger uninterrupted.
 - a. All piping insulation shall be continuous through the hanger without interruption, and a protection system shall be used. The system shall consist of a block of molded calcium silicate or cellular glass insulation whose thickness and temperature rating shall be compatible with the insulation requirements of the piping system served and a metal shield. The blocking shall be a minimum of 12 inches long, cover the bottom half of the pipe and be secured to the piping to prevent shifting.
 - b. The metal shield shall be 300 series stainless steel matching the curvature and covering the blocking. The metal gauge shall be as follows:

1) Nominal Pipe Size	Metal Gauge
2) Up to 6 inches	16
3) 6 to 10 inches	14
4) 12 inches and over	12
 - c. The length of the metal shield shall be 12 inches or match the length of blocking used. The shield shall cover the bottom half of the pipe.
- B. Testing
1. All tests shall be performed in accordance with the requirements of Division 1.
 2. The insulation, composite and accessories shall be tested in accordance with ASTM E84, NFPA 255 or UL723.

END OF SECTION 15081

SECTION 15090

PIPE SUPPORT SYSTEMS

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. This Section includes all pipe support systems as shown on the Drawings.

1.02 REFERENCES

- A. American National Standards Institute (ANSI)
 - 1. B31.1, Power Piping
 - 2. B31.3, Chemical Plant and Petroleum Refinery Piping
- B. American Society for Testing and Materials (ASTM)
 - 1. A276, Standard Specification for Stainless and Heat Resisting Steel Bars and Shapes
 - 2. A575, Standard Specification for Steel Bars, Carbon, Merchant Quality
- C. American Welding Society (AWS)
 - 1. D1.1, Structural Welding Code
- D. Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS)
 - 1. SP58, Pipe Hangers and Supports - Materials and Design
 - 2. SP69, Pipe Hangers and Supports - Selection and Application

1.03 DESIGN

- A. Assure design, materials of construction and installation of pipe hangers, supports, guides, restraints, and anchors for air and process piping are in accordance with ANSI B31.3, and MSS Standard SP-58 and SP-69, except where modified by this Specification. For steam and hot and cold water piping, assure design, materials of construction and installation of pipe hangers, supports, guides, restraints, and anchors are in accordance with ANSI 31.1, and MSS SP-58 and SP-69.

1.04 SUBMITTALS

- A. Certifications that products used meet standards referenced.
- B. Shop Drawings consistent with Section 01300 and including:
 - 1. Product technical data
 - 2. Scaled drawing showing guides, hangers, supports, anchors, structural members and appurtenances used for pipe support system.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Concrete Inserts (Continuous Slot)
 - 1. Products as manufactured by Unistrut (P3200), or approved equal, and which meet these Specifications.

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PIPE SUPPORT SYSTEMS

- B. Concrete Inserts (Individual Slot)
 - 1. Products as manufactured by ITT Grinell (Figure 281), or approved equal, and which meet these Specifications.
- C. Concrete Inserts (Self Drilling Expansion Anchor)
 - 1. Products as manufactured by Phillips (Flush End or Snap Off End Type), or approved equal, and which meet these Specifications.
 - 2. Provide stainless steel anchorage for exposed and submerged locations.
- D. Beam Clamp
 - 1. Products as manufactured by ITT Grinell (Figure 131), or approved equal, and which meet these Specifications.
- E. Hangers (Pipe Size 4-inch and Less)
 - 1. Products as manufactured by ITT Grinell (Figure 108 with Figure 114), or approved equal, and which meet these Specifications.
- F. Hangers (Pipe Size Over 4-inch)
 - 1. Products as manufactured by ITT Grinell (Figure 590 for cast/ductile pipe, or Figure 260), or approved equal, and which meet these Specifications.
- G. Hangers (Hot Water Application for Pipe size over 4-inch)
 - 1. Products as manufactured by ITT Grinell (Figure 181 with Figure C-82), or approved equal, and which meet these Specifications.
- H. Vertical Pipe Supports
 - 1. Products as manufactured by ITT Grinell (Figure 261), or approved equal, and which meet these Specifications.
- I. Pipe Support Saddles
 - 1. Products as manufactured by ITT Grinell (Figure 264), or approved equal, and which meet these Specifications.
- J. Pipe Covering Protection Saddle
 - 1. Products as manufactured by ITT Grinell (Figure 16D - 166A), or approved equal, and which meet these Specifications.
- K. Copper Pipe Hangers
 - 1. Products as manufactured by ITT Grinell (Figure CT-269, 261-C), or approved equal, and which meet these Specifications.
- L. Wall Brackets
 - 1. Products as manufactured by ITT Grinell (Figure 199), or approved equal, and which meet these Specifications.
- M. Channel Frame Pipe Supports
 - 1. Products as manufactured by Unistrut Corporation, Powerstrut, Inc, or approved equal, and which meet these Specifications.

SECTION 15090

PIPE SUPPORT SYSTEMS

2.02 COMPONENTS

- A. Galvanize all structural steel angles, rods, channels, and special devices integral to hanger and support system unless otherwise noted on drawings.
- B. Hanger Rods
 - 1. ASTM A276 in wet/corrosive areas
 - 2. ASTM A575 in non-corrosive areas
 - 3. Maximum total hanger load
 - a. 3/8-inch diameter (min) rod: 610 LBS
 - b. 1/2-inch diameter rod: 1,130 LBS
 - c. 5/8-inch diameter rod: 1,810 LBS
 - d. 3/4-inch diameter rod: 2,710 LBS
 - e. 7/8-inch diameter rod: 3,770 LBS
 - f. 1-inch diameter rod: 4,960 LBS
 - 4. Continuous thread type with rods electro-galvanized or cadmium plated after threads are cut except where stainless steel is specified.
- C. Expanding pipe supports: Spring hangers conforming to MSS-SP58
- D. Trapeze Hangers
 - 1. Galvanized angle iron, channels or other structural shapes unless otherwise noted on drawings
 - 2. Provide either curved or roller surfaces at support point corresponding with type of hanger scheduled.
- E. Anchors and Alignment Guides
 - 1. Carbon steel anchors and alignment guides.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to installation, inspect and verify condition of substrate. Installation constitutes installer's acceptance of substrate for satisfactory installation.
- B. Prior to installation, inspect and verify condition of pipe support system. Installation constitutes installers acceptance of condition for satisfactory installation.

3.02 PREPARATION

- A. Correct defects or conditions which may interfere with or prevent a satisfactory installation.

3.03 ERECTION/INSTALLATION/APPLICATION

- A. Install in accordance with MANUFACTURER's instructions

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PIPE SUPPORT SYSTEMS

- B. Locate hangers, supports, and accessories to support pipe system at concentrated loads and in accordance with minimums defined in MSS-SP69.
- C. Install supports capable of supporting the pipe for service and testing conditions shown on piping Specification Schedules. Allow free expansion and contraction of the piping to prevent excessive stress resulting from service and testing conditions or from weight transferred from the piping or attached equipment.
- D. All piping systems and pipe connections to equipment shall be properly anchored and supported to prevent undue deflection, vibration, dislocation due to seismic events and line pressures, and stresses on piping, equipment, and structures.
- E. Provide piping systems exhibiting pulsation, vibration, swaying, or impact with suitable constraints to correct the condition. Movements from trap discharge, water hammer, and similar internal forces are included in this requirement.
- F. Weld supports in accordance with the requirements of AWS Code D1.1 Structural Welding. Weld anchors to pipe in accordance with ANSI B31.3.
- G. Locate piping and pipe supports as to not interfere with open accesses, walkways, platforms, and with maintenance or disassembly of equipment.
- H. Support vertical pipe runs in pipe chases at base of riser and at each floor. Support pipes for lateral movement with clamps or brackets.
- I. Install individual or continuous slot concrete inserts for use with hangers for piping and equipment. Furnish and install concrete inserts as concrete forms are installed.
- J. Size hangers to fit around outside of pipe insulation.
 - 1. Provide a pipe covering protection saddle for insulated hot pipe 4-inch and larger at support point.
 - 2. Install a 16-inch length of 9 LB density fiberglass pipe insulation between pipe and hanger or support for insulated piping without saddles.
 - 3. Insert to cover lower half of pipe utilizing insulation suited to pipe temperature.
 - 4. Thickness of pipe covering protection saddle and 9 LB density fiberglass to match final insulation thickness.
- K. Provide pipe anchors to prevent movement of pipe at point of attachment.
- L. Install pipe alignment guides on both sides on each expansion joint or loop to assure proper alignment of expanding and contracting pipe. Guides are not substitutes for hangers or other pipe supports. Provide two guides before and after each expansion joint/loop. Locate the first guide four pipe diameters away from the joint/loop, the second guide 10-12 pipe diameters from the first. Provide additional guides 75 ft on center thereafter unless anchors are present in that distance.
- M. Suspend piping installed on galvanized steel trapeze hangers from concrete inserts or approved structural clips.

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PIPE SUPPORT SYSTEMS

- N. Provide wall bracket supports for pipe located near walls and 8 ft or more above floor elevation.
- O. Provide pipe support saddles for pipe located 3 ft or less from the floor elevation in lieu of hangers.
 - 1. Use schedule 40 galvanized steel support pipe risers recommended by saddle manufacturer.
 - 2. Provide steel floor plate with collar 3/16-inch thickness, circular in shape, and sleeve type connection to pipe.
 - 3. Size floor plate 4-inch larger than support pipe.
 - 4. Fit collar over outside of support pipe and extend up 2-inch from the floor plate.
 - 5. Weld floor plate to collar and grind all edges smooth. Hot-dip galvanized assembly after fabrication.
- P. For hangers placed directly on copper pipes, use copper or cadmium plated type hangers or isolate copper pipe from steel hanger with electrically insulating material. For all other applications use hangers cadmium plated or galvanized.
- Q. Adjust supports and hangers to allow for proper pitch of pipes.
- R. Where more than two pipes run parallel, support using trapeze hanger or individual hangers.
- S. Secure channel frame pipe supports to walls or floors using suitable anchors.

3.04 FIELD QUALITY CONTROL

- A. After erection of piping systems, and prior to pipe testing and flushing, inspect hangers for design offset, adequacy of clearance for piping and supports in the hot and cold positions, guides to permit movement without binding, and adequacy of anchors.

3.05 SCHEDULE

- A. In certain locations, pipe supports, anchors, and expansion joints have been indicated on the drawings, but no attempt has been made to indicate every pipe support, anchor, and expansion joint. It shall be the CONTRACTOR's responsibility to provide a complete system of pipe supports, to provide expansion joints, and to anchor all piping, in accordance with the following minimum requirements:
 - 1. Steel, stainless steel and ductile iron pipe support schedule.

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PIPE SUPPORT SYSTEMS

Pipe sizes - IN	Maximum Spacing Between Supports - FT
1-1/2 and less	5
2 thru 4	10
5 thru 8	15
10 and greater	20

2. Copper pipe support schedule

Pipes Sizes - IN	Maximum Spacing Between Supports - FT
2-1/2 and less	5
3 thru 6	10
8 and greater	15

3. Plastic pipe support schedule

Pipes Sizes - IN	Maximum Spacing Between Supports - FT *
1-1/4 and less	3
1-1/2 thru 3	4
4 and greater	5

* Maximum fluid temperature of 100 deg F.

4. Miscellaneous. Space supports for soil and waste pipe and other piping systems, not included above, every 5 feet.
 5. Where mechanical coupling or expansion joints are used, place hanger within 2 feet of each side of fittings to keep pipes in alignment.
 6. Provide at least one support for each length of pipe, at each change of direction and at each valve.
 7. Above spacing is a minimum and where shown on the Drawings shall be installed in those locations.
- B. Pipe supports and expansion joints are not required in buried piping, unless shown on the drawings or specified in other sections. Concrete blocking or other suitable anchorage for buried piping shall be provided as indicated on the drawings or specified in other sections.
- C. All piping shall be rigidly supported and anchored so that there is no movement or visible sagging between supports.

END OF SECTION 15090

SECTION 15100

VALVES AND APPURTENANCES

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install complete and ready for operation all valves and appurtenances as shown on the Drawings and as specified herein.
- B. The equipment shall include, but not be limited to, the following:
1. Flexible hose connectors
 2. Gate valves
 3. Rubber flapper check valves
 4. Butterfly valves
 5. Air release valves
 6. Pressure sustaining fill valve
 7. Orifice plate
 8. Valve boxes
 9. Hose bibbs
 10. Pressure gauges
 11. Sodium hypochlorite injection quills
 12. Solenoid valves
 13. Restrained flange adapters
 14. Fire hydrant (potable and reclaimed water)
 15. Yard hydrant (reclaimed water)
 16. Ball valves
 17. Rotometer
 18. Dismantling joints
- C. The JEA standards identified in the Water Treatment Plant Standards, January 1, 2016 and Water and Sewer Standards Manual, January 1, 2019 edition (or latest edition) will be used for the following items:
- | | |
|-----------------------|--|
| 1. Gate Valves | WTP Standards Exhibit XI-I |
| 2. Check Valves | WTP Standards Exhibit XI-I |
| 3. Butterfly Valves | WTP Standards Exhibit XI-I |
| 4. Valve Boxes | W&S Manual Section 351 VII, AW-301 |
| 5. Air Release Valves | WTP Standards Exhibit XI-I and W&S Manual Section 351 VIII.7 |
| 6. Tapping Sleeves | W&S Manual Section 351 VIII, AW-202 |
| 7. Tapping Valves | W&S Manual Section 351 VIII, AW-304 |
| 8. Dismantling Joints | W&S Manual Section 351 II, AW-401 |
- These items must conform to those standards and shall be submitted for review and approval to the ENGINEER under this specification section.
- D. All valves that come into contact with potable water shall be certified in accordance with NSF standards including, but not limited to, NSF 61.

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VALVES AND APPURTENANCES

1.02 RELATED WORK

- A. Excavation, Backfill, Fill and Grading for pipe is included in Division 2.
- B. JEA Standards latest edition.

1.03 DESCRIPTION OF SYSTEMS

- A. All of the equipment and materials specified herein are intended to be standard for use in controlling the flow of water, wastewater, air, sludge, or chemicals, etc., depending on the applications.

1.04 QUALIFICATIONS

- A. All of the types of valves and appurtenances shall be products of well-established reputable firms who are fully experienced, reputable and qualified in the manufacture of the particular equipment to be furnished. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these specifications as applicable.

1.05 SUBMITTALS

- A. Complete shop drawings of all valves and appurtenances shall be submitted to the ENGINEER for approval in accordance with the requirements of Section 01300.
- B. Valve submittals shall include the following:
 - 1. Valve tag number
 - 2. The manufacturer and supplier
 - 3. The address at which equipment will be fabricated or assembled
 - 4. Drawings showing assembly details, materials of construction and dimensions
 - 5. Descriptive literature, bulletins and/or catalogs of the equipment
 - 6. The total weight of each item
 - 7. A complete bill of materials
 - 8. Additional submittal data, where noted with individual pieces of equipment
- C. Test reports
 - 1. Provide certified hydrostatic test data, per manufacturer's standard procedure or MSS-SP-61 for all valves.
- D. Certificates
 - 1. For each valve specified to be manufactured, tested and/or installed in accordance with AWWA and other standards, submit an affidavit of compliance with the appropriate standards, including certified results of required tests and certification of proper installation.

SECTION 15100

VALVES AND APPURTENANCES

1.06 TOOLS

- A. Special tools, if required for normal operation and maintenance shall be supplied with the equipment.

1.07 VALVE DESIGNATIONS AND SCHEDULE

- A. All valves shall be identified by a unique valve tag as identified in the valve schedule prepared by the CONTRACTOR. The specific type of valve to be used will be identified by the symbol and/or call out on the Drawings. The CONTRACTOR shall identify each valve by its assigned tag number on all shop drawings and equipment submittals or as designated on the Drawings.
- B. The CONTRACTOR shall refer to the P&IDs, civil plans, and mechanical plans for type of each valve called out by abbreviation or drawing symbol. Prior to the first valve submittal, CONTRACTOR shall submit a detailed valve schedule listing all of the yard and process valves to be furnished along with the Contract Drawing P&IDs edited electronically which shall include the valve tag numbers prepared by the CONTRACTOR identifying each valve. The valve schedule shall include: "RECLAIMED", valve tag number, valve type and direction, valve size, end connections, operator type (number of turns to open, as applicable) and other information required by JEA details for buried valves. The valve tag numbering shall be linked to the P&ID Sheet on which it is shown. Where electric, hydraulic, or pneumatic actuators are supplied their type shall be so noted with an E, H or P. Modulating duty actuators shall be noted with an M following the actuator type notation. An excerpt of an EXAMPLE schedule is as follows:

Valve Tag.	Type	Size	Ends	Operator (Number of Turns)	Notes
401A	BFV	16-in	Flanged	Gear/Handwheel (35 Turns)	Extra descriptions necessary
4002A	BFV	16-in	Flanged	Gear/Handwheel (35 Turns)	
101	PSV	16-in	Flanged	EM	

- C. Valve tags shall comply with requirements of JEA's water and sewer standards manual, Section 702.
- D. Valve tags in the yard shall comply and be labeled with the requirements shown on the Drawings.

1.08 WARRANTY

- A. All equipment supplied under this section shall be warranted for a period of one (1) year by the MANUFACTURER from substantial completion.

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VALVES AND APPURTENANCES

- 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 OWNER.
- C. The MANUFACTURER'S warranty period shall run concurrently with the CONTRACTOR'S warranty period. No exception to this provision shall be allowed.

PART 2 – PRODUCTS

2.01 GENERAL

- A. All valves and appurtenances shall be of the size shown on the Drawings and as far as possible all equipment of the same type shall be from one manufacturer.
- B. All valves and appurtenances shall have the name of the maker and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body.
- C. All reclaimed water hose bibbs and fire hoses shall be labelled as non-potable with signs stating "Do Not Drink" in English and Spanish. Signs shall be compliant with DEP Rule 26-610.469.
- D. For all valves, all exposed hardware including nuts and bolts shall be 316 stainless steel and shall remain unpainted to allow easy removal.

2.02 VALVES ACTUATORS – GENERAL/MANUAL

- A. The valve manufacturer shall supply, mount, and test all actuators on valves at the factory. The valves and their individual actuators shall be shipped as a unit.
- B. Unless otherwise noted on the Drawings, valves shall be manually actuated; non-buried valves shall have an operating wheel, handle or lever mounted on the operator; those with operating nuts shall have a non-rising stem with an AWWA 2-inch nut. At least two tee handles shall be provided for all operating nuts. Unless otherwise noted, operation for all valves shall be CCW open.
- C. All actuators shall be capable of moving the valve from the full open to full close position and in reverse and holding the valve at any position part way between full open or closed.
- D. Each operating device shall have cast on it with the word "OPEN" and an arrow indicating the direction of operation.

2.03 FLEXIBLE HOSE CONNECTOR

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VALVES AND APPURTENANCES

- A. The CONTRACTOR shall install flexible hose connectors on the suction side of the new pump as indicated on the Drawings or as required to accommodate any thermal expansion, contraction, or seismic movement of the piping system. The CONTRACTOR shall install and guide per manufacturers' installation instructions and Mechanical Contractors Association of America "Guidelines for Quality Piping Installation".
- B. Flexible hose connectors shall be capable of compensating for lateral movement and vibration.
- C. Flexible hose connectors shall be manufactured complete with section of corrugated metal house, compatible braid, with inlet and outlet connections as required and shall have a maximum pressure of 110 psi at 70°F.
- D. Flexible hose connectors shall be of 321 SS hose with 304 SS braid and 150 lb carbon steel plate flanges. The flexible hose connectors shall be manufactured by The Metraflex Company®, Chicago, IL or an ENGINEER approved equal.
- E. Materials which will be in contact with the potable water shall contain no lead components or have any measurable lead content.

2.04 GATE VALVES

- A. Gate valves shall meet JEA Standard specifications as listed under WTP Standards Exhibit XI-I and Water and Sewer Standards Manual AW-302.
- B. Buried gate valves shall be installed vertically, no exceptions.

2.05 RUBBER FLAPPER CHECK VALVES

- A. Rubber flapper check valves shall meet JEA Standard specifications as listed under WTP Standards Exhibit XI-I. Each check valve shall be provided with a magnetic proximity-style limit switch suitable for outdoor environments under IP65 rating. Switch shall be normally open rated for 10-30 VDC, 20-120 VAC, and 2 amps. The switch shall be provided with 316 SS mounting bracket by check valve supplier and switch/bracket shop-drawing included with check valve submittal. The switch mounting bracket shall be sufficiently long for switch to engage tip of indicating rod (with plastic indicator removed) to increase accuracy. A Teflon sleeve shall be provided on valve indicator rod to prevent wear on rod from slot. A minimum of three springs with different spring constants shall be provided with each mounting bracket and the least stiff spring sufficient to return rod shall be used.
- B. Check valve flapper shall not extend past the valve.

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VALVES AND APPURTENANCES

2.06 BUTTERFLY VALVES

- A. Butterfly valves shall meet JEA Standard specifications as listed under WTP Standards Exhibit XI-I for above ground service butterfly valves. Acceptable manufacturers shall be GA Series 800, worm gear with handwheel or M&H series CL with hand wheel.

2.07 AIR RELEASE VALVES

- A. All ARVs shall be stainless-steel construction and shall be installed and of the sizes as shown on the Drawings. Air release valves shall meet JEA Standard specifications as listed under WTP Standards Exhibit XI-I and Section 351 VIII.7. Acceptable manufacturers for 1-inch ARVs shall be Crispin or Val Matic. Acceptable manufacturers for 2-inch ARVs shall be A.R.I.

2.08 PRESSURE SUSTAINING FILL VALVE

- A. **FUNCTION:** The electronic control valve with solenoid control shall open or close in response to an electrical signal. Two solenoid pilot valves will be provided that alternately add or relieve line pressure from the upper cover chamber of the valve, causing it to open wide, close tight, or maintain a fixed position in response to an electrical signal directed by an electronic controller. Valve can be configured to perform a wide range of functions; including, but not limited to: pressure reducing, pressure sustaining, flow control, and level control.
- B. **MAIN VALVE:** The main valve shall be a hydraulically operated, diaphragm actuated globe valve of either angle or oblique (Y) pattern design, having semi-straight flow with no right angle turns. The valve shall be center guided, having an unobstructed flow path with no stem guides, bearings, or supporting ribs. The valve shall have a maximum pressure rating of 250 psi for ANSI Class 150# flanges and 400 psi for all other end connections (threaded, grooved, or ANSI Class 300# flanges). All necessary repairs shall be possible without removing the valve from the line.
- C. **ACTUATOR:** The actuator assembly shall be a double-chambered diaphragm design with an inherent separating partition between the lower surface of the diaphragm and the main valve. The entire actuator assembly shall be removable from the valve as a single, integral unit. The seal shall be rectangular in cross section contained on three and one-half sides, and the seal disc shall be capable of accepting a V-Port Throttling Plug. The diaphragm within the main valve actuator assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. A 4-20mA position transmitter shall be installed via an indicator rod connected directly to the top of the valve stem.

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- D. **PILOT CONTROL SYSTEM:** The two primary solenoid pilots shall be ASCO Model 8320G230MS 3-way solenoids with screw type manual operators. All solenoids shall be 120VAC and shall have manual operators or bypass valves. The valve shall be factory assembled with all control tubing, opening and closing speed controls, isolations ball valves, control filter and pilot. Solenoid valve upstream control tubing shall be combined into a common header with $\frac{3}{4}$ inch NPT fitting and rigidly supported from pressure sustaining valve body ready for connection of a CONTRACTOR installed $\frac{3}{4}$ inch stainless steel pipe connection to an upstream port on the proportional pressure reducing valve. It is the CONTRACTOR's responsibility to coordinate the length and appurtenances required to connect the solenoids on the pressure sustaining valve to the proportional pressure reducing valve.
- E. **MATERIALS OF CONSTRUCTION:** The valve body and cover shall be ductile iron to ASTM A536, with an approved fusion bonded epoxy coating. External nuts and bolts shall be SAE 316 stainless steel. The interior trim shall be stainless steel. Valve bearing shall be tin bronze C90700, ASTM B30. The nylon reinforced diaphragm and all O-rings shall be EPDM, with the seat seal being Buna-N. The control loop accessories, pilot, tubing and fittings shall all be SAE 316 stainless steel.
- F. **MANUFACTURER:** The valve shall be Bermad Model WW-20"-718-ES-C1-03-Y-C-A5-EB-5AC-NN-N.
- G. **SPARE:** Provide one spare three-way solenoid valve properly packaged for long-term storage.
- H. **STARTUP SERVICES:** The manufacturer shall provide a factory-authorized service representative to commission and verify the installation meets the requirements of the manufacturer and prepare the valve for operation in accordance with design requirements. Representative shall prepare and submit a signed certificate of installation prior to ENGINEER witnessed site acceptance testing. Commissioning and verification shall be provided for a total of 16 hours over a 2-day period. CONTRACTOR shall engage a factory-authorized service representative to train OWNER's maintenance personnel to adjust, operate, and maintain the equipment provided under this specification and all accessories associated therewith. Training shall be provided for a total of 8 hours over a single day.

2.10 ORIFICE PLATE

- A. Provide a replaceable solid plate with a concentric round, square-edged orifice of specified dimension(s). Orifice plates shall be installed between two pipe flanges. Either direct to flange (orifice flange) mountings or styles that require carriers or holding blocs are acceptable. Design pressure for supplied orifice plate assembly shall be 200 psi minimum. Orifice plate and carrier shall be manufactured from 304

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stainless steel. Bolts and hardware securing orifice plate shall be 316 stainless steel. Seal rings shall be Hycar or Teflon. The CONTRACTOR shall submit cut sheets of proposed equipment for ENGINEER'S approval and coordinate Contractor's chosen style with pipe manufacturer to accommodate selected equipment within specified assembly.

- B. Orifice plate shall have an internal diameter of 6.44-inches as indicated in the Drawings.

2.11 VALVE BOXES

- A. All buried valves shall have cast-iron two or three-piece valve boxes with cast iron covers. Valve boxes shall be provided with suitable heavy bonnets and to extend to such elevation at or slightly above the finished grade surface as directed by the ENGINEER. The barrel shall be one or two-piece, screw type, having 5-1/4-inch shaft. Covers shall have "WATER" cast into the top for all water mains and "SEWER" cast into the top of all wastewater force mains and "REUSE" cast into the top for all reclaimed water mains. All valves shall have actuating nuts extended to within six inches of the top of valve box cover.
- B. Valve boxes shall be provided with concrete base and valve nameplate with suitable anchors for casting in concrete. Valve boxes shall meet JEA Standard specifications as listed under W&S Manual Section 351 VII, AW-301.

2.12 HOSE BIBBS

- A. Hose bibbs shall be brass, polished chromium plated, as manufactured by Chicago Faucet Company. Potable water bibbs shall be No. 952, 1-1/2-inch with vacuum breaker and shut off valve as detailed on the Drawings.
- B. CONTRACTOR shall provide a hose, mounting hardware and supports, and pipe supports at all locations as detailed on the Drawings.
- C. All reclaimed water hose bibbs shall be installed with non-potable water signs. As per DEP Rule 62-610.469, reclaimed water hose bibbs shall be labelled as non-potable with signs stating "DO NOT DRINK" in English and in Spanish.

2.13 PRESSURE GAUGES

- A. Each pressure gauge shall be direct mounted, 304 SS with a minimum 4.5-inch diameter dial and furnished with a clear glass window, 1/4-inch shut-off valve, and a bronze pressure snubber. Provide diaphragm seals between shut-off valve and pressure gauge. All gauges shall be weatherproofed. The face dial shall be white finished aluminum with jet black graduations and figures. The face dial shall indicate the units of pressure being measured (e.g. feet, inches, etc.) or be dual scale.
- B. Pressure gauges shall be equal as manufactured by Ashcroft Gauges, Deer

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Park, New York; or engineer approved equal.

- C. Install as per details provided on the Drawings.
- D. Gauge rating shall be the range as shown on the Drawings and confirmed during the shop drawing process, provide a table of all pressure gauges, location, application, and pressure range for review and approval.
- E. Diaphragm seals shall be installed for all pressure gauges and pressure switches to protect pressure gauges and pressure switches from contact with the fluid in the pipeline. Gauges shall be furnished as part of a complete factory assembly including gauge, snubber, diaphragm seal, liquid fill, bar stock isolation valve and threaded Type 316 stainless steel interconnecting piping. Furnish also a ½-inch backflushing connection and valve.
- F. Diaphragm seals shall be minimum 2-1/2-inch diameter, or as required for the connected pressure gauges. The diaphragm shall be "thread attached" to both piping and pressure switches or gauges. Furnish mineral oil fill between the diaphragm seal and the gauge.
 - 1. Diaphragm seals shall have an upper housing of Type 316 stainless steel, with the lower housing of a material specifically chosen according to the fluid type and pressure being monitored, with Type 316 stainless steel bolts. Diaphragms shall be Type 316 ELC stainless steel.
 - 2. Each diaphragm seal shall be connected to its respective piping or equipment with threaded Type 316 stainless steel pipe and fittings. Pipe size and diaphragm tap size shall match the size of the gauge tap on the equipment, but shall not be less than ¾-inch, except for connections to plant water piping which shall be minimum ½-inch. Furnish a plug valve shut-off valve between the pipeline or equipment and the diaphragm seal.
 - 3. Each diaphragm seal shall have a minimum ¼-inch NPT flush connection with plug valve and gauge tap to match the size of the gauge.
 - 4. Furnish pulsation dampeners adequate to prevent pulsation and/or vibration of the gauge indicator under all system operating conditions.

2.14 SODIUM HYPOCHLORITE INJECTION QUILL

- A. The sodium hypochlorite injection assembly shall include single injection quill housed in a new precast concrete vault as shown on the Drawings. The injector shall provide a single feed point into the pipe.
- B. The injection quill shall be retractable and rated for 25 psi with a minimum 1.5-inch threaded connection and 1-1/2-inch solution tube. Materials of construction shall be stainless steel of a grade that is compatible with 15 percent sodium hypochlorite solution.
 - 1. Connection to the reclaimed water main shall be via a 2-inch 316 stainless steel welded bushing or nipples. Connection shall be capable of

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withstanding maximum water main pressure. Ball valve assembly must include a compression gland and have an acceptable safety device to prevent accidental release of solution tube while under maximum water main pressure and/or surge conditions.

2. Solution tube shall be sized to match pump discharge diameter or injection flowrate. A ball check valve shall be included to prevent backpressure from the main from entering chemical feed system. Dual stainless steel limit chains shall be included to prevent withdrawal of solution tube past the compression gland. Limit chain length shall be preset by manufacturer to allow closure of the ball valve before complete withdrawal of the solution tube.
3. Connection to the PVC piping shall be via 1-1/2-inch flexible tubing as shown on the Drawings and be capable of withstanding maximum pump discharge pipe pressure.
4. The corporation stop and injector assembly shall be Saf-T-Flo or ENGINEER approved equal.
5. The injection quill tip shall be beveled at 45 degrees.

2.15 SOLENOID VALVES

- A. Solenoid valves shall be packless piston type direct acting for sizes less than 1-inch and internal pilot operated for sizes 1-inch and larger, 2-way or 3-way, valves and shall be ASCO Valve, Inc., RedHat Solenoid Valves; or similar by Atkomatic Valve Co.
- B. Valves shall be energized to open.
- C. Valves shall have forged brass bodies, NPT end connections of the connected piping Type 304 stainless steel internal parts, and Buna-N or Ethylene Propylene valve seats. Valves shall have a minimum 150 psig safe working pressure and zero minimum operating pressure differential. Connections shall be threaded.
- D. Solenoid valves shall be watertight NEMA 4X rated.
- E. Note that solenoid valves may be shown on Electrical, Instrumentation and/or Mechanical Drawings, or may only be specified.

2.16 RESTRAINED FLANGE ADAPTERS

- A. Flanged adapters shall be made of ductile iron conforming to ASTM A536 and have flange bolt circles that are compatible with ANSI/AWWA B16.1 for 125 lbs. Adapter flanges shall meet or exceed AWWA C900, ASTM D2241 and ASTM D1599 (125#/Class 150 Bolt Pattern).
- B. Restraint for flange adapter shall consist of a plurality of individual actuated gripping wedges to maximize restraint capability. Torque limiting actuating screws shall be

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used to insure proper initial set of gripping wedges.

- C. The flange adapters shall be capable of deflection during assembly or permit lengths of pipe to be field cut to allow a minimum 0.6 inch gap between the end of the pipe and the mating flange without affecting the integrity of the seal.
- D. All internal surfaces of the gasket ring (wetted parts) shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C213. Sealing gaskets shall be constructed of EPDM. Exterior surfaces of the gasket ring shall be coated with a minimum of 6 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C116/A21.16.
- E. All hardware shall be 316 SS.
- F. The flange adapter shall be as per JEA Water and Wastewater Standards AW-409.

2.17 FIRE HYDRANT

- A. Provide potable and reclaimed water fire hydrant(s) in accordance with JEA Standard Detail W-13.

2.18 YARD HYDRANT

- A. Provide yard hydrant(s) in accordance with the Drawings.

2.19 BALL VALVES

- A. PVC
 - 1. Ball valves for PVC pipe shall be of PVC Type 1 with union, socket, threaded or flanged ends as required. Ball valves shall be full port, full flow, all plastic construction, 150 psi rated with Teflon seat seals and T-handles. PVC ball valves shall be as manufactured by Celanese Piping Systems, Inc., Wallace and Tiernan Inc., Plastiline, Inc., or equal.
 - 2. All valves shall be mounted in such a position that valve position indicators are plainly visible when standing on the floor.
 - 3. Ball valves for sodium hypochlorite service shall be vented.
- B. Stainless Steel
 - 1. Ball valves shall be 316 stainless steel body per ASTM A351 Grade CF8M, two-piece split body, full port, and fire safe as per API 607 4th edition.
 - 2. Ball valves shall be manufactured with 150 lb flanges.
 - 3. The design of the valves shall be such that it shall provide suitable seating in both directions. In order to determine the position of the ball within the valve (open or closed), there shall be an easily visible, permanent indicator on the valve. Ball valves shall have a 316 stainless steel ball.
 - 4. Seats shall be TFM 1600 enhanced Teflon seats. The fully open port area shall be approximately 100 percent of the nominal pipe area.

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5. Valve shafts shall be ground and polished and shall be type 304 stainless steel. Teflon-lined bearings shall be supplied in both trunnions of the valve body.
6. Stainless handles on sizes ½ – 2-inch with travel stops and lockout devices and carbon steel handles on sizes 2 ½ – 12-inch with travel stops and lock out devices.
7. Valves to be furnished with an actuator shall have ISO 5211 secure mount actuator mounting pad. Valve actuators shall conform to AWWA C507 as specified herein.
8. Stainless steel ball valves shall be model F150 as manufactured by Flo-tite, F15 by Flow-tek, Apollo Series 76, or Ohio Valve Fig. 166RT.

2.20 ROTOMETER

- A. Rotometer shall be Series 7520 by King Instrument Co, or ENGINEER approved equal. Fitting material shall be PVC.

2.21 DISMANTLING JOINTS

- A. All dismantling joints shall be ductile iron conforming to ASTM A536 and shall be installed and of the sizes as shown on the Drawings. Dismantling joints shall meet JEA Standard specifications as listed under AW-4.1 and Section 351 II.3.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. All valves and appurtenances shall be installed in the locations shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the ENGINEER before they are installed.
- B. After installation, all valves and appurtenances shall be tested at least 2 hours at the working pressure corresponding to the class of pipe, unless a different test pressure is specified. If any joint proves to be defective, it shall be repaired to the satisfaction of the ENGINEER.
- C. Install all floor boxes, brackets, extension rods, guides, the various types of operators and appurtenances as shown on the Drawings that are in masonry floors or walls and install concrete inserts for hangers and supports as soon as forms are erected and before concrete is poured. Before setting these items, the CONTRACTOR shall check all plans and figures which have a direct bearing on their location and he shall be responsible for the proper location of these valves and appurtenances during the construction of the structures.
- D. Pipe for use with flexible couplings shall have plain ends as specified in the respective pipe sections in Division 15.
- E. Fire and yard hydrants shall be set at the locations designated by the ENGINEER and bedded on a firm foundation. Each hydrant shall be set in true vertical

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VALVES AND APPURTENANCES

alignment and properly braced. Concrete thrust blocks shall be placed between the back of the hydrant inlet and undisturbed soil at the end of the trench. Minimum bearing area shall be as shown on the Drawings. Felt roofing paper shall be placed around hydrant elbow before placing concrete. If directed, the hydrant shall be tied to the pipe with suitable rods or clamps, galvanized, painted, or otherwise rustproof treated. Concrete used for backing shall be no leaner than 1 part cement, 2-1/2 parts sand, and 5-1/2 parts stone. Hydrant paint shall be touched up as required after installation.

- F. Flanged joints shall be made with stainless steel bolts, nuts and washers. Mechanical joints shall be made with mild corrosion resistant alloy steel bolts and nuts. All exposed bolts shall be painted the same color as the pipe. All buried bolts and nuts shall be heavily coated with two (2) coats of bituminous paint comparable to Inertol No. 66 Special Heavy.
- G. Yard hydrants shall be installed in accordance with manufacturers recommendation and applicable requirements of fire hydrants above.
- H. Prior to assembly of split couplings, the grooves as well as other parts shall be thoroughly cleaned. The ends of the pipes and outside of the gaskets shall be moderately coated with petroleum jelly, cup grease, soft soap or graphite paste, and the gasket shall be slipped over one pipe end. After the other pipe has been brought to the correct position, the gasket shall be centered properly over the pipe ends with the lips against the pipes. The housing sections then shall be placed. After the bolts have been inserted, the nuts shall be tightened until the housing sections are firmly in contact, metal-to-metal, without excessive bolt tension.
- I. Prior to the installation of sleeve-type couplings, the pipe ends shall be clean thoroughly for a distance of 8 inches. Soapy water may be used as a gasket lubricant. A follower and gasket, in that order, shall be slipped over each pipe to a distance of about 6 inches from the end, and the middle ring shall be placed on the already laid pipe end until it is properly centered over the joint. The other pipe end shall be inserted into the middle ring and brought to proper position in relation to the pipe already laid. The gaskets and followers shall then be pressed evenly and firmly into the middle ring flares. After the bolts have been inserted and all nuts have been made up finger tight, diametrically opposite nuts shall be progressively and uniformly tightened all around the joint, preferably by use of a torque wrench of the appropriate size and torque for the bolts.
- J. Valve boxes with concrete bases shall be installed as shown on the Drawings. Mechanical joints shall be made in the standard manner. Valve stems shall be vertical in all cases. Place cast iron box over each stem with base bearing on compacted fill and top flush with final grade. Boxes shall have sufficient bracing to maintain alignment during backfilling. Knobs on cover shall be parallel to pipe. Remove any sand or undesirable fill from valve box.

SECTION 15100

VALVES AND APPURTENANCES

3.02 SHOP PAINTING

- A. Ferrous surfaces of valves and appurtenances shall receive an exterior coating of rust-inhibitive primer as specified in Section 09900. Interior coatings shall be the manufacturer's standard except that valves on raw and potable water pipes shall be coated with paints approved by both EPA and AWWA NSF 61 approved for potable water service. All pipe connection openings shall be capped after shop painting to prevent the entry of foreign matter prior to installation.

3.03 FIELD PAINTING

- A. All metal valves and appurtenances specified herein and exposed to view will be painted as part of the work in Section 09900. All exposed pipe joints on pipe, valves and fittings shall be caulked 360 degrees prior to painting.

3.04 INSPECTION AND TESTING

- A. Completed pipe shall be subjected to hydrostatic pressure test for 4 hours at full working pressure. All leaks shall be repaired and lines retested as approved by the ENGINEER. Prior to testing, the gravity pipelines shall be supported in an approved manner to prevent movement during tests.

END OF SECTION 15100

SECTION 15140

DOMESTIC WATER PIPING

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. The CONTRACTOR shall furnish and install domestic water pipe, fittings, valves, accessories, specialties as shown, specified or required for a complete installation and satisfactory operation. Provide pipe and fittings of new materials, protected from dirt, moisture, and mechanical damage.

1.02 REFERENCES

- A. ASSE 1010 - Water Hammer Arresters
- B. PDI WH201 - Water Hammer Arresters
- C. ASTM D 2846 – Chlorinated Polyvinyl Chloride (CPVC) Plastic Hot and Cold-Water Distribution Systems
- D. ASTM F 441 - Chlorinated Polyvinyl Chloride (CPVC) Plastic Pipe
- E. CSA B137.6 - Chlorinated Polyvinyl Chloride (CPVC) Plastic Pipe, Tubing, and Fittings
- F. FBC-P Florida Building Code, Plumbing (latest edition)
- G. NSF Standard 61 – Drinking Water System Components

1.03 SUBMITTALS

- A. Provide all submittals in conformity with Section 01300.
- B. Product Data and Information: Provide data on pipe materials, pipe fittings, valves and accessories. Provide MANUFACTURERS catalog information and indicate valve data and ratings.
- C. Shop Drawings: Provide shop drawings showing the following:
 - 1. Layout of pipes, fittings, supports, valves and equipment.
 - 2. Sections showing elevations of pipes, fittings, supports, valves and equipment.
 - 3. Pipe size, type, material and schedule.
- D. Operation and Maintenance Manuals: Submit operation and maintenance manuals for the valves, gauges, and thermometers as specified in Section 01730.

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DOMESTIC WATER PIPING

1.04 QUALITY ASSURANCE AND QUALIFICATIONS

- A. The work shall be completed by a certified plumbing contractor as defined by Florida Department of Business and Professional Regulation.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle all products and materials as specified in Section 01600 and as follows:
 - 1. Accept valves and specialties on site in shipping containers with labeling in place. Inspect valves for damage.
 - 2. Provide temporary end caps and closures on piping and fittings. Maintain end caps in place until installation.
 - 3. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Pipe and Fittings
 - 1. Provide pipe and fittings that have been manufactured from virgin rigid Chlorinated Polyvinyl Chloride (CPVC) vinyl compounds with a cell class of 24448 as identified in ASTM D 1784.
 - 2. Pipe and fittings shall conform to ASTM D 2846 and to National Sanitation Foundation (NSF) Standards 14 and 61. Pipe and fittings shall be manufactured in the United States.
 - 3. Buried pipe shall be in accordance with ASTM F 1668.
 - 4. Solvent cement joints shall be made using a CPVC cement conforming to ASTM F 493.
- B. Valves:
 - 1. Provide valves recommended by their MANUFACTURER for the conditions of use as installed, and capable of tight shutoff under those conditions. Provide valves recommended for a fluid operating temperature up to 250 degrees F.
 - 2. Provide valves in insulated pipes with an extended neck to clear the insulation.
 - 3. Provide a chromium-plated stop valve with handwheel at an accessible location on each water connection at each plumbing fixture.
 - 4. Provide accessible pressure rated 3/4-inch hose end gate valves at low points for draining each water piping system.
 - 5. Ball Valves: Provide a screwed pattern 2-piece brass or bronze ball valve rated at 125 psi minimum, precision ground, free floating ball, stem

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DOMESTIC WATER PIPING

shoulder preventing blowout, reinforced Teflon stem seals and seats, and a rustproof handle with stop clearing the pipe insulation.

- C. Water Hammer Arrestor: Provide each shock absorber meeting the requirements and be sized no smaller than recommended by Plumbing and Drainage Institute "Standard WH201" and ASSE Standard 1010. Isolate each absorber from the piping system by a ball valve, locate accessible for service, and prevent "water hammer" by absorbing surge pressures created by the quick-closing valve(s). Construct absorber of stainless steel or other material which is nonrusting, and include a wetted bellows contained in a pressurized chamber and rated for 150 psi working pressure.
- D. Escutcheons: Provide chrome nickel-plated brass escutcheons, sized to fit over the pipe and its insulation, at locations where exposed pipes penetrate finished surfaces.
- E. Drain Valves: Provide each cold water, hot water and circulating water piping system with 3/4-inch globe valves with vacuum breaker hose adapters, accessibly located at piping low points for completely draining the system.
- F. Wall Hydrant: Provide 3/4" hose valve, wheel handle, vacuum breaker and enclosure box. Valve body shall be brass. Vacuum breaker shall be in accordance with ASSE 1011. Recessed box shall be stainless steel construction with hinged locking cover.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. General: Install water piping specialties in accordance with the MANUFACTURERS recommendations and approved shop drawings.
- B. Piping Installation: Install domestic water piping clear of all building elements.
 - 1. Review elevations before proceeding with the Work, and the location, depth, etc.
 - 2. Pitch horizontal water pipes to facilitate draining through drain hose valves installed at low points.
- C. Water Hammer Arrestor: Install shock absorbers on each water pipe supplying solenoid valves or other automatic or manual quick-closing valves.
- D. Pipe Expansion Provisions: Connect, support and guide piping to permit and control pipe expansion and contraction and to accommodate building expansion, contraction and settling without damage.
 - 1. Provide piping expansion loops or expansion joints sized to accommodate possible expansion without exceeding allowable pipe and fitting stresses in

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DOMESTIC WATER PIPING

straight sections of hot water piping more than 50 feet in length. Locate expansion devices midway between anchor points, and the pipes guided as recommended.

2. Provide anchors for piping within a structure consisting of welded plates, angles, channels, or beams braced and securely fastened to the pipe and to structural members adequate to safely withstand resulting stresses.
- E. Pipe Sleeves: Provide steel pipe sleeves for pipes piercing concrete and masonry construction. Install pipe sleeves with welded water stop plates in floors, exterior walls and foundation walls.
1. Seal watertight insulated and uninsulated lines installed in the pipe sleeves with an elastic mechanical pipe sleeve seal of size and service designation as recommended by the MANUFACTURER for proper sealing.
 2. Furnish appropriate fire-rated sleeve seal and insulated pipe protectors for fired rated walls and floors.
- F. Pipe and Valve Identification: Identify all pipelines and valves in accordance with section 15076 and JEA Standards.
- G. Hangers and Supports: Provide hangers and supports as specified in Section 15060.
- H. Pipe Insulation: Provide insulation on pipe and valves as specified in Section 15081.
- I. Disinfection: domestic water piping shall be disinfected as specified in Section 15141.

3.02 FIELD QUALITY CONTROL

- A. MANUFACTURER's Field Services: Furnish the services of a qualified representative of the MANUFACTURER to provide instruction on proper installation of the equipment, testing of the equipment and place the equipment in trouble-free operation.
- B. Tests: After installation of the piping, control equipment and all appurtenances, subject each unit to a field running test.
1. Apply a water pressure test to all parts of the domestic water system before the piping is concealed and before the fixtures and equipment are connected. Use a hydrostatic pressure of not less than 100 psig or 150 percent of system operating pressure, applied to the system for a period of 4 hours. There shall be no leaks at any point in the system at this pressure.

END OF SECTION 15140

SECTION 15141

DISINFECTION

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Disinfection of all pipelines, conduits, pumps, tanks, structures, and equipment which are to store, handle or carry potable water. All labor, chlorine and equipment, including taps, corporation stops, temporary pumps, hoses, miscellaneous piping and other items necessary to perform the work, shall be furnished and installed by the CONTRACTOR, and removed after completion of the disinfection procedure.

1.02 REFERENCES

- A. AWWA C651- Disinfecting Water Mains
- B. AWWA C652- Disinfection of Water-Storage Facilities
- C. Florida Building Code, Plumbing (Latest Edition)

1.02 QUALITY ASSURANCE

- A. Disinfection shall be in accordance with AWWA C651 for water mains and AWWA C652 for water storage facilities and equipment, except as modified herein. Disinfection procedures for new water mains and water storage facilities shall also conform to the requirements of the International Plumbing Code, Section 610 "Disinfection of Potable Water System" except as modified herein.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 PIPELINES

- A. Pumps, hydrants, and other water handling equipment items that are part of the potable water distribution system shall be disinfected in the same manner as described herein for the pipelines.
- B. Pipelines shall first be flushed with clean water. Disinfection shall be accomplished by the Continuous Feed Method, as specified in AWWA C651, using sodium hypochlorite solution.
- C. Water-chlorine solution with a concentration not less than 50 mg/l of available chlorine shall then be added at one end of the section being disinfected and discharged at the far end. The water-chlorine solution shall be added until the water coming from each downstream blow off has a residual of not less than 25 mg/l of chlorine.

SECTION 15141

DISINFECTION

- D. The pipelines shall then be closed and the solution allowed to remain in the lines for at least 24 hours. The chlorine residual in the pipeline shall then be rechecked. If the free chlorine residual is less than 10 mg/l after 24 hours, the procedure shall be repeated until the free chlorine residual after 24 hours is 10 mg/l or greater.
- E. After the 24-hour holding period, the pipelines and equipment shall be thoroughly flushed and filled with clean water. Flushing water shall not be permitted to enter existing water mains.
- F. Flushing water shall not be discharged to sanitary or storm sewers without permission of local authority. Where necessary, Federal, State and local regulatory agencies shall be contacted to determine special provisions for the disposal of heavily chlorinated water.
- G. When new potable water pipelines are to be connected to an existing water distribution system, the connecting piping shall be disinfected and tested in accordance with the procedure set forth in Section 9.1 or Section 9.2, as applicable, of AWWA C651.

3.02 WATER SUPPLY

- A. The CONTRACTOR shall provide all necessary apparatus to convey the water to the point of use and perform the disinfection procedure.

3.03 VERIFICATION OF DISINFECTION

- A. After the completion of disinfection, bacteriological samples shall be taken by the CONTRACTOR and tested at a certified laboratory. Samples shall be taken as required by the FDEP. The test reports shall be submitted to the ENGINEER for review and approval. If the samples are not satisfactory, the entire disinfection procedure shall be repeated at the expense of the CONTRACTOR until satisfactory samples are obtained.

END OF SECTION 15141

SECTION 15150

SANITARY WASTE AND VENT PIPING

PART 1- GENERAL

1.01 SECTION INCLUDES

- A. This Section includes furnishing and installing sanitary waste and vent pipe, fittings, accessories, specialties as shown, specified, or required for a complete installation and satisfactory operation. Provide pipe and fittings of new materials, protected from dirt, moisture and mechanical damage.

1.02 RELATED SPECIFICATIONS

- A. Specification 15060 - Hangers and Supports
- B. Specification 15410 - Plumbing Fixtures

1.03 REFERENCES

- A. Florida Building Code, Plumbing (latest edition)

1.04 SUBMITTALS

- A. General: Provide submittals, including the following, in conformity with Section 01300.
- B. Product Data and Information: Provide data on pipe materials, pipe fittings, and accessories.
- C. Shop Drawings: Provide shop drawings showing the following:
 - 1. Layout of pipes, fittings, supports, and equipment.
 - 2. Sections showing elevations of pipes, fittings, supports, valves and equipment.
 - 3. Pipe size, type, material, and schedule.

1.05 QUALITY ASSURANCE AND QUALIFICATIONS

- A. The work shall be completed by a certified licensed plumbing Contractor as defined by Florida Department of Business and Professional Regulation.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle all products and materials as specified in Section 01600 and as follows:
 - 1. Provide temporary end caps and closures on piping and fittings. Maintain end caps in place until installation.
 - 2. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.07 SPART PARTS, TOOLS, AND SUPPLIES

- A. Provide 3 sets of all special access tee wrenches or keys for removal of cleanout covers.

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SANITARY WASTE AND VENT PIPING

PART 2- PRODUCTS

2.01 MANUFACTURERS

- A. The following manufacturers are acceptable. Equivalent products of other manufacturers may be submitted for approval.
- B. PVC - Pipe and Fittings
 - 1. Charlotte Pipe and Foundry Company -Schedule 40 DWV pipe
 - 2. or approved equal
- C. Pipe Sleeves
 - 1. Thunderline Corp. - "Link Seal "Model WS".
 - 2. or approved equal

2.02 PVC - PIPE AND FITTINGS

- A. Pipe and fittings shall be manufactured from virgin rigid PVC (polyvinyl chloride) vinyl compounds with a cell class of 12454 as identified in ASTM D 1784.
- B. PVC Schedule 40 pipe shall be Iron Pipe Size (IPS) conforming to ASTM D 1785 and ASTM D 2665. Injection molded PVC Schedule 40 fittings shall conform to ASTM D 2665. Fabricated PVC DWV fittings shall conform to ASTM F 1866. All Pipe and fittings shall be manufactured in the United States. All systems shall utilize a separate waste and vent system. Pipe and fittings shall conform to NSF International Standard 14.
- C. Buried pipe shall be installed in accordance with ASTM D 2321 and ASTM F 1866.
- D. Solvent cement joints shall be made in a two step process with primer conforming to ASTM F 656 and solvent cement conforming to ASTM D 2564.

2.03 PIPE SLEEVE

- A. Caulking for plastic pipe in wall sleeve shall be by a mechanical, modular, rubber sealing element placed in between the sleeve and pipe and expanded to make a tight fit or other method approved by the ENGINEER.

2.04 EQUIPMENT

- A. Escutcheons: Provide chrome nickel-plated brass escutcheons, sized to fit over the pipe and its insulation, at locations where exposed pipes penetrate finished surfaces.
- B. Vent Flashing: Refer to Roof Vent detail on Architectural drawings.
- C. Cleanouts:

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SANITARY WASTE AND VENT PIPING

1. Size: Same as connected branch.
2. Body: PVC.
3. Closure Plug: PVC.
4. Riser: Drainage pipe fitting and riser to clean out of same material as drainage piping.

PART 3- EXECUTION

3.01 INSTALLATION

- A. Piping Installation: Install plumbing piping clear of all building elements.
 1. Pitch drain-line piping uniformly downward in the direction of flow not less than 1/8-inch per lineal foot.
 2. Review elevations before proceeding with the Work, and the location, depth and size of sewers before connections are made.
 3. Before running any drains and sewers within buildings, or any vent or drain stacks, or any water lines, verify that they can be run without trapping, sagging or interfering with columns, beams, piping, fixtures, ducts, or other system components. Coordinate necessary changes before pipes are installed.
 4. Flash pipes passing through the roof watertight with 4-pound per square foot sheet lead, except as otherwise shown. Extend flashing out on the roof not less than 18 inches from the pipe or edge of drain in all directions, and turn down into vent pipes.
- B. Cleanouts: Provide cleanouts at ends of mains, each change in direction of more than 45 degrees, spaced not more than 50 feet apart in all straight runs, and at the base of all soil stacks, downspouts, and fixture traps. Terminate cleanouts for concealed pipes flush with finish floor, wall or grade with trim as specified. Provide cleanouts of the same size as the pipe up to 4 inches in diameter, and 4-inch size for larger pipes and located for convenient access.
- C. Pipe Sleeves: Provide steel pipe sleeves for pipes piercing concrete and masonry construction. Install pipe sleeves with welded water stop plates in floors, exterior walls and foundation walls.
 1. Seal watertight insulated and uninsulated lines installed in the pipe sleeves with an elastic mechanical pipe sleeve seal of size and service designation as recommended by the manufacturer for proper sealing.
 2. Furnish appropriate fire-rated sleeve seal and insulated pipe protectors for fired rated walls and floors.
- D. Pipe Identification: Identify all pipelines in accordance with section 15076 and JEA Standards.
- E. Hangers and Supports: Provide hangers and supports as specified in Specification 15060.

3.02 INSPECTION AND TESTING

- A. All pipelines shall remain undisturbed for 24 hours to develop complete strength at all joints. All pipelines shall be subjected to a hydrostatic pressure test for 2 hours at full

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SANITARY WASTE AND VENT PIPING

working pressure. All leaks shall be repaired, and lines retested as approved by the ENGINEER. Prior to testing, the pipelines shall be supported in an approved manner to prevent movement during tests.

- B. The test pressures and temperatures for the various pipelines shall be as follows. Pipe shall be pressure tested with water. Pressure testing with air or gas is not permitted.
 - 1. Drain piping: 15 psi at ambient temperature
 - 2. Vent piping: 15 psi at ambient temperature

END OF SECTION 15150

SECTION 15410

PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. The CONTRACTOR shall furnish, install, test and place in satisfactory operation all plumbing fixtures as specified herein, and as shown on the Contract Drawings.
- B. Plumbing fixtures shall be furnished complete with all accessories, attachments, fastenings and other appurtenances as specified or as may be required for a satisfactory installation.

1.02 RELATED SPECIFICATIONS

- A. Specification 15140 – Domestic Water Piping
- B. Specification 15141 – Disinfection
- C. Specification 15150 – Sanitary Waste and Vent Piping

1.03 REFERENCES

- A. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use.
- B. ASME A112.18.1M - Plumbing Fixture Fittings.
- C. ASME A112.19.2M - Vitreous China Plumbing Fixtures.
- D. ANSI A112.19.5 - Trim for Water-Closet Bowls, Tanks, and Urinals (Dimensional Standards).
- E. ANSI/CABO A117.1 - Accessible and Usable Buildings and Facilities.
- F. U.S. Department of Commerce Commercial Standard.
- G. Florida Building Code, Plumbing (Latest Edition)

1.04 DESIGN REQUIREMENTS

- A. Plumbing fixtures shall be of the water conservation type and shall conform to the requirements of the local Code.
- B. Contract Drawings are generally diagrammatic and installation of the plumbing fixtures in the allotted spaces shall be verified.

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PLUMBING FIXTURES

1.05 SUBMITTALS

- A. The CONTRACTOR shall submit shop drawings and material specifications for the approval of the ENGINEER in accordance with Section 01300.
- B. Manufacturer's technical information which shall include:
 - 1. Product Data and Information: Provide catalogue cuts of all plumbing fixtures, sizes, rough-in dimensions, utility sizes, faucets, drains, carriers, flush valves, trim and finishes, and all electrical requirements. Complete assembly, layout required clearances and installation drawings with clearly marked dimensions. Provide a list of manufacturer's recommended special tools and spare parts to be supplied.
 - 2. Operation and Maintenance Manuals: Submit operation and maintenance manuals in accordance with Section 01730 for plumbing fixtures, faucets, drains, mixing valves, flush valves, carriers, assembly of parts list for flush valves, signage, emergency equipment and electric water coolers as required.

1.06 QUALITY ASSURANCE AND QUALIFICATIONS

- A. The CONTRACTOR shall be a licensed plumber in the state of Florida.
- B. All plumbing fixtures shall be "First Quality" as defined and set forth in Commercial Standard CS77-28 as promulgated by the U.S. Department of Commerce. All fixtures are to be white vitreous china unless otherwise specifically noted. Where enameled iron fixtures are specified, they shall be furnished with acid resisting enamel.
- C. Plumbing fixtures shall essentially be as efficient as those fixtures that have been tested to perform satisfactorily for at least two years.
- D. Fixtures shall be properly protected from damage during construction and shall be cleaned in accordance with manufacturer's instructions.
- E. Fixtures and fittings proposed shall be from one manufacturer and of similar character in any room or location. Escutcheons, handles, etc., on the different fixtures shall be of the same design.
- F. All plumbing fixtures and other related materials shall be inspected for chips, cracks, dents and other flaws. Only items free from defects shall be installed in the work. All fixtures shall be furnished with all necessary supports, hangers, brackets, etc., for the proper installation of the fixtures. Such supports, etc., shall be in accordance with the manufacturer's recommendations.
- G. All wall hung fixtures shall be adequately supported from floor with fixture support carriers independent from walls, and floor mounted fixtures shall be secured to concrete slabs with lead expansion inserts.

SECTION 15410

PLUMBING FIXTURES

1.07 DELIVERY, STORAGE AND HANDLING

- A. The CONTRACTOR shall deliver the plumbing fixtures and appurtenances to the site in the original sealed packing crate. All products shall be protected from chips, scratches or any damage. Any product damaged shall be replaced at no additional cost to the OWNER. The fixtures will be inspected for damages. Fixtures gouged, chipped or otherwise damaged will not be considered acceptable.
- B. The CONTRACTOR shall be responsible for securing storage until final acceptance. The OWNER will not be responsible for any products lost or stolen. Plumbing fixtures shall be stored on heavy wood blocking or platforms so that they are not in contact with the ground.
- C. To avoid unnecessary handling, plumbing fixtures shall be unloaded as close to the place where they are to be installed as is practical. Interiors shall be kept free from dirt and foreign matter.

1.08 JOB CONDITIONS

- A. Protection: At the end of each days' Work or other stopping point throughout the construction, CONTRACTOR shall provide temporary covering over all plumbing fixtures and trim as required to prevent damage due to moisture, dirt, plaster, concrete or other material. Chipped, cracked, dented or damaged fixtures or trim will not be accepted in the finished installation.

1.09 FIELD MEASUREMENTS

- A. The CONTRACTOR shall verify all dimensions and shall make any field measurements necessary and shall be fully responsible for accuracy and layout of the work.
- B. The CONTRACTOR shall review the Contract Drawings and any discrepancies shall be reported to the ENGINEER for clarification prior to starting installation.

PART 2 PRODUCTS

2.01 MATERIALS

- A. All plumbing fixtures provided shall be of high quality and shall be manufactured from the following materials:
 - 1. Vitreous china shall be non-absorbent, hard-burned, and vitrified throughout the body.
 - 2. Porcelain enameled ware shall have specially selected, clear white, acid-resisting enamel coating evenly applied on surfaces.
 - 3. Internal parts of flush and/or flushometer valves, may contain acetal resin, fluorocarbon, nylon, acrylonitrile-butadiene-styrene (ABS) or other plastic

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PLUMBING FIXTURES

material, if the material has provided satisfactory service under actual commercial or industrial operating conditions for not less than 2 years. Plastic in contact with hot water shall be suitable for 180 degrees Fahrenheit water temperature.

4. No fixture will be accepted that shows cracks, blisters, thin spots, or other flaws. All fixtures shall be white and faucets shall have chrome plated flexible tube risers with loose key operated shutoff valves.
- B. Fixtures shall be equipped with appurtenances such as traps, faucets, stop valves, and drain fittings. Each fixture and piece of equipment requiring connections to the drainage system shall be equipped with a trap. All exposed traps shall be cast brass swivel chromium plated, grounded joint, and with cleanout.
- C. Brass expansion or toggle bolts capped with acorn nuts shall be provided for supports, and polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view.
- D. Plumbing fixtures shall be as indicated in the Plumbing Fixture Schedule on the Contract Drawings.

2.02 FIXTURES

- A. Water Closet:
 1. Item No. WC:
 - a. Manufacturer: American Standard, Kohler or approved equal
 - b. Type: Floor mounted, rear outlet, siphon jet.
 - c. Features:
 - 1) Elongated bowl.
 - 2) Flush Valve – Exposed manual valve, flush cycle of 1.6 GPF, diaphragm type, chrome plated, with back pressure vacuum breaker. Sloan Royal series or approved equal.
 - 3) ADA Compliant
 - d. Materials: Vitreous China, white.
 - e. Adjustable Fitting with closet connection assembly which includes face plate, ABS extension (with integral test cap), chrome plated hardware and neoprene fixture gasket.
 - f. Accessories:
 - 1) Seat, white open front
- B. Lavatories:
 1. Item No. LAV:
 - a. Manufacturer: American Standard, Kohler, or approved equal
 - b. Type: Wall hung lavatory.
 - c. Faucet holes: 4-inch centers
 - d. Materials: Vitreous China, white.
 - e. Features:
 - 1) Self-draining deck
 - 2) Front overflow.

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PLUMBING FIXTURES

- 3) Concealed arm support
- f. Faucet: Deck mounted mixing faucet, 4-inch fixed center, 2-3/4-inch lever handle and 4-3/4-inch cast brass sprout, 0.5 gpm vandal proof non-aerating spray. Chicago Faucets or approved equal
- g. Carrier: Jay R. Smith Mfg. Co.; Model 0800, commercial type.
- h. Accessories:
 - 1) Trap, "P" trap with cleanout, slip joint inlet, 17-gauge tubing, 1-1/4 inch by 1-1/2 inch outlet, chrome finish.
 - 2) Brass grid strainer
 - 3) Stop Valve: 1/4-inch turn ball valve, lead free, brass construction and chrome plating. Acceptable manufacturers are Brasscraft KT series; Mcguire Manufacturing LFBV series; Keeney Manufacturing PCLF series.

2.03 SAFETY EQUIPMENT

- A. Combination Shower/ Eyewash
 - 1. EES, All Stainless Steel:
 - a. Model: Haws Drinking Faucet Co.; Model 8330.
 - b. Shower: Stainless steel deluge shower head with 20 gpm flow control.
 - c. Eyewash: Stainless steel aerated eye/face wash and stainless-steel bowl, with 3.7 gpm flow control.
 - d. Valve: Stay open ball valves with stainless steel ball and stem.
 - e. Support: Freestanding, 1-1/4-inch stainless steel pipe and fittings with stainless steel 9" diameter floor flange.
 - f. Sign: 8" x 10" vertical orientation, plastic.
 - g. Flow Switch – thermal differential mass flow switch with dual RTD sensors; constructed of 316L stainless steel; rated for 90-260 VAC at 4 watts; outputs are DPDT relay contacts at 5 amp, 250 VAC with fail safe capability; integral self-testing, that is automatic during power-up; flow rate setpoint for water at 2.5 ft per sec; sensor response time of 0.5 to 10 seconds; repeatability for flow shall be < 0.5 % of set point ±1% of span over a range of ±50 deg F. Flow switch shall be manufactured by Delta M Corporation, Model No. FS21NX-075-S6-002.00-AC-LE-00.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Fixtures requiring hot and cold water shall have the cold-water faucet on the right-hand side of the fixture and the hot water faucet on the left hand side of the fixture. Each fixture shall have shut off valves or stops for hot and cold water.
- B. Each fixture shall be separately trapped.

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- C. Pipe openings shall be closed with caps or plugs during installation. Fixtures shall be tightly covered and protected against dirt, water, chemicals and mechanical injury.
- D. Plated or polished fittings, pipes and appliances shall be coated with protective material immediately after installation.
- E. Where space limitations prohibit fixture connections with standard fittings in conjunction with the cast-iron floor flange, special short-radius fittings shall be provided. Connections between earthenware fixtures and flanges on soil pipe shall be made gas-tight and water-tight with a closet-setting compound or neoprene gasket and seal. Use of natural rubber gaskets or putty will not be permitted. Fixtures with outlet flanges shall be set the proper distance from floor or wall to make a first-class joint with the closet-setting compound or gasket and fixture used.
- F. Confirm location, size of fixtures and openings before installation.
- G. Layout fixtures as indicated on the drawings.
- H. Carefully install fixtures in accordance with manufacturer's data with sufficient clearances to coordinate with accessories, specialties and equipment specified in other divisions of these specifications and/or as shown on the drawings.
- I. Hangers and carriers shall be installed in accordance with manufacturer's recommendations and in accordance with good practice and workmanship.
- J. Provide one support for each water closet with all necessary hardware and gaskets, suitable for specified floor construction.
- K. Upon completion of the work, all labels shall be removed, fixtures and trim shall be cleaned of all dirt, grease and markings and all valves properly adjusted.
- L. Clean all exposed metal surfaces from grease, dirt, paint or other foreign material.
- M. Fixtures shall be properly protected from damage during construction and shall be cleaned in accordance with manufacturer's instructions.
- N. Fixtures, chrome-plated piping, fittings and trim shall be polished before requesting acceptance of the system.
- O. All exposed valves and trim shall be chrome plated.
- P. The entire plumbing installation shall be in accordance with best standard practice and in conformance with the plumbing ordinances in the local Building Code.
- Q. Lavatory faucets for handicapped and non-handicapped utilization shall match.
- R. Insulate drain, trap, hot and cold-water supply lines under handicapped lavatories.

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- S. Safety Equipment:
 - 1. System Shutoff Valves:
 - a. Shutoff valves shall give visual indication of position (open or closed).
 - b. Shutoff valves shall be lockable valves and locked in open position.
 - 2. Each safety combination safety shower/eyewash shall have red safety signoff tag. After completing requirements listed below, Contractor and Commission shall sign red safety signoff tag. Requirements are as follows:
 - a. Visually check safety shower/eyewash piping for leaks.
 - b. Verify that upon operation, stay-open valves remain open.
 - c. Showerheads to be between 82 inches and 96 inches above standing surface.
 - d. Shower spray pattern, when valve is full open, shall be a minimum 20 inches in diameter at 60 inches above standing surface.
 - e. Water arcs from eyewash spray heads must cross. Test with eyewash gauge; Haws Drinking Faucet Co., Model 9015.
 - f. Minimum flow rates for safety showers shall be 20 gpm.
 - g. Minimum flow rates for eyewashes shall be 3 gpm.

3.02 FIXTURE HEIGHTS

- A. The CONTRACTOR shall install fixtures to the heights above finished floor as indicated on the Architectural drawings. Installation of fixtures for use by the physically handicapped shall be in accordance with ANSI/CABO A117.1.
- B. Water Closet Flush Valves:
 - 1. Standard 11 inches minimum above bowl rim.
 - 2. Handicapped 27 inches from finished floor.

3.03 ADJUSTING

- A. Upon completion of the installation, the CONTRACTOR shall adjust all fixtures for their intended use.
- B. The CONTRACTOR shall operate each fixture to ensure their performance without splashing, noise or overflow.

3.04 CLEANING

- A. The CONTRACTOR shall thoroughly clean all surfaces of the installed fixtures and polish all chromed surfaces.
- B. Fixtures shall be protected and use of fixtures will not be permitted until permission is given by the ENGINEER.

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PLUMBING FIXTURES

3.05 PROTECTION OF FINISHED WORK

- A. Protect finished Work as specified in Division 1.
- B. Fixture Use: Do not permit use of fixtures prior to being accepted by the OWNER.

3.06 SUPPORT TESTING

- A. All wall hung fixtures shall have a sand bag load placed on the fixture in accordance with the testing schedule below and shall not exhibit any downward deflection.

Testing Schedule	
Fixture	Load
Water Closet	250 lbs
Lavatory	150 lbs

3.07 INTERFACE WITH OTHER PRODUCTS

- A. Review millwork shop drawings. Confirm the location and size of fixtures and openings before rough-in and installation.

END OF SECTION 15410

SECTION 15480

DOMESTIC WATER HEATER

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUBMITTALS

- A. Submit product data for each type and size of domestic-water heater indicated in accordance with Section 01300.
 - 1. Submit wiring diagrams for power, signal and control wiring.
 - 2. Product Certificates: For each type of tankless, electric, domestic-water heater, from manufacturer.
 - 3. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- B. Warranty
- C. Operation and Maintenance Data in accordance with Section 01730 for domestic-water heaters.

1.03 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

PART 2 – PRODUCTS

2.01 WATER HEATER

- A. Electric Tankless Water Heater
 - 1. Unit shall have ABS - UL 94 rated cover.
 - 2. Element shall be replaceable cartridge and shall be iron free nickel chrome material
 - 3. Unit shall be UL listed.
 - 4. For specifics, refer to water heater schedule on the drawings.

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DOMESTIC WATER HEATER

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install domestic-water heaters per the manufacturer's instructions.
 - 1. Maintain manufacturer's recommended clearances.
 - 2. Arrange units so controls and devices that require servicing are accessible.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 5. Anchor domestic-water heaters to substrate.
- B. Install domestic-water heaters level and plumb, according to the layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
 - 1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping.

3.02 CONNECTIONS

- A. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.03 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION 15480

SPECIFICATION 15506
REFRIGERANT PIPING SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. The CONTRACTOR shall furnish, install, test and place into satisfactory operation all refrigerant piping systems including all pipe, valves, accessories and supports required as shown on the Contract Drawings and specified herein.

1.02 RELATED SPECIFICATIONS

- A. Specification 09900 - Painting
- B. Specification 15951 - Testing, Adjusting and Balancing
- C. Specification 03300 - Cast-In-Place Concrete
- D. Specification 15060 - Hangers and Supports - HVAC
- E. Specification 15076 - Ductwork and Equipment Identification
- F. Specification 15081 - Piping Insulation

1.03 REFERENCES

- A. Equipment shall comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
 - 1. American Society of Mechanical ENGINEERs (ASME).
 - 2. American Society for Testing and Materials (ASTM).
 - 3. American Welding Society (AWS).
 - 4. Air Conditioning and Refrigeration Institute (ACRI).
 - 5. National Fire Protection Association (NFPA).
 - 6. Applicable Federal, State and local laws and/or ordinances.
- B. Where conflict arises between the local codes and the requirements of the National Electrical Code, The National Fire Code, NEMA, ASTM, etc., the more stringent requirements shall prevail.

1.04 DESIGN REQUIREMENTS

- A. Drawings show the general arrangement and extent of work to be done, but the exact locations and arrangement of all parts shall be determined as the work progresses, to conform in the best possible manner with its surroundings. The exact location of all parts of the work must be governed by the general building plans and the actual building conditions. Piping, equipment, ducts, etc. found to interfere with the construction of the building, plumbing apparatus and piping, electrical wiring or other obstructions, etc. shall be located to clear such obstructions. Connections shown to the various units are intended as an indication only. The actual connections shall be made and to best suit each particular case, provide for expansion, circulation and minimize the amount of space required.

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REFRIGERANT PIPING SYSTEMS

- B. Drawings do not show all offsets, fittings, accessories and details which may be required. The CONTRACTOR shall examine all of the Drawings and Specifications for conditions which may affect the installation of his work and shall arrange his work accordingly. Provide all required items to complete the systems to the extent required by the Drawings and Specifications.
- C. If piping can be run to better advantages, the CONTRACTOR, before proceeding with the Work, shall prepare and submit complete drawings showing all details of the proposed rearrangement for written approval.

1.05 SUBMITTALS

- A. In accordance with the procedures and requirements set forth in Section 01300, the CONTRACTOR shall obtain from the manufacturer and submit the following submittals.
- B. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information and design calculations required for evaluation of the compliance of the proposed equipment with the Contract Documents.
- C. Partial, incomplete or illegible submittals will be returned to the CONTRACTOR without review for resubmittal.
 - 1. Submit product literature for materials specified.
 - 2. Submit shop drawings for piping systems, roof supports, sizing, and valving arrangements.
 - 3. Submit tightness test results.
 - 4. Deviations from drawings and specifications.

1.06 QUALITY ASSURANCE AND QUALIFICATIONS

- A. The equipment covered by these specifications is intended to be standard equipment of proven performance as manufactured by reputable concerns. In conformance with Division 1, equipment shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed in accordance with the best practices of the trade and as shown on the Contract Drawings.
- B. Manufacturers, subcontractors, and dealers shall be submitted for approval in accordance with Division 1.
- C. Federal Clean Air Act, Section 608:
 - 1. CONTRACTOR shall adhere to the requirements of Section 608 of the Federal Clean Air Act for handling, capture, removal, recycling, disposal, etc. of hydrochlorofluorocarbon (HCFC) and chlorofluorocarbon (CFC) substances used as refrigerants or otherwise in existing equipment. CONTRACTOR is required to utilize only USEPA certified technicians to remove, service, maintain, dispose of, etc. equipment containing such substances. CONTRACTOR is also required to certify that they own certified recovery or

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REFRIGERANT PIPING SYSTEMS

recycling equipment necessary to perform such work before being permitted to prepare for or engage in such work.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Store to keep material clean and free from damage.
- B. Handle to prevent damage during installation and storage.
- C. Items to be incorporated into wall construction shall be delivered to job site in sufficient time so as not to hold up construction.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS

- A. Rigid Tubing
 - 1. Refrigerant pipe shall be Type ACR, per ASTM B280, streamlined hard temper and cleaned and dehydrated copper tubing supplied with nitrogen charge and pressure tight plugs for each length.
 - 2. Condensate drain pipe shall be Type K, per ASTM B88, copper piping.
- B. Fittings:
 - 1. Pipe fittings shall be streamlined pattern wrought copper.
 - 2. Unions shall be wrought copper; 300 psig working pressure; female pattern; brass to brass seat; ground joint; solder to solder connections; conform to ASTM B75.
 - 3. Flanges shall be wrought copper; 300 psig working pressure; tong-and-groove raised ground face; bolt holes spot faced; conform to ASTM B75.
 - 4. Gaskets shall be of a material suitable for the refrigerant, temperature and pressure for which they will be used.
- C. Joints:
 - 1. All joints shall be high temperature silver brazed joints in accordance with AWS A5.8.
- D. Corrosion Resistance
 - 1. All refrigerant piping shall have a field applied Bronz Glow coating.

2.02 VALVES

- A. Manual shut-off valves shall be ball type; brass body with chrome plated ball with Teflon ball seals; solder connections; 500 psig working pressure U.L. labeled. Arrows on forged brass body and stem show flow direction. Manufactured by Henry Valve Co., or approved equal.
- B. Check valves shall provide positive seal against reverse flow; spring loaded mechanism; neoprene seats; brass body; 425 psig working pressure; sized as required for application.

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- C. Hermetic, direct acting solenoid valves shall be normally closed type; dual voltage 4-wire coil as required; manual lift stem; solder connections. 500 psig working pressure. Pressure drop not to exceed 2 psig when full open.
- D. Expansion valves shall be sized as required by specific evaporator requirements; solder-flange connections; thermostatic modulating type; complete with sensing bulb and distributor.

2.03 ACCESSORIES

- A. Liquid and moisture indicators shall be single port type; forged brass body; reversible color moisture indicator; minimum 500 psig working pressure; leakproof; solder connections; self-cleaning molded sight glass with brass safety cap; U.L. labeled. Manufactured by Sporlan Valve Co., Series See All, or approved equal.
- B. The CONTRACTOR shall coordinate accessories included in packaged air-cooled condensing units. Any accessories not included in packaged unit shall be furnished and installed in refrigerant piping.
- C. The CONTRACTOR shall buy and install a complete charge of refrigerant.

2.04 EQUIPMENT MOUNTING SUPPORTS

- A. Refrigerant piping support channels shall be mounted to the equipment mounting supports with Type 316 stainless steel rods and flanges.

2.05 HANGERS AND SUPPORTS

- A. The CONTRACTOR shall provide and install all hangers, rods, supports, bolts, nuts, washers, inserts, and appurtenances as required to mount piping. See Specification 15060 for additional requirements for hangers and supports.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine areas to receive piping, valves and accessories for:
 - 1. Defects that adversely affect execution and quality of work.
 - 2. Deviations beyond allowable tolerances for piping, valves and accessories.
 - 3. Start work only when conditions are satisfactory.
- B. Material Cleaning
 - 1. Thoroughly clean all piping, fittings, valves and accessories prior to installation.

3.02 INSTALLATION

- A. All refrigerant piping installations shall conform with ANSI B9.1. Conform to all applicable regulatory and standards listed in Article 1.03.

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- B. Reduction in pipe sizes shall be made using concentric reducer couplings.
- C. Joints shall be made using a brazing compound, containing silver alloys having a melting point of 1350 degrees F or higher, Silfos or approved equal.
- D. Liquid-moisture indicators shall be installed upstream of any expansion valves, in the liquid line to the receiver, and elsewhere as shown on the Drawings.
- E. All pipes, whether insulated or not, shall be identified with pipe labels and the direction of flow indicated.
- F. Install oil traps and oil return line tubing in refrigerant piping as required.
- G. Refer to Specification Section 15060 for pipe hangers and supports.
- H. Field coordinate for exact pipe penetrations and routing of all piping.
- I. Provide flashing and counter flashing for equipment mounting supports.
- J. All refrigerant piping shall have a field applied Bronz Glow coating.

3.03 IDENTIFICATION

- A. Each piping shall be identified with the equipment item numbers given on the Contract Drawings. A corrosion resistant tag or nameplate, securely affixed in a conspicuous place on each unit shall give the equipment item number, manufacturers name or trademark and such other information as the manufacturer may consider necessary, or as specified, to complete identification.

3.04 TESTING

- A. General
 - 1. Shall be performed as specified herein and in accordance with Division 1.
- B. Certified Shop Tests:
 - 1. All certified shop test shall be performed, and the shop test reports submitted prior to scheduling the witness shop test.
- C. Field Tests:
 - 1. Remove and plug the connection points of any controls or relief valves that could be damaged by test pressure.
 - 2. Remove all expansion valves and install temporary bypasses.
 - 3. Front seat both the compressor suction and discharge valves.
 - 4. Open the liquid line shutoff valve at the condenser, and any auxiliary valves in the hot gas and liquid lines.
 - 5. Apply control power to open all solenoid valves.
 - 6. Connect a cylinder of oil pumped, dry nitrogen to the front seat port of the compressor discharge valve.
 - 7. Introduce dry nitrogen into the system to a pressure of 150 psig.

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8. Using a rubber mallet, tap each solder connection sufficiently hard to start any leak that might subsequently open from thermal expansion and contraction or vibration.
9. Test all piping for leaks by observing system pressure drop and applying a bubble test to all joints and connections.
10. After testing is completed, bleed the test pressure and repair any leaks found.
11. After the system is assumed to be free of leaks, charge enough refrigerant through the liquid line charging valve to raise the pressure to 15 psig. Remove the refrigerant connection and charge enough dry nitrogen into the system to raise the test pressure to 150 psig.
12. Test all joints with a Halide torch or electronic leak detection meter. Record all test results.
13. After the results of the pressure tests have been approved, release test pressure and mechanically evacuate the system to a minimum of 22 inches Hg vacuum and maintain for 24 hours with no leaks. Disconnect the vacuum pump prior to vacuum leak test.
14. Record and report the test results.
15. After test results have been approved by the ENGINEER, remove plugs and temporary bypass, and fully charge the system with the specified refrigerant.
16. All leaking joints shall be disassembled and remade using new materials. Retesting shall be conducted on all portions failing the tests.

END OF SECTION 15506

SECTION 15750

AIR CONDITIONING AND CONDENSING UNITS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. The CONTRACTOR shall furnish and install all air conditioning units and air-cooled condensing units with the requirements specified herein and as shown on the Contract Drawings.
- B. The equipment shall be furnished complete with all accessories, special tools, spare parts, base attachments, mountings, anchor bolts and other appurtenances as specified or as may be required for a satisfactory installation.

1.02 RELATED DETAILED SPECIFICATIONS

- A. Specification 03300 - Cast-In-Place Concrete.
- B. Specification 09900 – Surface Preparation and Painting.
- C. Specification 15076 – Piping, Ductwork and Equipment Identification.
- D. Specification 15081 - Pipe Insulation.
- E. Specification 15506 - Refrigerant Piping System.
- F. Specification 15951 - Testing, Adjusting and Balancing.
- G. Specification 16150 - Electric Motors.

1.03 REFERENCES

- A. Equipment shall comply with the latest applicable provisions and recommendations of the following, except as otherwise shown or specified.
 - 1. American Society of Mechanical Engineers (ASME).
 - 2. American Society of Testing Materials (ASTM).
 - 3. Air Movement and Control Association (AMCA).
 - 4. Air Conditioning and Refrigeration Institute (ACRI).
 - 5. National Fire Protection Association (NFPA).
 - 6. National Electrical Code (NEC).
 - 7. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
 - 8. Applicable Federal, State and local laws and/or ordinances.
 - 9. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.
 - 10. ANSI/ASHRAE/IES 90 A - Energy Conservation in New Building Design Standard.
 - 11. AHRI 210/240 - Unitary Air-Conditioning Equipment and Air-Source Heat Pump Equipment, (less than 135,000 Btuh).
 - 12. AHRI 360 - Commercial and Industrial Unitary Air Conditioning Equipment testing and rating standard, (equipment greater than 135,000 Btuh).
 - 13. AHRI 340 - Commercial and Industrial Unitary Heat pump Equipment, (heat pumps above 135,000 Btuh).

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14. ANSI Z21.47/UL1995 - Unitary Air Conditioning Standard for safety requirements.

B. Where conflict arises between the local codes and the requirements of the National Electrical Code, The National Fire Code, National Electrical Manufacturers Association (NEMA), ASTM, etc., the more stringent requirements shall prevail.

1.04 QUALITY ASSURANCE

A. The equipment covered by these Specifications is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Contract Drawings.

B. It is the intent of these specifications that all components of the air conditioning unit be provided by one vendor who shall have the sole responsibility of matching all components and providing equipment which functions together as a system.

C. Units shall be as manufactured by Trane or American Standard.

1.05 SUBMITTALS

A. In accordance with the procedures and requirements set forth in Sections 01300 and 01730, the CONTRACTOR shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings.
2. Preliminary Operation and Maintenance Manuals.
3. Final Operation and Maintenance Manuals.
4. Spare Parts List.
5. Special Tools List.
6. Reports of Certified Shop Tests.

B. Each submittal shall be identified by the applicable equipment identification number and specification section.

C. Shop Drawings

1. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.
2. Partial, incomplete or illegible submissions will be returned to the CONTRACTOR without review for resubmittal.
3. Shop drawings shall include but not be limited to:
 - a. Equipment specifications and data sheets identifying all materials used and methods of fabrication.
 - b. Complete assembly, layout, installation and foundation drawings with clearly marked dimensions.
 - c. Fan performance curve indicating the operating point.
 - d. Internal static pressure including drop thru heating coil, DX Coil, unit mounted accessories and 0.3-inch for filter dirt shall not exceed the difference between the total and external static pressures.

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- e. Motor nameplate data as specified in Specification 16150 - Electric Motors.
 - f. Copies of the manufacturers specifications type size, performance characteristics, efficiency installation instructions, detailed drawings for vibration isolators.
 - g. Details of corrosion-resistant coating.
 - h. Weights of all components parts, assembled weight of units and approximate total shipping weight.
 - i. Example equipment nameplate data sheet.
 - j. Interconnecting wiring diagrams.
 - k. List of recommended lubricants.
- D. Operations and Maintenance Manuals
- 1. The CONTRACTOR shall submit operation and maintenance manuals in accordance with the procedures and requirements set forth in Section 01730.

1.06 SPARE PARTS, TOOLS AND SUPPLIES

- A. Comply with the requirements of Division 1 - General Requirements.
- B. Furnish all special tools necessary to disassemble, service, repair and adjust the equipment.
- C. Furnish all spare parts as recommended by various equipment manufacturers.
- D. Spare parts lists, included with the shop drawing submittal shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.
- E. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be property identified by a separate number. Those parts which are identical for more than one size, shall have the same parts number.

1.07 WARRANTY

- A. All equipment supplied under this section shall be warranted for a period of one (1) year by the MANUFACTURER. Warranty period shall commence as outlined in Section 01740 and JEA General Conditions.
- 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 OWNER.
- C. The MANUFACTURER'S warranty period shall run concurrently with the CONTRACTOR'S warranty period. No exception to this provision shall be allowed.

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PART 2 - PRODUCTS

2.01 AIR HANDLING UNITS

A. General

1. Air conditioning unit shall conform to the requirements and conditions listed in the Documents.
2. Air conditioning unit shall be specifically designed for the performance and service conditions specified, and shall be designed to operate in a humid and corrosive environment, continuously or intermittently, whichever imposes the most severe duty.
3. These specifications shall be considered as minimum requirements. The CONTRACTOR shall inform himself of the practices and experiences with air conditioning units in water and wastewater treatment plants and shall add such additional features as are necessary for satisfactory operation and functioning of the equipment.
4. Units shall be of the configuration, capacity and style as indicated on the drawings and equipment schedule and as specified herein.
5. Provide indoor-mounted, draw-thru, packaged air conditioning unit(s). Unit(s) shall be factory-assembled including direct-expansion evaporator coil, expansion valve(s), check valves, condensate drain pan, centrifugal fan assembly with fan motor(s) and mounting bracket sheaves, drives and belts, filters, and electrical controls. Units shall be suitable for either horizontal or vertical airflow configuration and be used with or without ductwork.

B. Manufacturers

1. Units shall be as manufactured by Trane or American Standard.

C. Unit Construction

1. Unit casing shall be constructed of zinc-coated, heavy gauge, galvanized steel. Exterior surfaces shall be cleaned, phosphatized and finished with a baked enamel finish.
2. Unit casing shall be completely insulated with fire-retardant, permanent, foil-faced, odorless glass fiber material.

D. Unit Components

1. Air Filters
 - a. Approved manufacturers: AAF, Airguard, and Farr.
 - b. Provide 2-inch MERV 8 throwaway filters, factory installed. Units shall have filter access from either side panel.
 - c. All filters shall be 16-inch x 25 inch nominal sizes.
2. Cooling Coils
 - a. Coil performance shall be provided as indicated on the schedule and drawings. Coil capacities, pressure drops and selection procedures shall be certified to ARI Standard 410.
 - b. Coils shall have same-end header connections. Refrigerant coils shall have non-ferrous headers.
 - c. Refrigerant Cooling Coils
 - 1) Refrigerant cooling coils shall be provided as indicated on the schedule.

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- 2) Refrigerant cooling coils shall have 0.0075-inch-thick aluminum fins. Fins shall be mechanically bonded to 5/8-inch OD seamless copper tubes with 0.024 inch thick walls. Fins shall have collars drawn, belled and firmly bonded to the tubes by means of mechanical expansion. Coils shall be circuited for counter-flow heat transfer. Coil casings shall be constructed of 304 stainless steel.
- 3) Refrigerant cooling coils shall be proof and leak tested under water. Pressure and leak test shall be at 370 psig. After testing, coil circuiting shall be air dried, charged with dry nitrogen, and sealed to ensure all circuiting is free of any water or contaminants.
- 4) Refrigerant cooling coils shall have factory installed expansion valves.
- d. Drain Pans
 - 1) Provide double sloped condensate drain pan constructed of PVC with external connections on either side of unit. The drain pan shall be removable for cleaning.
3. Fans
 - a. Approved manufacturers: Trane, Twin Cities, or approved equal.
 - b. Fans shall be tested, rated and certified in accordance with ANSI/AMCA Standard 210 for air delivery and in accordance with AMCA Standard 300 for sound power levels and shall bear the AMCA seal. The fan balancing process, including vibration limits and documentation, shall be performed in accordance with ANSI/AMCA Standard 204. Fan and motor performance requirements shall be as shown on the schedule and drawings. Maximum rated speed of the fans shall not exceed 75% of the first critical speed.
 - c. Housed Centrifugal Fans
 - 1) Fan shall be all aluminum DWDI with FC or high-efficient AF blades as indicated on the schedule and drawings. The HP characteristic of all fans shall be non-overloading.
 - 2) Fan bearings shall be heavy duty, grease lubricated, self-aligning, antifriction pillow block type. Fan bearings shall be rated for a minimum average life (L-50) per ANSI/ABMA of 200,000 hours at design operating conditions. For easy accessibility, lubrication lines for fan bearings shall extend to the drive side of the fan, on the unit interior.
 - d. Fan Motors
 - 1) Approved manufacturers: A. O. Smith, Baldor, and Toshiba.
 - 2) All motors shall conform to ANSI/NEMA MG 1 as well as all applicable requirements of NEC and shall be UL Listed. Motors shall be inverter ready, TEFC, and of the voltage, phase, frequency, and HP indicated on the schedule and drawings. Motors shall be premium efficient, exceeding the EPA efficiency requirements. Motors shall be 1800 rpm, except where noted. The motor shall be provided with a heavy duty, adjustable, steel base.
 - 3) Provide access to motor, drive and bearings through removable casing panels.
 - 4) Motors shall be NEMA Design B, with Class B insulation.
 - e. V-Belt Drives (Sheaves)

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- 1) Sheaves for motors and fans shall be variable and adjustable pitch and shall be selected at a minimum service factor of 1.5. Sheaves shall have multiple grooves, requiring a minimum of two belts for operation.
- E. Vibration Isolation
1. The entire unit shall be mounted on vibration isolation pads to reduce vibration and noise transmission to building structures, equipment and adjacent spaces.
- F. Miscellaneous Features
1. Electric Heating Coils: Provide electric heat coils constructed of heavy-duty nickel chromium elements with pilot duty or automatic line break high limit controls. Coils shall be UL listed and installed in insulated sheet metal enclosure for installation on fan discharge, factory-supplied and field-installed.
 2. Mounting Sub-base: Provide sub-base constructed of heavy-gauge sheet metal with baked enamel finish. Sub-base shall elevate vertical floor mounted air handling unit in order to make proper condensate drain connections, factory-supplied and field-installed.
- G. Air Handling Unit Controls
1. Provide factory installed and wired controls including fan contactor, low voltage terminal strip and single point power entry.
 2. Provide factory installed evaporator defrost control to prevent coil freezing at low evaporator temperatures.
 3. Provide all required relays, interlocks, controls, etc. for interlock of duct smoke detectors and unit shutdown.
 4. Provide wall mounted thermostat for unit control. Thermostat shall be Honeywell T6 Pro Series thermostat.

2.02 AIR COOLED CONDENSING UNIT

- A. General
1. Provide self-contained, packaged, factory-assembled and pre-wired units suitable for outdoor use consisting of cabinet, compressor(s), condensing coil and fan(s), integral subcooling circuit(s), filter drier(s), and controls. Provide expansion valve(s) and check valves for split system heat pump unit(s).
 2. Outdoor units shall be designed to operate at outdoor ambient temperatures as high as 115°F. The unit shall be certified to UL 1995. Exterior shall be designed for outdoor application.
- B. Casing
1. Unit casing shall be constructed of heavy gauge, galvanized steel and painted with a weather-resistant powder paint finish on all louvered panels and the fan top panel. The corner panels shall be prepainted. All panels shall be subjected to a 1,000 hour salt spray test. The base shall be made of a CMBP-G30 weatherproof material to resist corrosion.
- C. Refrigerant Controls

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1. Refrigeration system controls shall include condenser fan, compressor contactor and high pressure switch. High and low pressure controls shall be inherent to the compressor. Refrigeration system shall include a factory supplied liquid line drier.
- D. Compressor
 1. The compressor shall have internal over temperature, pressure protection and total dipped hermetic motor, and centrifugal oil pump with low vibration and noise.
- E. Condenser Coil
 1. The outdoor coil shall have low airflow resistance and efficient heat transfer. The coil shall be protected on all four sides by louvered panels.
- F. Low Ambient Cooling
 1. Provide evaporator defrost control with TXV to permit low ambient cooling down to 30°F.
- G. System Control Options
 1. Disconnect Switch - A NEMA 3R stainless steel disconnect switch shall be provided for each unit.
 2. Anti-short-cycle timer shall be provided to prevent rapid on-off compressor cycling in light load conditions by not allowing compressor to operate for 5-7 minutes upon shutdown. Timer shall consist of a solid state timing device. 24-volt, 60 cycle with either 5 or 7 minute fixed-off timing period.
- H. Air Cooled Condensing Unit Controls
 1. Provide factory-wired condensing units with 24-volt control circuit with internal fusing and control transformers, contactor pressure lugs and/or terminal block for power wiring. CONTRACTOR to provide field installed unit mounted disconnect switch. Units shall have single point power connections.

2.03 COATINGS

- A. All air conditioning unit coils and copper piping inside unit cabinet shall be factory dip-coated by Bronz-Glow Technologies Inc. before installation. Color shall be platinum. The refrigeration components (filter driers, receivers, reversing valves, thermostatic expansion valves, metering devices, valves, etc.) shall be spray coated by Bronz-Glow Technologies before installation.
- B. All condensing unit coils, copper piping and refrigeration components inside unit cabinet shall be factory dip-coated by Bronz-Glow Technologies Inc. before installation. Color shall be platinum. The refrigeration components (filter driers, receivers, reversing valves, thermostatic expansion valves, metering devices, valves, etc.) shall be spray coated by Bronz-Glow Technologies before installation.

2.04 MOTORS

- A. Motors shall be of the totally enclosed fan cooled type. Where indicated on the schedule, the motors shall be compatible for service with variable frequency drives.

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- B. All motors shall be of the energy efficient type. Motors rated greater than 1,000 watts shall meet or exceed ASHRAE 90-75 requirements for a power factor not less than 95 percent.
- C. Motors shall be selected so that the maximum break horsepower required at any point on the performance curve does not exceed the nominal motor horsepower; operation in the service factor is not acceptable. Motors shall be mounted externally on an adjustable base.
- D. The drive shall be of the static-resistant, V-belt type with adjustable sheave.
- E. For motors less than or equal to 10 Hp, the belts shall be selected for 120 percent of the rated load at design conditions; for motors greater than 10 Hp the belts shall be selected for 150 percent of the rated load at design conditions.
- F. A removable belt guard with openings to allow for tachometer readings at both drive and fan shafts shall be provided.

2.05 CONTROLS

- A. Staging Controls
 - 1. Provide NEC Class II, electronic, adjustable zone control to maintain zone temperature setting.
- B. Sequence of Operation
 - 1. Control Cooling Mode for Zone Sensor Control
 - a. When the system switch is set to the COOL position and the zone temperature rises above the cooling setpoint, the unit shall energize the compressor contactor, provided the high/low pressure and the discharge temperature limit controls are closed. When the compressor contacts close, the compressor and the outdoor fan motor start to maintain the zone temperature to within $\pm 2^{\circ}\text{F}$ of the sensor setpoint at the sensed location. On units with dual circuits, the second stage of cooling is initiated as a result of the Proportional/Integral control algorithms calling for additional cooling.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Air conditioning units and air-cooled condensers shall be installed, connected and placed in satisfactory working order in accordance with the manufacturer's instructions and details, approved shop drawings, and the Contract Drawings.

3.02 IDENTIFICATION

- A. Each unit of equipment shall be identified with the equipment item numbers given on the Contract Drawings. Manufacturer shall provide a corrosion-resistant stainless steel tag or nameplate, securely affixed in a conspicuous place on each unit shall give the equipment item number, manufacturer's name or trademark and

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such other information as the manufacturer may consider necessary, or as specified, to complete identification.

3.03 TESTING

- A. All tests shall be performed in accordance with the requirements of Division 1.
- B. Motor tests in accordance with Specification 16150 - Electric Motors.
- C. Field tests shall be performed in accordance with Division 1, and Specification 15951 – Testing, Adjusting and Balancing.

3.04 MANUFACTURER'S REPRESENTATIVE

- A. The CONTRACTOR shall provide the services of a qualified manufacturer's technical representative who shall adequately supervise the installation and testing of all equipment furnished under this Contract. The services of the manufacturer's representative shall be provided for a period of not less than 3 days at each site as follows:
 - 1. At least 1 trip of up to 1 day during installation of the equipment.
 - 2. One trip of up to 1 day after acceptance of the equipment.
 - 3. One trip of 1 day for training and troubleshooting.Travel to and from site will not be included in determining the above time.
- B. Any additional time required to achieve successful installation and operation shall be at the expense of the CONTRACTOR.

END OF SECTION 15750

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DUCTWORK AND DUCT ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. The CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all ductwork complete with auxiliary equipment and accessories as shown, specified and/or required for proper operation.

1.02 RELATED SPECIFICATIONS

- A. Specification 09900 - Painting.
- B. Specification 15060 - Hangers and Supports - HVAC.
- C. Specification 15951 - Testing, Adjusting, and Balancing.

1.03 REFERENCES

- A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified. General requirements of this Contract shall supersede the Standards in case of conflict:
 - 1. American Society of Heating, Refrigerating and Air Conditioning ENGINEERS (ASHRAE).
 - 2. Sheet Metal and Air Conditioning Contractors National Association (SMACNA).
 - a. HVAC Duct Construction Standards.
 - b. Seismic Restraint Manual - Guidelines for Mechanical Systems.
 - 3. ASTM A 774 - As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.
 - 4. ASTM A 778 - Welded, Unannealed Austenitic Stainless Steel Tubular Products.
 - 5. NFPA 91 - Blowers and Exhaust Systems for Dust, Stock and Vapor Removal or Conveying.
 - 6. UL 555 - Fire Dampers.
 - 7. UL 181 - Factory Made Air Ducts and Connectors.
 - 8. UL 214 - Tests for Flame Propagation of Fabrics and Films.
 - 9. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
- B. Contractor shall provide certification that all stainless steel accessories including screws, hangers, supports, etc. for stainless steel, and FRP ductwork are Type 316 stainless steel.
- C. Field Measurements: Take field measurements prior to installation to ensure proper fitting of Work.
- D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.04 SUBMITTALS

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- A. CONTRACTOR shall submit working drawings, shop drawings and material specifications for the approval of the ENGINEER in accordance with the requirements of Section 01300. Working drawings and shop drawings shall include, but not limited to:
1. 1/4-inch scale duct layouts.
 2. Dimensions.
 3. Details of construction.
 4. Details of installation, hanger details and spacing.
 5. Manufacturer's literature, illustrations, specifications, and engineering data.
 6. Registers, grilles and diffusers.
 7. Fire Dampers (UL Listed):
 - a. Closing mechanisms.
 - b. Fusible link operating temperature.
 - c. Installation details.
 - d. Access Doors.
 8. Flexible connections.
 9. Other technical data related to the specified material and equipment as requested by ENGINEER.
 10. Duct sealants.
 11. Air outlet schedule indicating room name and location of each outlet. Cross reference contract designation and manufacturer's model number or name.
- B. Test Reports: Submit the following test reports for approval where required.
1. UL Label, Fire Dampers.
 2. Volume Damper leakage tests from an AMCA approved testing laboratory.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
1. Engage a single firm, with undivided responsibility for performance and other requirements and components of the ductwork.
 2. Engage a firm which can show successful experience in the fabrication and erection for ductwork systems of scope and type like the required Work.
- B. Installer Qualifications:
1. CONTRACTOR shall have at least 5 years' experience in the installation of the Work specified. He shall employ only tradesmen with specific skills and experience in this type of Work.
 2. CONTRACTOR shall have undivided responsibility as a single firm for performance and other requirements for the installation of the Work specified herein.
- C. Requirements of Regulatory Agencies: Comply with applicable provisions of regulatory agencies below and others having jurisdiction.
1. Underwriters Laboratories, Incorporated (UL)
 2. National Fire Protection Association (NFPA).
 3. National Electrical Code.
 4. Local and State Building Codes and Ordinances:
 - a. International Fire Prevention and Building Code.
 - b. International Building Code (IBC) Latest Edition, Section 1621

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- c. ASCE 7, Latest Edition, Section 9.61
5. Permits: CONTRACTOR shall obtain and pay for all required permits, fees and inspections.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Metal Ductwork:
 1. Galvanized Steel (G90 Coating)
 - a. Air devices for galvanized ductwork shall be aluminum.
 2. Aluminum (with 3003 ductwork H-14 alloy and temper)
 - a. Air devices and ductwork accessories for aluminum ductwork shall be aluminum.

2.02 METAL DUCTWORK

- A. General:
 1. All work shall be constructed and installed properly in accordance with the recommendations given in the latest edition of the Sheet Metal & Air Conditioning CONTRACTORS National Association (SMACNA) HVAC Duct Construction Standards and Rectangular Industrial Duct Construction Standards. All ductwork shall be constructed in accordance with the Schedule of Duct Construction Standards listed on the last page of this section.
 2. All ducts shall conform accurately to the dimensions indicated on the Contract Drawings, shall be straight and smooth on the inside with neatly finished joints, and shall not be decreased at any point to avoid obstructions. No piping, conduit or structural work shall be installed in or through any ductwork. All ductwork shall be run as close as possible to structural members, walls and ceilings. Ductwork shall be as shown on the contract drawings, subject to such modifications as may be necessary to suit field conditions to clear any obstruction or conflicts with other equipment.
 3. Where existing walls, floors or roofs must be penetrated, CONTRACTOR shall neatly cut the required openings and patch the existing work to provide a neat and finished appearance.
 4. All longitudinal seams shall be Pittsburgh Z.
 5. Curbs to prevent water leakage shall be provided around all floor openings. Where concrete curbs are not indicated on the Contract Drawings, provide curbs fabricated of 4" x 4" x 1/4" thick angles with welded corners. The curb shall be set in a mastic compound and securely fastened to the floor to provide a watertight installation. Curb materials shall match the associated ductwork.
- B. Galvanized Steel Ductwork
 1. All ductwork shall be fabricated of galvanized steel or as otherwise called for. Complying with A527 lock forming quality with ASTM A525 G90 zinc coating, milling phosphatized. Cross breaking shall not be used on ductwork which is to be finished with rigid insulation. Ductwork passing through or coming in contact with concrete or masonry shall receive a heavy coat of bituminous

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paint prior to installation of the ductwork. Transverse duct connection shall be bolted, gasketed connection as manufactured by Ductmate 35 System as manufactured by Duct Mate Industries, SMACNA T-25 Type, or approved equal.

2. Schedule
 - a. All ductwork shall be fabricated and installed in accordance with the schedule listed at the end of this section.
 - b. All air outlets for galvanized steel ductwork shall be aluminum.

2.03 DUCTWORK ACCESSORIES

- A. Hangers and Supports:
 1. All ductwork shall be securely hung and anchored to the building structure. Unless otherwise shown or specified, hangers and stiffeners for ducts shall conform with the recommendations given in the SMACNA HVAC Duct Construction standards. Ducts shall be supported on trapeze hangers with angles or rods. Use of strap hangers and straps is prohibited.
 2. All ductwork shall be supported from trapeze type hangers. Hanger rods shall be minimum 3/8 inch for all ducts with half perimeter up to 72 inches, and 1/2 inch diameter for all ducts with half perimeter larger than 72 inches. A pair of rods shall be provided at each duct support point. Maximum hanger spacing shall be 8 feet for ducts with half perimeter up to 72 inches and 6 feet for ducts with half perimeter larger than 72 inches.
 3. All hangers, rods, supports, bolts, nuts, washers, inserts, and appurtenances shall be Type 316 stainless steel.
 4. Hanger construction and installation shall conform to SMACNA Standards, except as specified. No sheet metal duct hangers or straps will be allowed.
 5. Support shall be furnished at each fitting.
 6. Conform to all requirements of Specification 15060 - Hangers and Supports - HVAC.
- B. Sleeves: Where ductwork passes through masonry walls, partitions or floors provide minimum 16-gauge sleeves. Caulk airtight with fire resistant sealant between sleeve and ductwork. Materials shall be as follows:
 1. Galvanized steel for galvanized steel and aluminum ductwork.
- C. Volume Dampers:
 1. Reference: SMACNA Standards.
 2. Manufacturer: Provide dampers manufactured by one of the following:
 - a. Ruskin.
 - b. Swartout.
 - c. Or approved equal.
 3. Material: Volume dampers shall be aluminum construction in aluminum and galvanized steel ductwork.
 4. Blades: Opposed blades, vinyl edge seals.
 5. Provide outside handle, quadrant and approved position indicator and locking device.
 6. Performance:
 - a. Damper Leakage: Not more than 16 cfm per square foot at 4-inch W.G.
 - b. Certification: Manufacturer shall provide certified test data.

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- D. Sheet Metal Safing (Blankoff): Provide aluminum sheet metal safing to close off and seal airtight all unused areas behind louvers. Insulation shall be 2-inch-thick, R-10 fiberglass, permanently sandwiched between aluminum sheet metal.
- E. Access Doors:
 - 1. Reference: SMACNA Standards.
 - 2. Type: Gasketed cam lock covers.
 - 3. Materials: Same as duct.
 - 4. Unless otherwise specified access doors shall be:
 - a. 12 by 6 inches for ducts sizes 12-inches and smaller.
 - b. 12 by 12-inches for ducts size 14-inches.
 - c. 21 by 14-inches for ducts between 14 and 36 inches.
 - d. 25 by 17 inches for ducts between 36 and 60 inches.
 - e. Two 25 by 17 inch doors for ducts larger than 61 inches.
 - 5. Access doors for fire dampers shall be stenciled "FIRE DAMPER ACCESS" with minimum ½-inch high letters.
- F. Flexible Connections:
 - 1. Reference: SMACNA Standards for pressure classification of 3 inches water gage.
 - 2. Material (unless otherwise specified):
 - a. Minimum 1/16-inch thick, 6-inch wide reinforced butyl or EPDM sheeting.
 - b. 16 gauge, 3-inch wide galvanized steel strip for galvanized steel ductwork.
 - c. 0.080 thick, 3-inch wide aluminum strip for aluminum ductwork.
- G. Turning Vanes:
 - 1. Reference: SMACNA.
 - 2. Construction: Same Material as ductwork.
 - 3. Vanes: Double thickness.
- H. Gravity Backdraft Dampers:
 - 1. Construction:
 - a. Multiple, interlocked blades mounted in frame.
 - b. Felt gasketed blade edges.
 - c. Stainless steel or brass bearings.
 - d. Tie rod connecting each blade.
 - e. Counterweights or adjustable spring attached to tie rods.
 - f. Metal frame.
 - 2. Materials:
 - a. Same material as ductwork.
 - b. Tie Rod: Aluminum 0.081 gage.
 - c. Louver Arm: Aluminum 0.081 gage.
 - d. Bumpers: Waterproof felt.
 - 3. Leakage:
 - a. Dampers with dimensions 24-inch or larger shall be certified that leakage does not exceed 20 CFM per square foot with 1 inches of static pressure across damper.

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- b. Dampers with dimensions less than 24-inch shall be certified that leakage does not exceed 40 CFM per square foot with 1 inches of static pressure across damper.
- I. Hardware:
 - 1. All fastening devices used for galvanized steel and aluminum ductwork shall be galvanized steel.
 - 2. All gasketing material shall be butyl.
- J. Bird Screens and Frames: (Aluminum): Bird screens shall conform to ASTM E 437, Type I, Class 1, 2 by 2 mesh, [0.031-inch diameter aluminum wire]. Frames shall be removable type aluminum construction.

2.04 REGISTERS, GRILLES AND DIFFUSERS

- A. Manufacturer: Provide equipment as manufactured by one of the following:
 - 1. AJ Manufacturing Company.
 - 2. Carnes.
 - 3. Tuttle & Bailey.
 - 4. Titus.
 - 5. Or approved equal.
- B. General:
 - 1. Units shall be factory-fabricated of aluminum construction when installed in aluminum and galvanized steel ductwork and shall distribute the specified of air volume (cubic feet per minute).
 - 2. Outlets for diffusion, spread, throw, and noise level shall be as required for specified performance. Performance shall be certified according to ASHRAE 70. Inlets and outlets shall be sound rated and certified according to ASHRAE 70.
 - 3. Diffusers and registers shall be provided with volume damper with accessible operator, unless otherwise indicated; or if standard with the manufacturer, an automatically controlled device will be acceptable. Volume dampers shall be opposed blade type for all diffusers and registers, except linear slot diffusers. Linear slot diffusers shall be provided with round or elliptical balancing dampers.
 - 4. Where the inlet and outlet openings are located less than 7 feet above the floor, they shall be protected by a grille or screen according to NFPA 90A.
 - 5. Registers and Grilles:
 - a. Units shall be four-way directional-control type, except that return and exhaust registers may be fixed horizontal or vertical louver type similar in appearance to the supply register face.
 - b. Registers shall be provided with sponge-rubber gasket between flanges and wall or ceiling.
 - c. Grilles shall be as specified for registers, without volume control damper.
 - 6. An additional volume damper shall be installed in duct stub to each air outlet for balancing of air volume.

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- C. Supply Registers: Supply registers shall be double deflection type, complete with adjustable vertical face bars and a key operated opposed blade damper. Air turning devices shall be installed at all collar take-offs to supply registers. Air turning devices shall be Price Industries or approved equal. The air turning devices shall have two sets of individually adjustable blades to equalize flow and control volume at collar takeoffs and shall be gasketed around the perimeter.
 - 1. Supply registers installed in aluminum or galvanized ductwork shall be of aluminum double deflection type complete with opposed blade aluminum damper. Supply registers shall be Price Industries Model 620DAL or approved equal.
- D. Exhaust and return registers shall be complete with fixed horizontal face bars, set straight, and a key operated opposed blade damper.
 - 1. Return and exhaust registers and damper installed in aluminum or galvanized ductwork shall be of aluminum construction with opposed blade aluminum damper. Supply registers shall be Price Industries Model 610ZDAL or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Turning vanes shall be installed in all miter elbows to permit air to make the abrupt turns with a minimum of turbulence. The turning vanes shall be quiet and free from vibration when the system is in operation. Turning vanes shall be double thickness type. Vanes shall be installed in all short radius elbows in accordance with SMACNA standards and Industrial Duct Construction standards. Duct clean out doors shall be provided at each elbow with turning vanes.
- B. Manual volume dampers larger than 11" in any dimension shall be opposed blade type. The damper blades shall be operated by a lockable dial regulator and may be set in any position. The dial regulators shall be marked so that the "open" and "shut" positions are clearly identified. The dial regulators on insulated ductwork shall be mounted on an elevated platform which will finish flush with the surface of the insulation. Manual volume dampers shall be located at accessible points and wherever possible some distance from a duct transition or fitting. Care shall be taken during installation to make certain that sheet metal fasteners do not protrude into the duct and interfere with damper operation. Dampers shall be provided in each branch duct take off and in both ducts downstream of each trunk duct split.
- C. Splitter type dampers shall not be installed.
- D. Duct access doors shall be provided within working distance of, and on the fusible link side of all fire dampers, adjacent to volume dampers, on the linkage side of automatic dampers and at all other apparatus requiring service or inspection in the duct system. The doors shall be rigid and airtight, and provided with neoprene gaskets, hinges and sash locks. Whenever space requirements are such that a hinged access door is impractical, a screw fastened lift-out door shall be provided instead.

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- E. Access doors in finished work such as walls, plaster, wood paneling and in suspended ceilings which do not have removable panels, shall be provided for all concealed valves, controls, test openings, duct access doors, and at all other locations requiring service, inspection or adjustment of a concealed item. The CONTRACTOR shall submit details of construction and material to the ENGINEER for review. In general, the access doors shall match the appearance of the finished work in which they are installed and shall be of sufficient size to permit service, inspection or adjustment of the concealed item.
- F. Test openings shall be installed in the ductwork at the points listed below. The openings shall be sealed by a screw cap and gasket and shall be installed so that the insulation is not disturbed when the cover is removed. The test openings shall be located as follows in all heating, ventilating, air conditioning systems:
 - 1. In the outside air duct adjacent to the unit.
 - 2. In the exhaust air duct adjacent to the unit.
 - 3. In the main supply duct on each unit.
- G. Flexible connections for preventing the transmission of vibrations through the ductwork to the structure shall be installed between the ductwork and all air moving equipment and at the building joints. Flexible connections shall be neoprene-impregnated fabric collars with cemented seams fastened with straps and bolts of the same material as the ductwork. Flexible connections shall not be painted or used to correct misalignment.
- H. CONTRACTOR shall furnish and install sleeves for registers, grilles, and dampers mounted in the masonry, concrete plenums or shafts. Sleeves shall be 16 gage and shall match the attached ductwork.
- I. After the installation is completed, the CONTRACTOR shall seal all joints air tight. Sealants and tape shall have a flame spread not greater than 25 and a smoke developed rating of not over 50.
- J. Safing shall be provided to seal off remaining portions of shafts and louvers which are not covered by the plenums or equipment attached to the shaft or louver. Safing shall consist of a two-inch-thick R-6 rigid fiberglass board type insulation sandwiched between two 16-gauge minimum sheets. Insulation shall be secured to the sheets with adhesive. All edges of the panels shall be provided with a 16-gauge minimum channel secured in place with sheetmetal screws six inches on centers. Insulated sandwich panels shall be removable type with maximum space of 18 inches and supported on 3 x 3 x 1/4" angle. Provide intermediate supports. The CONTRACTOR shall submit details of construction to the ENGINEER for review.
 - 1. The sheets, channels and hardware used for the safing shall be 316 stainless steel.
- K. All ductwork shall conform accurately to the dimensions shown, the ducts shall be straight and smooth inside with joints neatly finished; ductwork shall be installed so as to preclude the possibility of vibration under all operating conditions.
- L. Tape and seal all joints as per SMACNA Standards.

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- M. Elbows shall have a minimum centerline radius of 1-1/2 times the width of the duct. Turning vanes shall be provided at all square elbows. Turning vanes shall be double wall and shall be quiet and free from vibration when the system is in operation.
- N. Provide flexible connections at inlet and discharge of air handling equipment.
- O. Provide volume dampers where indicated on the Drawings and as required to facilitate accurate volume control. The duct of the damper shall be reinforced to prevent vibration. Volume dampers specified with air devices shall be installed in addition to those shown on the Drawings.
- P. Provide access doors for all dampers for inspection and maintenance.
- Q. Install all ductwork and accessories to provide a system free from buckling, warping, breathing or vibration.
- R. All expansion joints in ducts at building expansion joints shall be suitably supported at each end by support guides within 12 inches of joint.
- S. All ducts at flexible connections with air handling equipment, and fans shall be supported at free end within 12 inches of flexible connection.
- T. Provisions shall be made for supporting all ductwork, dampers, and other ductwork accessories, where necessary.
- U. Coordinate all air outlets for compatibility with ceiling system.
- V. All ductwork shall arrive on site fully fabricated, not in two halves for field fabricated.

3.02 ADJUSTMENT

- A. Set volume control devices for approximate positions in preparation for final testing and balancing.
- B. Start fan system and check for excessive leaks and vibration and correct.

3.03 BALANCING

- A. Systems shall be completely tested, adjusted and balanced by a qualified ENGINEER. A complete balancing procedure shall be submitted for approval. All equipment and connections required to balance the systems shall be provided.
- B. All duct systems shall be balanced as specified in Specification 15951 - Testing, Adjusting and Balancing.

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DUCTWORK AND DUCT ACCESSORIES

3.04 CLEANING

- A. Remove all loose materials and obstructions from interior of ducts.
- B. Remove debris and waste materials resulting from installation.

3.05 PAINTING

- A. Surface Preparation and Shop Painting:
 - 1. Clean and prime coat ferrous metal surfaces of equipment in the factory/shop in accordance with the requirements of Specification 09900.
 - 2. Coat polished and non-ferrous metal surfaces with corrosion prevention compound which shall be maintained during storage and until equipment begins operations.
- B. Field Painting: Painting required for exterior surfaces of ductwork and insulation, and finish painting of items only primed at the factory, are specified in Specification 09900, Painting.

3.06 CONSTRUCTION AND MATERIAL SCHEDULE

- A. Schedule of Metal Duct Construction Standards:

Schedule of Duct Construction Standards		
Service	Pressure Classification	Construction Standards
All ductwork on fan discharge side	3" W.G. POS.	SMACNA HVAC Duct Construction Standards
All ductwork on suction side	3" W.G. NEG.	SMACNA HVAC Duct Construction Standards
Transfer air duct not connected to fan	2" W.G. POS. or NEG.	SMACNA HVAC Duct Construction Standards

- 1. Notes:
 - a. All accessories, including but not limited to, turning vanes, air turning devices, manual volume dampers, motor operated control dampers, access doors, supports, angles, clamps, hangers and hardware, shall be the same material as the associated ductwork and suitable for the pressure classification given above.
- B. Ductwork Material Schedule:
 - 1. All ductwork in the restroom shall be aluminium.
 - 2. All remaining ductwork shall be galvanized.
- C. Ductwork Seal and Leakage Schedule:
 - 1. All ductwork: Seal Class A, Leakage Class 4.

END OF SECTION 15810

SECTION 15815

DUCT INSULATION

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. The CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all duct insulation complete with auxiliary equipment and accessories as shown, specified and/or required for proper operation.

1.02 RELATED SPECIFICATIONS

- A. Specification 07900 - Caulking and Sealants
- B. Specification 09900 - Painting
- C. Specification 15060 - Hangers and Supports – HVAC
- D. Specification 15076 - Piping and Equipment Identification
- E. Specification 15810 - Ductwork and Duct Accessories

1.03 REFERENCES

- A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified. General Requirements of this Contract shall supersede the Standards in case of conflict:
 - 1. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
 - 2. ASTM E 84 - Surface Burning Characteristics of Building Materials
 - 3. NFPA 255 - Surface Burning Characteristics of Building Materials
 - 4. UL 723 - Test for Surface Burning Characteristics of Building Materials
 - 5. NFPA 90A - Installation of Air Conditioning and Ventilating Systems
 - 6. ASTM C 449 - Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
 - 7. ASTM C 534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
 - 8. ASTM C 547 - Mineral Fiber Pipe Insulation
 - 9. ASTM C 552 - Cellular Glass Thermal Insulation
 - 10. ASTM C 553 - Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
 - 11. ASTM C 612 - Mineral Fiber Block and Board Thermal Insulation
 - 12. ASTM C 647 - Properties and Tests of Mastics and Coating Finishes for Thermal Insulation
 - 13. ASTM C 916 - Adhesives for Duct Thermal Insulation
 - 14. ASTM C 920 - Elastomeric Joint Sealants

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DUCT INSULATION

15. ASTM C 1126 - Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation
- B. Field Measurements: Take field measurements where required prior to installation to ensure proper fitting of Work.
- C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.04 SUBMITTALS

- A. CONTRACTOR shall submit working drawings, shop drawings and material specifications for the approval of the ENGINEER in accordance with the requirements of Section 01300.
- B. Samples: Submit for approval samples of the following:
 1. Thermal Insulation - Flexible.
 2. Thermal Insulation - Rigid.
- C. Shop Drawings: Submit for approval manufacturer's catalog literature, specifications and illustrations with the following information:
 1. Thermal properties
 2. Physical properties
 3. Fire hazard ratings
 4. Facing information
 5. Installation instructions
 6. Jointing recommendations for butt joints and longitudinal seams

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 1. Engage a single firm, with undivided responsibility for performance and other requirements and components of the duct insulation installation.
 2. Engage a firm which can show successful experience in the manufacture of duct insulation systems of scope and type similar to the required Work.
- B. CONTRACTOR's Qualifications:
 1. CONTRACTOR shall have at least 5 years' experience in the installation of the Work specified. He shall employ only tradesmen with specific skills and experience in this type of Work.
 2. CONTRACTOR shall have undivided responsibility as a single firm for performance and other requirements for the installation of the Work specified herein.

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DUCT INSULATION

- C. Requirements of Regulatory Agencies: Comply with applicable provisions of regulatory agencies below and others having jurisdiction.
 - 1. Underwriters Laboratories, Incorporated (UL).
 - 2. National Fire Protection Association (NFPA).
 - 3. Local and State Building Codes and Ordinances.
 - a. International Building Code
 - b. International Fire Code
 - c. International Energy Conservation Code
- D. General: Insulation systems including covering, mastics, adhesives, sealers and facings shall have the following Fire Hazard Classifications in accordance with ASTM E 84:
 - 1. Flame spread, 25 maximum.
 - 2. Fuel contributed, 50 maximum.
 - 3. Smoke developed, 50 maximum.
- E. Source Quality Control: Perform the following tests and inspections at factory.
 - 1. Flame Spread
 - 2. Smoke Developed
 - 3. Fuel Contributed
- F. Manufacturer's Markings:
 - 1. Stamp or label with manufacturer's name and brand every package or standard container of covering, adhesive and coating delivered to the job site for use.
 - 2. Exposed side of insulation shall be legibly labeled by the manufacturer to show thickness, type and manufacturer.

1.06 JOB CONDITIONS

- A. Sequencing: Obtain the ENGINEER's approval of insulation, adhesives, coatings and method of installation before installing any insulation.
- B. All duct leaks shall be sealed prior to installation of external insulation to prevent billowing and damage to insulation.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Manufacturer: Provide insulation of one of the following:
 - 1. Owens Corning.
 - 2. CertainTeed Corporation.
 - 3. Johns-Manville Corporation.
 - 4. Or approved equal.

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DUCT INSULATION

- B. Exposed Ductwork Insulation (Rigid): All exposed ductwork as listed under Paragraph 3.05 - Schedules, shall be insulated with minimum 1-1/2-inch thick (except 2 inches thick for ducts located outdoor and outside air intake plenums) glass fiber board having a density of not less than 3.0 lbs./cu.ft., and a thermal conductivity of not more than 0.23 BTU-inch/hour square feet °F at 75°F mean temperature. The insulation shall be Johns-Manville No. 814 Spin - Glas, Certain Teed Corporation Industrial Board, or approved equal. The insulation shall be impaled over pins welded to the duct surface on 12-inch centers. The pins shall be coated with vapor barrier adhesive, and the insulation shall then be secured with caps over the pins. All joints and breaks in the vapor barrier shall be sealed with 3" wide strips of the vapor barrier facing. All insulation shall be reinforced with corner bead. The facing shall be finished with a 3-ply application of lagging adhesive, glass fabric reinforcing and a finish coat of mastic.
- C. Concealed Ductwork Insulation (Flexible): All concealed ductwork as listed under Paragraph 3.05 - Schedules, shall be insulated with 1-1/2-inch thick flexible fiberglass duct insulation, having a thermal conductivity of not more than 0.28 BTU-inch/hour square feet °F at 75°F mean temperature. The insulation shall have a reinforced foil vapor barrier facing. Insulation shall be secured with 4-inch wide bands of adhesive on 12-inch centers. All joints shall be sealed by adhering a 2-inch sealing lap or 3-inch strips of vapor barrier facing applied with vapor barrier adhesive. On horizontal ducts over 24-inch wide, welded pins and clips shall be used on the underside on 18-inch centers.
- D. Adhesives and Accessories:
1. Mineral Fiber Insulation Cement: Cement shall be in accordance with ASTM C 195.
 2. Lagging Adhesive: Lagging adhesives shall be nonflammable and fire-resistant and shall have flame spread and smoke developed ratings of 25/50 when measured in accordance with ASTM E 84.
 3. Contact Adhesive: Adhesive may be dispersed in a non-halogenated organic solvent with a low flash point (flash point less than minus 25°F when tested in accordance with ASTM D 3278) or, dispersed in a nonflammable organic solvent which shall not have a fire point below 200°F. The adhesive shall be nonflammable and fire resistant.
 4. Caulking: Caulking shall be in accordance with ASTM C 920.
 5. Corner Angles: Nominal 0.016-inch type 316 stainless steel 1 x 1 inch with factory applied kraft backing and adhesive.
 6. Finishing Cement: Mineral fiber hydraulic-setting thermal insulating cement ASTM C 449.
 7. Fibrous Glass Cloth and Glass Tape: Fibrous glass cloth and glass tape shall have flame spread and smoke developed ratings of no greater than 25/50 when measured in accordance with ASTM E 84.
 8. Staples shall be outward clinching Type 316 stainless steel.

SECTION 15815

DUCT INSULATION

9. White Vapor Retarder ASJ (All Service Jacket): For use on hot/cold pipes, ducts, or equipment. Vapor retarder jackets used on insulation exposed in finished areas shall have white finish suitable for painting.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Ensure that all surfaces are clean and dry before applying insulation.

3.02 PREPARATION

- A. Ensure that ductwork has been inspected and released for application of insulation.

3.03 INSTALLATION

- A. Install insulation so as to make surfaces smooth, even and substantially flush with adjacent duct insulation.
- B. Follow manufacturer's application instructions for all materials used.
- C. Duct sizes indicated on Drawings are clear inside dimensions. Increase duct sizes to give designated inside dimensions when internal insulation is used.
- D. Thickness of rigid insulation shall be greater than the seams or angles of ductwork to which it is applied.
- E. Duct insulation shall be continuous through sleeves and prepared openings.
- F. Insulation shall terminate at fire dampers and flexible connections.
- G. Vapor barrier materials shall be applied to form a complete unbroken vapor seal over insulation.
- H. Provide Type 316 stainless steel jacketing and waterproof sealants for insulated ducts exposed to outdoor.
- I. Field painting shall comply with the requirements of Specification 09900, Painting.
- J. Identification markers and labels shall be in conformance with Specification 15076 - Piping and Equipment Identification.

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DUCT INSULATION

3.04 CLEANING

- A. Remove all debris, waste materials and loose foreign matter resulting from installation.

3.05 SCHEDULES

- A. Thermal Insulation - Rigid: The following exposed ductwork exposed in room shall be insulated:
 - 1. All outside air intake ducts and plenums from the outside air intake louver, outside air intake shaft, or roof mounted intake up to the point where the duct or plenum is connected to the heating and ventilating units, air conditioning units, or supply fans in heated and air conditioned spaces.
 - 2. All exhaust and return air ductwork from air conditioned spaces.
 - 3. All supply and return air ductwork associated with air conditioning units.
 - 4. All heated and air conditioned ductwork located in unheated spaces.
 - 5. All heated and air conditioned ductwork located outdoors shall be insulated and covered with weatherproof stainless steel jacket.
 - 6. Where indicated on the Contract Drawings.
- B. Thermal Insulation - Flexible: The following ductwork located above hung ceiling shall be insulated:
 - 1. All supply, exhaust and return ductwork associated with air conditioning units.
 - 2. All outside air intake ducts and plenums from the outside air intake louver, outside air intake shaft or roof mounted intake up to the point where the duct or plenum is connected to the heating and ventilating units and supply fans.
 - 3. Where indicated on the Contract Drawings.
- D. Insulation Thickness: All ductwork insulation shall be 2-inch thick (R-8 min.) except for outside air intake plenum and outside air ductwork insulation which shall be 3 inches thick (R-12 min.).

END OF SECTION 15815

SECTION 15830

FANS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. The CONTRACTOR shall provide all labor, materials, equipment and incidentals to furnish and install all fans in accordance with the requirements specified herein as shown on the Contract Drawings or specified in the Specifications.
- B. The equipment shall be furnished complete with all accessories, special tools, spare parts, base attachments, mountings, anchor bolts and other appurtenances as specified or as may be required for a satisfactory installation.
- C. All fans shall be furnished in accordance with the schedule shown on the Contract Drawings.

1.02 RELATED SPECIFICATIONS

- A. Specification 09900 – Painting
- B. Specification 15951 – Testing, Adjusting and Balancing
- C. Specification 16150 – Electric Motors

1.03 REFERENCES

- A. Equipment shall comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
 - 1. American Society of Mechanical Engineers (ASME)
 - 2. American Society of Testing Materials (ASTM)
 - 3. Air Movement and Control Association (AMCA)
 - 4. Sheet Metal and Air Conditioning CONTRACTORS National Association (SMACNA)
 - 5. National Fire Protection Association (NFPA)
 - 6. National Electric Code (NEC)
 - 7. Applicable Federal, State and local laws and/or ordinances
- B. Where conflict arises between the local codes and the requirements of the National Electrical Code, The National Fire Code, NEMA, ASTM, etc., the more stringent requirements shall prevail.

1.04 SUBMITTALS

- A. In accordance with the procedures and requirements set forth in Section 01300, the CONTRACTOR shall obtain from the equipment manufacturer and submit the following:
 - 1. Shop Drawings
 - 2. Preliminary Operation and Maintenance Manuals
 - 3. Final Operation and Maintenance Manuals
 - 4. Spare Parts List
 - 5. Special Tools List

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6. Reports of Certified Shop Tests
7. AMCA Approval for Fan Ratings

B. Shop Drawings

1. Shop drawings shall include but not be limited to:
 - a. Equipment specifications and data sheets identifying all materials used and methods of fabrication.
 - b. Complete assembly, layout, installation and foundation drawings with clearly marked dimensions.
 - c. Fan performance curve indicating the operating point.
 - d. Details of corrosion resistance coating.
 - e. Motor nameplate data as specified in Specification 16150, Electric Motors
 - f. Detailed specifications and data sheets for all accessories such as roof curbs, dampers, damper operators disconnect switches, vibration isolators etc.
 - g. Example equipment nameplate data sheet.
 - h. Interconnecting wiring diagrams.
 - i. List of recommended lubricants.

C. Operations and Maintenance Manuals

1. The CONTRACTOR shall submit operation and maintenance manuals in accordance with the procedures and requirements set forth in Section 01730.

- #### D. Lubricants: The manufacturer shall submit a list with a minimum of four (4) manufacturers standard lubricants which may be used interchangeably for each type of lubricant required.

1.05 QUALITY ASSURANCE AND QUALIFICATIONS

- A. The equipment covered by these specifications is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Contract Drawings.
- B. It is the intent of these specifications that all components of the fans be provided by the CONTRACTOR through one vendor. The CONTRACTOR through the vendor shall have the sole responsibility of matching all components and providing equipment which functions together as a system.

1.06 SPARE PARTS AND SUPPLIES

- A. Furnish all special tools necessary to dis-assemble, service, repair and adjust the equipment.
- B. The following spare parts shall be furnished for up to every four (4) same size of fan:
 1. Two (2) sets of belts for each belt driven fan

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- C. Furnish all additional spare parts as recommended by the equipment manufacturers.
- D. Spare parts lists, included with the shop drawing submittal shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.
- E. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size, shall have the same parts number.

PART 2 - PRODUCTS

2.01 FANS - CONDITION OF SERVICE AND DESIGN DATA

- A. Fans shall be as specified below and shown on the Contract Drawings. The CONTRACTOR shall include, as part of this work, all supports required. The fans shall be installed where indicated on the Contract Drawings.
- B. Performance data for all fans shall be based on tests conducted in accordance with the "Standard Test Code for Centrifugal and Axial Fans" as adopted by the Air Movement and Control Association (AMCA) and shall be licensed to bear the AMCA certified rating seal for both sound and air performance. All fans shall be selected from performance curves and not from rating tables. A copy of the curve, indicating the operating point, shall be submitted for each proposed fan.
- C. Unless otherwise indicated, motors shall be of the totally enclosed premium efficiency type. Motors shall not be selected for operation in the service factor range/zone. The maximum brake horsepower required at any point on the performance curve shall not exceed the rated horsepower of the motor.
- D. All fans and damper operators shall each be provided with individual externally mounted disconnect switches. All enclosures shall be NEMA 12 otherwise specified.
- E. All dampers for roof mounted fans shall be mounted in the mounting pedestal with removable access panel for inspection and servicing of damper and operator. Mounting pedestal shall provide solid ventilator support and a weather tight seal.
- F. All fans shall be statically and dynamically balanced at the speed at which the unit is scheduled to operate. Fans with corrosion resistant coatings shall be balanced after being coated.
- G. The fans shall be either direct connected or V belt drive as indicated on the schedule. For motors less than or equal to 10 HP, the V belt drive shall be selected for 120 percent of rated capacity. For motors larger than 10 HP, the V belt drive shall be selected for 150 percent of rated capacity. All V belt drives shall be provided with adjustable sheaves. Exposed V-belt drives shall have removable belt guards with openings to allow for tachometer readings at both drive and fan

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shafts. Guards shall be so constructed as to allow visual inspection of the belts without removing the guard.

- H. All fan bearings shall be selected for a minimum L-50 life of 100,000 hours at maximum operating speed.
- I. All fans shall be provided (inside and outside) with baked on Heresite corrosion resistant coating including all accessories but not limited to the housing, wheels, curbs, liners, dampers, damper access sections.
- J. All fan motors shall be provided with high premium energy efficient totally enclosed fan cooled type. Where indicated on the schedule, explosion proof motors and AMCA Type "A" spark resistant construction fans shall be provided.
- K. All shafts shall be sized so the first critical speed is at least 20 percent over the maximum operating speed. Close tolerance shall be maintained along the length of the shaft.
- L. Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.
- M. Fan manufacturer shall provide sound power ratings in the eight octave bands. Sound power levels shall be based on AMCA Standard 301. Sound power ratings shall be in decibels, referenced to 10-12 watts.
- N. All dampers shall be of the low leakage type complete with galvanized steel channel frame, blades and baffles, inflatable fabric reinforced neoprene rubber blade edge seal, spring loaded side seals, and, where required, extended axles. Parallel blade action shall be provided for two position applications. Dampers shall be certified that leakage does not exceed 10 CFM per square foot with 2 inches of static pressure across damper. Dampers shall have stainless steel pins and nylon bushing.

2.02 WALL MOUNTED PROPELLER FANS

- A. Manufacturer: Provide products made by one of the following:
 - 1. Hartzell,
 - 2. Or approved equal.
- B. Type: Wall mounted, all aluminium propeller fan.
- C. Capacity: As specified in the Equipment Schedule on the Contract Drawings.
- D. Construction: Aluminium Wall Fan:
 - 1. Propellers:
 - a. Airfoil design.
 - b. Cast 319 aluminium alloy.
 - c. Statically and dynamically balanced.
 - d. Propellers equipped with malleable iron split taper bushing for alignment and locking of propeller to the shaft.

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- 1) Bushing held in place by compression and keyed to the shaft to prevent slipping or loosening.
 - 2) Positioned with three standard capscrews for easy assembly and disassembly.
 2. Venturi and Panel:
 - a. Heavy gauge aluminium.
 - b. Designed for airfoil propellers.
 3. Safety Guard:
 - a. 1/2 inch by 1/2-inch mesh wire screen that meets OSHA standards.
 - b. Removable sections to provide for easy access to motor.
 4. Damper: Backdraft damper, aluminium.
- E. Accessories:
1. All structural steel used for mounting fans shall be 316 stainless steel.
 2. The CONTRACTOR to provide additional stiffeners, angles and supports as required to mount the fans.
- F. Drive:
1. Direct drive as shown on the Contract Drawings.
- G. Painting:
1. All external and internal metal surfaces of fans, guards, (except propellers and motors) shall be factory primed and factory painted in accordance with Specification 09900, Painting.
 2. Propellers shall be factory coated with a 4-coat baked phenolic coating system minimum of 2 to 3 mils dry film thickness total, of Heresite Series P-413 or approved equal.

2.03 IN-LINE CABINET FANS

- A. Ceiling mounted exhaust fans shall be of the centrifugal direct or belt drive type. The fan housing shall be constructed of heavy gauge galvanized steel. The housing interior shall be lined with 1/2-inch acoustical insulation. The outlet duct collar shall include an aluminum backdraft damper and shall be adaptable for horizontal or vertical discharge.
- B. The access for wiring shall be external. The motor disconnect shall be externally mounted. The motor shall be mounted on vibration isolators. The fan wheel(s) shall be of the forward curved centrifugal type, constructed of galvanized steel and dynamically balanced.
- C. Ceiling fans shall be Model SP as manufactured by Greenheck of Schofield, Wisconsin, or approved equal.
- D. Direct drive fans shall be provided with solid state speed control as required.

PART 3 - EXECUTION

3.01 INSTALLATION

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FANS

- A. The fans shall be installed, connected and placed in proper working order in accordance with the manufacturer's instructions and details, and the Contract Drawings.

3.02 IDENTIFICATION

- A. A corrosion resistant tag or nameplate, securely affixed in a conspicuous place on each unit shall give the equipment item number, manufacturer's name or trademark and such other information as the manufacturer may consider necessary, or as specified, for complete identification.

3.03 TESTING

- A. Motor tests in accordance with Specification 16150, Electrical Motors.
- B. Field tests shall be performed in accordance with Specification 15951, Testing, Adjusting and Balancing and Division 1 of the Specifications.

3.04 MANUFACTURER'S REPRESENTATIVE

- A. The CONTRACTOR shall provide the services of a qualified manufacturer's technical representative who shall adequately supervise the installation and testing of all equipment furnished under this Contract. The services of the manufacturer's representative shall be provided for a period of not less than 3 days at each site as follows:
 - 1. One trip of 1 day during installation of the equipment.
 - 2. One trip of 1 day for startup.
 - 3. One trip of 1 day for training.
- B. Any additional time required to achieve successful installation and operation shall be at the expense of the CONTRACTOR. The manufacturer's representative shall sign in and out each day he is at the project. Travel time to and from the site shall not be included in measuring the above visits. Only time spent on the site shall be counted.
- C. Training
 - 1. The CONTRACTOR shall include in his request for manufacturer approval a certification that the manufacturer has been advised of the requirements of Specification 01465 - Equipment Testing and Startup, and that the costs associated with said training submittals and training have been included in the manufacturer's pricing.
- D. Lubricants
 - 1. The manufacturer shall submit a list with a minimum of four manufacturer's standard lubricants which may be used interchangeably for each type of lubricant required.

END OF SECTION 15830

SECTION 15910

HVAC INSTRUMENTATION AND CONTROL DEVICES

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. The CONTRACTOR shall, through the services of the controls supplier, furnish, install, test and place in operation, HVAC control devices, as detailed herein and as shown on the Contract Drawings. The controls shall be top quality, standard offerings of a nationally recognized manufacturer. When available, control devices shall be procured from a single manufacturer. The equipment shall be installed in accordance with the Specifications, manufacturer's recommendations and best industry practice. Controls shall be installed complete with all supports, mounting brackets and hardware, conduit and wiring, terminations, etc. to provide a complete and properly functioning installation.
- B. Conduits, raceways, wiring, junctions for control and signal wiring shown on Electrical Drawings are provided therein. All additional conduit required for a complete installation shall be provided under this specification section.
- C. As part of his testing, the CONTRACTOR shall assume the responsibility of testing of all electrical work associated with this system.
- D. Controls shall be correctly interfaced to the system and equipment to which they are associated and connected. Mounting brackets and/or stands, hardware, anchors and appurtenances shall be furnished and installed as required.

1.02 RELATED SPECIFICATIONS

- A. All work of this Division shall meet the requirements of the following related Sections and Divisions.
 - 1. Division 15
 - 2. Division 16 – Electrical

1.03 SUBMITTALS

- A. The CONTRACTOR shall submit working drawings, shop drawings and material specifications for all equipment and work provided, for the approval of the ENGINEER in accordance with the requirements of Section 01300 and Division 15.
- B. Submit the following items for review and approval by the ENGINEER:
 - 1. Manufacturer's installation, operation and maintenance manuals in accordance with Section 01730.
 - 2. Software, manuals and configuration data for all units requiring programming and/or configuration.

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HVAC INSTRUMENTATION AND CONTROL DEVICES

3. Drawings and descriptions of supports, mounting details and process connections and taps for all instruments.

1.04 WORK NOT INCLUDED

- A. Instrumentation/controls specifically identified in the Contract Drawings as being furnished with mechanical equipment shall be furnished and installed by the vendor or as specified elsewhere in the Contract Documents but will be calibrated and tested under this Section for proper operation and interface with the controls.
- B. Electrical conduit and wire specifically shown on the electrical drawings.

1.05 UNITS

- A. Units shall be as follows:

VARIABLE	UNITS
Temperature	Degree F
Pressure	
- Below Atmospheric	Inches of Hg Absolute
-Near but Below Atmospheric	Inches of Water
- Above Atmospheric	PSIG
-Absolute	PSIA Or Inches of Hg Absolute
Flow	
-Liquids	GPM @ 60 Degrees F
-Gas Or Vapor	SCFM @ 60 Degrees F and 14.7 PSIA
Capacity	0-100%
Heating Load	BTUs

1.06 IDENTIFICATION

- A. Each wall mounted control device shall have mounted adjacent to it an engraved laminated tag, (white with 1/4-inch black letters), indicating system served and equipment tag. Engravings shall be approved by the ENGINEER.

1.07 SIGNALS

- A. Discrete switch closure contacts shall use nominal 120 VAC control voltage. 24 Vdc discrete contact closures shall be used where indicated. All devices shall be rated for 120 Vac as a minimum. Contact rating shall be 2 amp minimum unless otherwise noted.

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HVAC INSTRUMENTATION AND CONTROL DEVICES

PART 2 – PRODUCTS

2.01 PANEL MOUNTED INSTRUMENTS

- A. Current Switch Alarms (alarm trips): The CONTRACTOR shall furnish and install current switch as stated herein.

2.02 AUTOMATIC TEMPERATURE CONTROL DEVICES

- A. Thermostats: The CONTRACTOR shall furnish and install room thermostats in all areas unless otherwise noted, in accordance with the following.
 - 1. Function: Temperature based on / off control of heating and cooling equipment.
 - 1. Type: Industrial, single or two stage, line voltage on / off control.
 - 2. Switch Type: Single or dual, sealed, snap action contacts.
 - 3. Contact Rating: 120Vac, 7.4A.
 - 4. Operating Range: 35 - 100 degrees F.
 - 5. Maximum Ambient: 145 degrees F.
 - 6. Enclosure: NEMA 4X; clear plastic cover; tamper proof setting dial, visible through cover; external mounting tabs.
 - 7. Sensor: external coiled capillary, tinned copper/ corrosion resistant.
 - 8. Adjustments: Internal set point, adjustable interstage differential.
 - 9. Provide separate HAND-OFF-AUTO switch in NEMA 4X enclosure as required.
 - 10. Manufacturer / Model: Honeywell T631F, G, or approved equal.
- B. Thermostats (Electrical Rooms): The CONTRACTOR shall furnish and install room thermostats in control rooms in accordance with the following.
 - 1. Function: Temperature based on/off control of cooling equipment.
 - 2. Type: Commercial, line voltage on/off control.
 - 3. Switch Type: Snap action contacts.
 - 4. Contact Rating: 120Vac, 7.4A.
 - 5. Operating Range: 50 - 80 degrees F.
 - 6. Mounting: Vertical on recessed electrical box.
 - 7. Enclosure: external set point display and thermometer, moisture and fungus resistant.
 - 8. Sensor: internal, bimetal.
 - 9. Adjustments: removable set point knob, adjustable differential (as required).
 - 10. Accessories: Manual switching sub-base with HAND-OFF-AUTO switch.
 - 11. Manufacturer / Model: Honeywell T6 Pro Series or approved equal.

PART 3 - EXECUTION

3.01 GENERAL

- A. It is the purpose and intent of these Documents that all penetrations, supports, and the installation of controls shall be provided under this Contract.
- B. The CONTRACTOR shall coordinate all controls which are in the same control loop. These instruments shall be of the same manufacturer and/or shall be fully matched.

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HVAC INSTRUMENTATION AND CONTROL DEVICES

- C. Instruments and controls shall contain no mercury in any quantity for any purpose.

3.02 LOCATION

- A. Control equipment locations indicated on drawings are diagrammatic. Actual locations shall be as close to the drawing locations as possible, in accordance with the manufacturer's recommendations, field verified and approved by the ENGINEER.
- B. Location and mounting detail drawings for all equipment shall be submitted to the Engineer for review and approval prior to any work commencing.
- C. Transmitters, electronic indicators, etc. and any device requiring routine access and maintenance shall be wall or stand mounted at between 4-1/2 and 5 feet.
- D. Equipment shall be installed in locations approved by the Engineer and out of the way of potential damage. Items shall be installed so as to provide ease of maintenance and operation. Equipment shall not be installed where it impedes access or egress within an area. In addition, the installation shall not block or impede maintenance or operational access to other equipment.

3.03 MOUNTING

- A. All instruments and equipment shall be securely and rigidly supported and mounted. Equipment shall be supported by structural members and not from other equipment or systems. When instruments such as gauges and switches are supported by pipe nipples, the pipe size shall be 1/2 inch minimum to the process pipe. Where shown on the drawings, mounting details shall be followed. All equipment specified under this Section shall be installed per the Contract Documents, manufacturer's recommendations and standard industry practice. When installation methods are not shown or specified, the manufacturer's recommendations shall be used after review and approval by the Engineer. All mounting and supporting hardware and appurtenances shall be furnished and installed under this Contract.

3.04 ELECTRICAL REQUIREMENTS

- A. Instruments requiring electrical power or signal connections shall have sufficient length of flexible conduit and wire to allow easy removal without disconnection from the system. Flexible connections shall be a minimum of 12 inches and a maximum of 24 inches long unless otherwise approved by the Engineer in writing.
- B. Electrical connections of wires to instruments shall be by screw terminal. When an instrument or devices terminals will not accept a #12 awg control or power wire, or when factory installed pigtails are provided, a suitable junction box, in accordance with Division 16 and area classification, shall be furnished and installed with and connected to the instrument.
- C. All instruments requiring 120 Vac power shall be supplied with an external power disconnect switch and surge suppressor. The switch and suppressor shall be

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HVAC INSTRUMENTATION AND CONTROL DEVICES

rated NEMA 4X and fabricated of stainless steel. Under this Contract the instrument shall be connected to the switch and isolator using 3/4-inch liquid tight flexible metal conduit and #12 awg conductors. In hazardous areas all work shall comply with the NEC and electrical specifications. Coordinate all installations with electrical installer.

3.05 ADJUSTMENT AND CLEANING

A. General

1. The System Supplier shall comply with the requirements of Division 1 and Division 15 of these Specifications and all instrumentation and control system tests, inspection, and calibration requirements for all instrumentation and controls provided under this Contract and specified herein. The Engineer, or his designated representative(s), reserve the right to witness any test, inspection, calibration or start up activity. Acceptance by the Engineer of any plan, report or documentation relating to any testing or commissioning activity specified herein shall not relieve the CONTRACTOR of his responsibility for meeting all specified requirements.
2. The System supplier shall provide the services of factory trained technicians, tools and equipment to field calibrate, test, inspect and adjust each instrument to its specified performance requirement in accordance with manufacturer's specifications and instructions. Any instrument which fails to meet any Contract requirements, or any published manufacturer performance specification for functional and operational parameters, shall be repaired or replaced, at the discretion of the Engineer, at no cost to the owner. The CONTRACTOR shall bear all costs and provide all personnel, equipment and materials necessary to implement all installation tests and inspection activities for equipment specified herein.
3. At least 60 days before the anticipated initiation of installation testing, the CONTRACTOR shall submit 2 copies to the Engineer of the detailed description of the installation tests to be conducted to demonstrate the correct operation of the instrumentation supplied hereunder.

END OF SECTION 15910

SECTION 15911

HVAC CONTROL PANELS, ENCLOSURES AND DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. The CONTRACTOR shall furnish, install, test and place in satisfactory operating condition, control panels, equipment enclosures and associated devices as indicated in the Specifications, and as shown on the Contract Drawings. The term enclosures shall apply to both equipment enclosures and control panel enclosures. All control panels and equipment enclosures shall be designed, assembled and furnished by the CONTRACTOR. The equipment shall be installed by the CONTRACTOR in accordance with the specifications, manufacturer's recommendations, Contract Drawings and best industry practice, together with all wiring, terminations, etc. to interface all instrumentation and controls, as required. Panels and enclosures shall be installed under the direct supervision of the CONTRACTOR. Mounting equipment such as brackets, stands, hardware and appurtenances shall be provided as required.
- B. This Section describes the requirements for all control panels and equipment enclosures housing control and instrumentation equipment, PLC, I/O and network hardware, operator interface terminals, wiring, terminals, etc. supplied for this contract, and the following:
 - 1. Control Panel Fabrication.
 - 2. Equipment Enclosures.
 - 3. Control Panel Equipment and Devices.

1.02 RELATED SPECIFICATIONS

- A. All work of this Division shall meet the requirements of the following related Sections and Divisions.
 - 1. Specification 15910 - Instruments and Devices.
 - 2. Specification 15951 - Testing, Balancing and Adjusting.

1.03 SUBMITTALS

- A. Submit working drawings, shop drawings and material specifications for the approval of the Engineer in accordance with the requirements of Section 01300.
- B. The CONTRACTOR shall submit the following items as a minimum for review and approval by the Engineer:
 - 1. Detailed fabrication drawings of all equipment provided under this Section. Drawings shall show materials; all dimensions both internal and external; internal equipment layout, dimensions and spacing; power input and wiring terminal locations; mounting location, heights, finishes and installation details.
 - 2. Detailed data sheets, installation manuals, instruction and operation manuals, manufacturer's literature, options and all other pertinent information for all equipment provided under this Section.
 - 3. Complete schematic wiring diagrams and internal point to point wiring diagrams for all units.
 - 4. Factory and field testing procedures and certified results.

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1.04 SHIPPING AND STORAGE

- A. Each panel shall be identified with purchaser's complete order number and tag number on a metal tag securely wired to the panel. Each component requiring identification for proper assembly shall be tagged separately.
- B. Panel shall be so packaged and packed that, with customary handling, it will be protected from damage in shipment. Each shipping section shall be mounted on skids.
- C. Before packing, all equipment shall be clean and dry.
- D. All electrical wiring leads between panel sections shall be clearly marked for reassembly and shall be coiled and rigidly held within the panel framework.
- E. Special handling instructions shall be conspicuously placed on all equipment requiring unusual handling and shipping care.
- F. In general standard panel instruments such as indicators, which can be damaged during transit shall be removed and shipped separately.
- G. When equipment is transported to the job site by ship, the following shall apply:
 - 1. All equipment shall be shipped as below deck cargo.
 - 2. Whenever practicable, panels shall be bolted to container frames. All exposed tubing, wiring, and instruments shall be protected by padding. Containers shall be lined with water proofing materials.
 - 3. Instruments shipped separately shall be packed in moisture-proof containers with a desiccant and held in a fixed position with packing.
 - 4. Crates and boxes shall be reinforced with steel straps. Crates and boxes with a net weight in excess of 400 lbs. shall have diagonal bracing on all faces. When net weight is in excess of 500 lbs., skids shall be bolted to the container frames.
- H. All equipment, once assembled, whether stored at the factory, on site or at a remote location, shall be kept protected and free from damaging environmental conditions. Unless otherwise specified, equipment shall be kept in a dry, dust free, temperature controlled area, free from temperature and humidity fluctuations, and in accordance with the equipment manufacturers recommendations. As a minimum, temperature shall be kept above 55 degrees F and no condensation shall occur.

PART 2 EQUIPMENT

2.01 GENERAL REQUIREMENTS

- A. The CONTRACTOR shall furnish and install control panels and enclosures to house all instrument, control and electronic equipment, wiring, terminals and accessories. Control panels and enclosures shall be provided as stated herein. Control panels and enclosures shall be assembled, wired, and tested in the CONTRACTORS own or other ENGINEER/OWNER approved facility of his choosing. All components and all necessary accessories such as power supplies, power conditioning equipment, mounting hardware, input and output terminal blocks, plug strips, relays, lighting,

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circuit breakers, fuses, etc., which may be required to complete the system shall be provided. Internal layout and internal point to point wiring for typical panels shall be identical.

- B. Unless otherwise indicated, panels, enclosures and all exposed panel mounted devices, shall have a minimum of a NEMA 12 rating. Enclosures shall be formed or welded construction, reinforced with Unistrut, Powerstrut, or approved equal to stiffen panels and doors and facilitate mounting of internal components or equipment. Enclosures shall be 16 USS gauge for units with all dimensions 24 inches or less, 14 USS gauge for units with all dimension greater than 24 inches and less than 48 inches. Enclosures with any dimension of 48 inches or more shall be 12 USS gauge. All floor mounted units shall be 12 USS gauge and shall be provided with jackscrews for leveling. For large and floor standing panels, each shipping section shall be provided with four removable lifting lugs.
- C. Doors shall be formed, with welded continuous hinged swing type with the hinge running vertically. Door swing shall be a minimum of 165 degrees. Door closure hardware on NEMA 12 units shall be a three-point closure system with single external lockable handle. Multiple clamp type closure is acceptable for small enclosures containing only terminals or non-maintenance items. NEMA 4 and 4X units shall have multiple clamp type closures on three sides of the door with padlock accessories and locks. Sufficient doors and access panels shall be provided to facilitate maintenance and testing of the control equipment. All doors shall be fitted with common keyed locks. The door edges and panel opening shall be rolled to prevent the entrance of water and debris when panels are opened.
- D. The use of prefabricated, standard "Hoffman" type industrial enclosures is acceptable. The enclosures shall be purchased factory finished as required herein.
- E. Provide additional stiffeners or separate mounting panels for OIT units mounted in panels.
- F. Steel members shall be provided in the back of the panel for rigidity and support of wiring, accessories, etc. Stiffeners shall be welded to the back face of the panel where required. Stiffeners shall not interfere with instrument installations and weld marks/discoloring shall not be visible. Sufficient stiffeners and/or supports shall be provided so that the panel face does not distort due to the weight of the instruments or equipment.
- G. All equipment and devices shall be identified with engraved nameplates both inside and out. The equipment shall be mounted such that service can occur without removal of other equipment. Face mounted equipment shall be flush or semi-flush mounted and gasketed, with flat black escutcheons. All equipment shall be accessible such that adjustments can be made while the equipment is in service and operating.
- H. The Contract Drawings show approximate dimensions of control panels and preferred front layout. The CONTRACTOR shall be responsible for detailed design of all control panels and enclosures. All panels and enclosures shall have a minimum of 6 inches of clear perimeter gutter space from internal equipment

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(including terminal strips and wireway) to the enclosure wall. Enclosures with a dimension greater than 36 inches shall have a minimum of 12 inches clear gutter space. Panel enclosures shall not be crowded. Ample space shall be provided between components to allow for heat dissipation and servicing. The internal components shall be arranged such that they can be serviced without removing other components.

- I. All control panels shall have a single power supply entry point and a power disconnect switch. Control devices shall be mounted in functional groups in accordance with good panel design practice so as to present a neat and functional appearance and so as to be readily identifiable and accessible for adjustment and service. The panel arrangement shall be approved by the Engineer.
- J. All panels and enclosures shall have sub plates and sub panels for mounting equipment. These shall be USS gauge #10 minimum and painted gloss white. A bonding jumper to the enclosure, of #10 AWG copper wire or braid shall be provided.
- K. Cut outs shall be made, without distorting the face of the panel, to the dimensions and tolerances specified on the instrument manufacturer's certified drawings. Cutouts shall be saw cut or punched smooth and straight, or round as required, parallel to the panel sides and ground smooth and free from burrs. Flame cutting will not be accepted. Both the front and back surfaces of the panel face near the cut outs shall be level to permit proper instrument installation.
- L. Panels shall be furnished with red laminated plastic warning signs in each section. The sign shall be inscribed "WARNING This Device Is Connected To Multiple Sources Of Power". Letters shall be 1/2 inch high, white.
- M. Floor mounted panels shall be free standing, requiring no external bracing or support. Angle Iron framing shall be provided at the bottom part of each panel. The framing shall be box construction, with all corners fully welded, and shall be reinforced with additional members as required to prevent buckling or distortion of the frame or the panel face due to normal handling during transportation and final assembly. The bottom 12 inches of floor mounted panels shall have no equipment or terminals located there.
- N. The rack framework shall be welded steel construction 1 5/8 x 5/8 inch using Powerstrut, Unistrut, or approved equal and/or angle iron to provide a rigid assembly. Racks shall be of open, box like framework with all frame supports welded and ground smooth. Steel straps shall be used for locating terminal blocks. The terminal blocks shall be factory assembled on a miniature mounting channel and the channel bolted to the steel strap.
- O. The joints at the bottom of the panel shall be even and flat to within 1/16 inch. Care shall be taken that the weight of each section is carried by the framework, and not by the bottom edge of the panel face.
- P. Panels, which are mounted on concrete slab shall be furnished with base bolt holes at the channel base for use in anchoring the panel to the slab. Removable lifting

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lugs shall be provided at the top of each panel. All mounting hardware and anchors shall be of 316 stainless steel.

- Q. Floor standing panels shall have solid bottoms. Panels in control rooms shall have all wireways brought directly into the panel bottom.
- R. All panels and enclosures shall be provided with a steel pocket for keeping drawings. One extra set of the as built drawings shall be provided and kept in the panel.

2.02 ELECTRICAL REQUIREMENTS

- A. All control panels and enclosures shall be powered by 120 vac unless otherwise specified. UPS protection shall be provided as indicated and will be supplied under this Contract. Panels and enclosures containing operator interface terminals shall have UPS protection for the OIT. The UPS shall be provided in accordance with Division 16.
- B. The wiring terminals shall be rail mount, screw type lift plate or suitable for solderless horseshoe connectors and rated at least 20 amps at 600 volts. The screws for solderless terminals shall be # 8 minimum. They shall be marked with a permanent, continuous marking strip from end to end with the numbers appearing on the approved shop drawings. One side of each terminal strip shall be reserved exclusively for field wiring. Common connections and jumpers required for internal wiring shall not be made on the field side of the terminal. Subject to the approval of the Engineer/Owner, a vendor's pre-engineered and prefabricated wiring termination system will be acceptable. Terminals for field wires shall be provided in an easily accessible area of the panel. Terminal blocks for current transformer circuits shall be the shorting type. Shorting terminal blocks shall be provided for all C.T. circuits when entering or leaving the panel.
- C. Wiring shall comply with accepted standard instrumentation and electrical practices. For each pair of parallel terminal blocks, the field wiring shall be between the blocks. Lift plate or box type terminals shall be used for connecting wires to terminal blocks. Solderless horseshoe connectors with insulating sleeves and # 8 bolt hole shall also be acceptable. The terminals for field wiring shall be properly sized UL approved to accept field wires of #12 gauge. Fused terminal blocks of the same style shall be used for all output connections to field devices.
- D. All wiring shall be enclosed in vented plastic wireway with covers. Wireways shall not be filled to more than 40% of capacity. Where wireway is not possible, conductors shall be run open and shall be bundled and bound at regular intervals, not exceeding 6 inches with nylon cable ties. The bundles shall be secured at intervals not to exceed 12 inches. Care shall be taken to separate electronic signal, discrete signal, and power wiring. Where wiring crosses on to a hinged panel, the wiring shall be bundled and run vertically along the hinge as long as possible to better distribute the twisting forces. The bundle shall be secured at both ends to the panels.

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- E. Interior panel wiring and field wiring shall be color coded and tagged at all terminations and devices with machine printed plastic sleeves. The wire number shall be as indicated on the approved shop drawings.
- F. All incoming and outgoing wiring shall terminate on panel terminal blocks unless approved otherwise in writing by the Engineer. The CONTRACTOR shall furnish all wiring between panel mounted instruments and the terminal blocks. Terminal blocks shall be rated at least 600 volts, 20A, Square D Type G, or approved equal.
- G. At shipping joints, interpanel wiring shall be completely installed, terminated with terminals, identified, factory tested and then coiled back for shipping.
- H. All wiring to devices mounted on enclosure doors shall be extra flexible and enough slack must be provided to prevent any tension when doors are at maximum opening. Wiring bundles run from panels to doors, shall be run lengthwise along the hinge to spread the opening torque along the greatest length of cable. Permanent cable anchors shall be provided at both ends of the cable to eliminate any torque being applied to wiring terminals.
- I. All wire mounts shall be either Epoxy glued or screwed to the equipment mounting plate. Screws shall not penetrate the enclosure. Stick on or self-sticking wire mounts will not be acceptable.
- J. For incoming wiring provide enclosed wiring troughs in the panel reserved for incoming field wires and wireways from the troughs direct to instrument terminals. Provide these troughs at bottom of panel if incoming wiring is from below.
- K. Terminal block layout shall be such as to provide ample access to wiring during installation, checkout, and maintenance. Minimum spacing between adjacent terminal blocks and/or panel edge shall be 6 inches. A minimum of 6 inches space shall be provided at the top and bottom of panels and enclosures.
- L. Duplicate terminals shall be provided on the panel for common field wires (such as annunciator common, AC power leads, neutrals, etc.) to limit the maximum number of wires on a terminal to two. Spare terminals equal to not less than 25% of the required points shall be furnished. Jumpers if required shall be connected to the panel manufacturer's side of the terminal blocks.
- M. All incompatible circuits (such as low level signals) shall be separated from power circuits and/or each other with separate slotted wireway and junction boxes.
- N. Wire for 120 Volt, 60 Hz control circuits shall be minimum No. 14 AWG stranded copper, NEC type MTW/THHN with 600 Volt insulation, and minimum 90 degree C rating. AC power wiring shall be 12AWG minimum. Internal wiring for panels controlling 4160 volt equipment, main pumps, blowers, switchgear. etc. shall be wired using 14 AWG tinned copper SIS wire. Wiring for current transformer circuits shall be 10 AWG tinned copper SIS and shall be yellow. Wiring for potential transformer circuits shall be 12 AWG SIS.

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- O. Wire for 24 volt DC Signals shall be minimum No. 16 AWG stranded tinned copper, shielded twisted pairs. Where terminated or connected, the end of the jacket and shield shall be sealed with heat shrink tubing.
- P. All AC and DC control and power wiring as well as all signal wiring, shall be tagged on both ends. Where contract documents have not specified wire numbers, the wire numbering scheme from the approved shop drawings shall be used. Terminals on panel terminal blocks shall be identified with a terminal block number and terminals shall be in sequential order.
- Q. Instrument transmission and control wires and associated panel terminal shall be identified with the instrument tag number, function, and polarity.
- R. Indicating lights color shall be as follows:

COLOR	FUNCTION
RED	RUNNING, BREAKER CLOSED
RED (FLASHING)	ALARM
GREEN	MOTOR OFF, BREAK OPEN, VALVE CLOSED
WHITE	CONTROL POWER ON
BLUE	VALVE OPEN

- S. Where indicated or required by codes, all panels and panel mounted equipment shall be explosion proof.

2.03 POWER DISTRIBUTION

- A. Electrical power shall be distributed throughout the panel and field instrumentation requiring 120 VAC, 60 Hz, by means of a power distribution panel or individual fuses. There shall be a common power disconnect switch.
- B. The number of circuit breakers or fuses shall depend upon the process functional requirements. The circuit breakers shall be arranged in neat functional groups so that an overload or short circuit inside the panel shall disable only a part of the process. As a minimum, circuits pertaining to one piece of equipment shall be fused or protected separately to allow servicing of that piece of equipment without affecting others.
- C. Surge protectors and power conditioners shall be provided for all electronic equipment located inside the panel. To provide protected power at a level that is safe for all connected equipment.
- D. An additional 120 vac duplex receptacle shall be provided in any panel or enclosure which contains equipment that requires programming or calibration. This shall be for powering laptop computers and test equipment only.

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2.04 GROUNDING

- A. Each panel mounted device shall be bonded or otherwise grounded to the subpanel on which it is mounted by means of machine threaded screws with locknuts, lock washers or other pressure mounting methods.
- B. Each panel shall be provided with at least two copper ground busses, one for AC instrument power (normally 115 VAC 60 Hz) grounds and one for DC signal grounds. The DC ground bus must be electrically isolated from the panel board.
- C. The DC ground bus shall be connected to a remote grounding rod by means of an independently run #2 AWG insulated copper ground wire.
- D. Ground busses shall be minimum 1/4-inch x 1 inch x 8 inch with two (#2/0) AWG lugs for connection to plant grounding system. These grounding busses shall be predrilled for connection of instrument, panelboard, or cable shield connection.
- E. When panel or field wiring for electronic instruments is specified shielded, a shield terminal shall be provided for each control loop at the terminal strip connection to and from field instruments. Shields shall be connected through the field terminal strip and continued to the equipment connection. Each shield shall be grounded at one point only, and this ground connected to the DC ground bus in the panels or as required by the equipment manufacturer.
- F. Subpanels for mounting of internal equipment, enclosure doors and all internal metal objects shall be grounded by means of a #10 AWG bonding jumper.

2.05 CONTROL LOGIC

- A. Control logic shall be performed using relays and/or PLCs as indicated and required. When not so indicated, logic shall be performed using hardwired relay logic and shall be monitored by the PLC.
- B. The control logic for fan/damper control, stop/start operation of heating and ventilating units, dehumidification units, Supply and Exhaust fans shall be implemented using relay logic with PLC monitoring as indicated and PLC generated start/stop commands when in workstation (remote) mode.

2.06 ENCLOSURE MATERIALS, TEMPERATURE CONTROL AND AREA CLASSIFICATION

- A. Enclosures for outdoor service shall be 304 SS NEMA 4X weatherproof construction with clear polycarbonate framed window in hinged and gasketed door to permit full view of all enclosed instrumentation and/or controls without opening. All doors shall be fitted with common keyed locks. Panels shall be suitable for wall or pipe mounting. Panels shall be insulated and equipped with thermostatically controlled internal space heaters for severe winter service. Heaters shall maintain 50 degree F interior temperature at a 0 degree F ambient temperature. Fiber glass enclosures will not be accepted.

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- B. Enclosures located inside electrical equipment rooms, administrative areas or air conditioned control rooms in non contaminated areas as well as floor standing panels containing an OIT, shall have a minimum of a NEMA 12 rating and shall be corrosion resistant. Corrosion resistant enclosures shall be made of 316 SS, or steel, coated with a powdered resin which is heat-cured 100% solid thermosetting epoxy.
- C. Enclosures used in all other areas, except hazardous locations, shall be rated NEMA 4X and shall be fabricated out of 316L stainless steel unless otherwise indicated. All the devices and hardware on the front of NEMA 4X rated panels will be specifically NEMA 4X rated. Splash-proof equipment and hardware shall not be acceptable for mounting on NEMA 4X panels. All enclosures shall include sealed gasketed doors to protect internal equipment from outside air.
- D. All enclosures containing heat generating equipment shall include integrally mounted fans to circulate the air within the enclosure and remove heat from the modules. Enclosures and doors shall be designed to dissipate heat through their exterior surfaces into the plant environment. Air shall not be exchanged between the enclosure's interior and the outside environment. Alternatively, cooling air can be drawn from non-contaminated area.
- E. Enclosures and panels located in areas where chlorine liquids or gasses are handled stored or transported, shall be fabricated out of a material suitable for use in such an atmosphere. Material selection shall be approved by the Engineer.

2.07 CONTROL, SELECTOR AND PUSH BUTTON SWITCHES

- A. Switches and push-button type operators shall be rated for the enclosure in which they are mounted. As a minimum, all devices shall be NEMA 12 and 13, oil and water tight. Switches and operators mounted in NEMA 4X panels shall have a NEMA 4X rating. All operators used on the project shall be from one manufacturer and shall be the same line.
- B. Devices shall be of the 30.5 mm type rated for extra heavy duty service.
- C. Selector switches shall have gloved hand operating handles.
- D. Push buttons shall be of the guarded type except those being used for stop control.
- E. Emergency stop push buttons shall be Push-Pull type with maintained contacts.
- F. Control and selector switches for control of 5 KV equipment and circuit breakers shall be switchgear duty control switches General Electric SB1, SBM or approved equal. Circuit Breaker trip control switches shall have 2 parallel contacts. Close switches shall have 2 series contacts. Normal after close and normal after trip contacts shall be provided.
- G. Control switches, selector switches, push buttons, etc. for use in explosion proof (NEMA 7) panels and/or equipment located in hazardous areas shall be rated explosion proof for use in Class 1 Division 1 atmospheres.

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2.08 INDICATING LIGHTS

- A. Indicating lights shall be 120 volt transformer type, with replaceable high intensity L.E.D. type lamp, unless otherwise noted.
- B. Indicating lights shall be rated for the enclosure in which they are mounted. As a minimum, all devices shall be NEMA 12 and 13, oil and water tight. Indicating lights mounted in NEMA 4X panels shall have a NEMA 4X rating. All indicating lights used on the project shall be from the same manufacturer as the operators specified above and shall be the same line.
- C. Devices shall be of the 30.5 mm type rated for extra heavy duty service.
- D. Indicating lights shall be push to test type. The push to test feature shall not interact with any other circuitry.
- E. Indicating lights for use in explosion proof (NEMA 7) panels and/or equipment located in hazardous areas shall be rated explosion proof for use in Class 1 Division 1 atmospheres and shall be push to test type.

2.09 RELAYS

- A. General purpose control relays shall be the socket mounted type for DIN rail mounting. Relays shall be tube socket or quick connect square base type. Miniature relays are not acceptable. Each relay shall have a minimum of two or three single pole double throw contacts each rated 5 or 10 amps as required. The relays shall have a push to test feature and a coil indicating light. Potter & Brumfield KRP, KUP, or approved equal
- B. Relays used for control of motors shall have a horsepower rating above that of the connected motor at the appropriate voltage. Motor overload protection shall be provided.
- C. Relays used for emergency shutdown and safety circuits, those common to several pieces of equipment and all relays associated with control or monitoring of 5 KV equipment shall be 4 pole (min.) 600 volt machine tool type. Contacts shall be convertible type with a 10 amp minimum ratings. These units shall be Allen-Bradley class 700 P, or approved equal.
- D. Relays used for control of 5 KV or higher circuit breakers shall be utility grade switchgear control relays having the proper AC and DC ratings. These units shall be General Electric type HGA, HFA, or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. All panels and enclosures shall be mounted straight, level and parallel to building surfaces.

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HVAC CONTROL PANELS, ENCLOSURES AND DEVICES

- B. Wall mounted panels and enclosures shall be securely mounted to walls or columns as indicated. They shall be spaced a minimum of 3/4 inch from the structure using strut or plates.
- C. Stand mounted units shall be supported using steel channel securely mounted to the floor with a minimum of four 1/2-inch stainless steel bolts. Stands shall be secure and level, shall easily support the mounted equipment and shall hold the equipment rigidly.
- D. All free standing control panels shall be installed on a 6 inch wide and 4 inch high reinforced concrete curb with chamfered corners. The curb shall be 1 inch larger than the panel on all sides.
- E. When panels or enclosures are installed on raised computer type floors, additional supports and bracing shall be provided under the floor as required to prevent the floor from being overloaded. Large and/or heavy panels having any dimension larger than 72 inches or weighing 300 lbs or more or where the weight of the completed panel exceeds 80% of the specified load bearing capacity of the flooring, shall be supported from the structural sub floor independently of the raised floor. Provide a welded steel support framework the size of the unit footprint capable of rigidly supporting the weight of the entire panel with a 50% safety factor. The floor system shall be installed flush and level with this frame. Load and bracing calculations shall be submitted for review. It shall be the responsibility of this CONTRACTOR to coordinate floor installation requirements with the appropriate CONTRACTOR. In areas where floor modifications are required, and the floor has already been installed, the CONTRACTOR shall retain the services of an approved flooring subcontractor to make the appropriate modifications at no additional cost to the owner.

3.02 TESTING

- A. All control panels and enclosures provided under this Contract shall be factory and field tested in accordance with all Sections of Specification 15920 - Testing Installation and Start-up.

END OF SECTION 15911

SECTION 15951

TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. The CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified, and required to perform testing, adjusting and balancing of all Heating, Ventilation and Air Conditioning Systems as specified or required for proper operation.
- B. The CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified, and required to perform testing, adjusting and balancing of the odor control system as specified or required for proper operation.

1.02 REFERENCES

- A. Reference Standards: Comply with applicable provisions and recommendations of the following except as shown or specified:
 - 1. ASHRAE (American Society of Heating, Refrigeration and Air Conditioning Engineer's, Inc.), Systems Volume, Latest Edition.
 - 2. Test, adjust and balance systems in accord with:
 - a. Associated Air Balance Council (AABC): National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems (AABC-MN-1).
 - b. National Environmental Balancing Bureau (NEBB): Procedural Standards for Testing Adjusting Balancing of Environmental Systems (NEBB-01).
 - c. AABC "National Standards for Field Measurements, Total System Balance, Air Distribution, Hydronics Systems, Volume One Number 81266".

1.03 SUBMITTALS

- A. CONTRACTOR shall submit working drawings, shop drawings and material specifications for the approval of the ENGINEER in accordance with the requirements of the Section 01300.
- B. Data Sheets:
 - 1. Submit samples of data sheets on each item of equipment for approval.
 - 2. Submit data sheets on each item of testing equipment required.
 - 3. Include name of device, manufacturer's name, model number, latest date of calibration, and correction factors.
- C. Report Forms:
 - 1. Submit specimen copies of report forms for ENGINEER's approval.
 - 2. Forms shall be 8-1/2 by 11-inch paper for loose leaf binding, with blanks for listing of the required test ratings and for certification of report.
 - 3. Reports shall be on the organizations approved forms imprinted with the company's name.

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TESTING, ADJUSTING, AND BALANCING

- 4. Certified report outlining procedure used to balance the system and the types of measuring devices used.
- D. Test results shall be submitted on approved forms in a typed format.
- E. Submit certified copies of required test reports to the ENGINEER for approval.

1.04 QUALITY ASSURANCE

- A. Balancers Qualifications:
 - 1. Submit work experience or resume of proposed biographical data on employee who will directly supervise the Testing, Adjusting and Balancing Work.
 - 2. Submit proof of certification by NEBB (National Environmental Balancing Bureau), AABC (Associated Air Balance Council), or SMACNA (Sheet Metal and Air Conditioning CONTRACTORS' National Association), or demonstrate that the standards and experience required for certification are possessed, all to the satisfaction of the ENGINEER.
 - 3. Submit a record of at least 5 years' experience in the testing and balancing contracting industry, engaged in heating, ventilating, and air conditioning work.

1.05 JOB CONDITIONS

- A. In accordance with the requirements of Division 1 of the Specifications, heating, ventilating, air conditioning equipment shall be completely installed and in continuous operation as required to accomplish the test, adjust, and balance work specified.
- B. Reports shall be certified by the testing ENGINEER that the methods used and the results achieved are as specified.

1.06 CORRECTIVE ADJUSTMENTS

- A. Should corrective measures caused by faulty installation require retesting, adjusting, and balancing, such work shall be performed at no additional expense to the OWNER.
- B. Inspections:
 - 1. Fan Belt Deflection: No less than 1/4-inch or more than a 1/2-inch.
 - 2. Finned Coils: Plate type fins shall be combed out with a fin comb for appropriate fin spacing. Helical fins shall be straightened with blunt bladed instrument.

PART 2 - PRODUCTS

2.01 INSTRUMENTS: GENERAL

- A. CONTRACTOR shall provide all necessary instrumentation, tools, ladders, etc. to complete all air balancing tests and adjustments.

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TESTING, ADJUSTING, AND BALANCING

- B. Instrumentation shall be in accordance with NEBB, AABC, or SMACNA requirements and shall be calibrated to the accuracy standards demanded by these organizations.
- C. Flow-measuring hoods (manufactured, not fabricated) shall be acceptable for measurement of ceiling diffuser performance only.
- D. CONTRACTOR shall assume full responsibility for safe keeping of all instrumentation during the course of work.

2.02 AIR BALANCE INSTRUMENTS

- A. Provide all velometers, anemometers, pitot tubes, differential air pressure gages, manometers, hook gages, static pressure probe units, etc. as may be required to perform all air balance tests of HVAC equipment, ducts, registers, grilles, etc.

2.03 SYSTEM PERFORMANCE MEASURING INSTRUMENTS

- A. Provide insertion thermometers, sling psychrometers, tachometers, revolution counters, clamp-on volt-ammeter recorders, and other instruments as required to measure all facets of the complete HVAC system performance.

PART 3 - EXECUTION

3.01 GENERAL

- A. All testing, adjusting, and balancing of air systems shall be performed in compliance with the standard procedure manual published by the testing, adjusting, and balancing organization affiliated with the CONTRACTOR. CONTRACTOR shall submit one copy of the standard procedure manual to the ENGINEER for his records.
- B. CONTRACTOR shall be solely responsible for the protection and safeguarding of his work and shall provide every protection against accidents, injury, and damage to persons and property.
- C. CONTRACTOR shall keep dust, dirt, and debris to an absolute minimum and reinstall all removed ceiling components to their original positions at the end of each day.
- D. CONTRACTOR shall be fully responsible for removal and reinstallation of ceiling system and replacement of any component damaged.
- E. CONTRACTOR shall install additional access panels at no extra cost to the OWNER, as is required to gain access to equipment concealed above ceilings, behind walls, or any other concealed space.
- F. Air systems shall be tested, adjusted, and balanced with clean filters.

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TESTING, ADJUSTING, AND BALANCING

3.02 INSPECTION

- A. The CONTRACTOR shall perform the following equipment checks.
 - 1. Verify proper overload heater sizes.
 - 2. Verify function of safety and operating controls.
 - 3. Verify proper operation of equipment.
 - 4. Report on inspection, observation and checking procedures.

3.03 TESTING OF PIPING, EQUIPMENT, AND DUCT

- A. In addition to any other references to testing specified in Division 1, the CONTRACTOR shall be bound by this section of the Specification to test and adjust all systems and accessories covered under this Contract. The CONTRACTOR shall also comply with the requirements of testing as outlined in the individual sections. Furthermore, he shall operate and maintain these systems for certain periods of time as specified herein and shall leave them in good working order. The CONTRACTOR shall provide all necessary equipment and labor for this work.
- B. Refrigerant piping must be tested before any piping is insulated or concealed. The entire refrigerant circuit must be thoroughly tested to be sure that it is absolutely tight. The system shall be tested with oil pumped, dry nitrogen. The low side of the system shall be tested at 150 psi and the high side at 300 psi. All pipe joints shall be tapped sharply with a rubber mallet and tested for leaks with a soap solution. After all leaks have been repaired, the system shall be charged with a small quantity of refrigerant and the entire system shall be checked with a halide leak detector. Once the system is found tight, it shall be allowed to stand for 6 hours with the pressure on. If any pressure drop occurs, except those due to changes in ambient temperature, the entire system shall be retested. The system shall be evacuated with a vacuum pump until vacuum of 2.5 mm Hg is achieved. Under no circumstances shall the compressor be used to evacuate the system. After evacuation, the system shall be allowed to stand for 12 hours. If no noticeable rise in pressure occurs, the system shall be charged.
- C. All ductwork systems including air outlets shall be tested, adjusted and balanced for within limits of the required airflows as indicated on Drawings and specified in this Section.
- D. After all final tests have been performed on all equipment and on all sub-systems installed under this Contract, including the testing of all controls specified in other Sections, and after the results from all such testing have been accepted, the CONTRACTOR shall test the overall system by demonstrating its ability to respond properly to normal changes in controlled parameters, as well as to system upsets. To facilitate this, he shall make available a minimum of two men, thoroughly familiar with the systems and equipment installed under this Contract, for a minimum of seven (7) days to test the system by changing controlled parameters and generating system upsets as directed by the ENGINEER and demonstrating that the sequential action appropriate to the particular change or upset occurs automatically. Where actual change or upset is not feasible, the CONTRACTOR shall simulate the change or the upset. Controlled parameter changes shall

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TESTING, ADJUSTING, AND BALANCING

include, but not necessarily be limited to, any change in temperature, pressure, flow rate, fluid level, load, etc., which should result in an automatic change in the position of a control valve or control damper, in the output rate of a piece of equipment, in the normal start-up or shutdown of equipment, etc. The change in the state of the controlled device or equipment shall be shown to result in a corrective action on the controlled parameter. Upsets shall include, but not necessarily be limited to, any condition which should cause annunciation of an alarm, safety shutdown of equipment, startup of standby equipment, closing of fusible-link devices, lifting of relief valves, etc. The CONTRACTOR shall immediately restore to its original state any safety device, the state of which has been changed by its having been tested.

- E. CONTRACTOR shall immediately correct any system deficiency that should come to light during testing.
- F. After the overall system testing has been completed, and after all final adjustments have been made, the CONTRACTOR shall operate and maintain all new systems and equipment, site-wide, associated therewith, for a period of thirty consecutive days. During this period all normal maintenance (filter replacements, strainer cleaning, periodic checks of safety devices, datalogging, etc.) shall be performed by the CONTRACTOR. If, during this period, any work beyond routine maintenance of equipment and materials installed under this Contract, should be required to maintain proper operation of the overall system, the elapsed time shall be forfeited, and a new thirty-day period shall commence following the completion of the corrective action.

3.04 BALANCING AND ADJUSTING

- A. In addition to any other reference to balancing and adjusting specified elsewhere in these specifications, the CONTRACTOR shall be bound by this portion of the specifications to balance, adjust and leave in good working order all systems and accessories covered under this Contract.
- B. The CONTRACTOR shall procure the services of an independent balancing and testing agency which specializes in the balancing and testing of heating, ventilating and air conditioning systems to balance, test and adjust all systems installed under this Section.
- C. The CONTRACTOR shall advise the ENGINEER at least two weeks in advance of the date scheduled for balancing to commence; at the ENGINEER's discretion, the balancing shall be conducted in the ENGINEER's presence.
- D. At least one (1) month prior to the commencement of balancing, the CONTRACTOR shall forward a detailed explanation of the balancing procedure to the ENGINEER for review. In general, the method shall conform to those specified by the Associated Air Balance Council or SMACNA.
- E. All piping systems shall be balanced under this Section to provide the flows indicated on the Contract Drawings or in the Specifications.

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- F. Air systems shall be balanced before refrigerant systems.
- G. Before beginning to balance the air systems the CONTRACTOR shall check, in the presence of the ENGINEER, all filters and coils for cleanliness, dampers (automatic, volume and fire) for correct position, all fans for proper rotation, and temperature controls for minimum completeness to allow for proper balancing. If any of the above or other conditions are found which would not allow for proper balancing the CONTRACTOR shall take the necessary corrective actions, at his own expense, before balancing begins.
- H. All heating, ventilating, and air conditioning systems shall be balanced by the CONTRACTOR by adjustment of dampers, fan sheaves, apparatus and air outlets to provide the air quantities indicated on the Contract Drawings. If necessary, adjustments of air outlets shall be made to eliminate drafts.
- I. Balancing for all air systems shall be accomplished in a manner to first minimize throttling losses, then fan speed shall be adjusted to meet design conditions. All air outlets and fans shall be balanced within 5 percent of the design capacity.
- J. After the systems have been balanced, the CONTRACTOR shall submit and certify to the OWNER, a list containing the following minimum information for air outlets and equipment:
 - 1. Room or facility served.
 - 2. Size, quantity and model of air outlet or equipment.
 - 3. Type of air outlet or equipment.
 - 4. Air flow indicated on Contract Drawings.
 - 5. Air flow measured.
 - 6. Fan cfm indicated on the Contract Drawings.
 - 7. Fan cfm measured.
 - 8. Fan motor running amps.
- K. The CONTRACTOR shall submit all recorded data to ENGINEER for review.
- L. The CONTRACTOR shall adjust any or all equipment which, in the OWNER's opinion, is not set within acceptable limits of ± 5 percent.

3.05 AUTOMATIC CONTROL SYSTEMS

- A. In cooperation with the control manufacturer's representative, set and adjust automatically operated devices to achieve required sequence of operations.
- B. Testing organization shall verify all controls for proper calibration and list those controls requiring adjustment by control system installer.

3.06 MARKING OF SETTING

- A. Following approval of testing, adjusting and balancing (TAB) Verification Report, the setting of all HVAC adjustment devices including valves, and manual dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time.

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TESTING, ADJUSTING, AND BALANCING

3.07 IDENTIFICATION OF TEST PORTS

- A. The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leakage or to maintain integrity of vapor barrier.

END OF SECTION 15951

SECTION 16010

BASIC ELECTRICAL REQUIREMENTS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Basic Electrical Requirements specifically applicable to Division 16 Sections, in addition to Division 1 - General Requirements.

1.02 REFERENCES

- A. The following JEA standards shall also be referenced for additional requirements. Where discrepancies arise between the JEA standards and these specifications, the more stringent requirement shall apply.
 - 1. JEA 2019 Water and Wastewater Standards Manual
 - 2. JEA 2017 Facility Standards Manual

1.03 SCOPE

- A. This scope covers the furnishing, installation, testing, adjusting and placing in operation all electrical equipment, devices, facilities, materials, and auxiliary items necessary for the complete and successful operation of all electrical equipment as herein described, shown on the plans, or deemed necessary for the completion of the electrical portion of the project. It is the intent of Division 16 to outline the electrical requirements of the contract in order to provide the information necessary for the construction of a fully operational system as shown on the plans and as herein described. Electrical scope of work shall include such things as follows:
 - 1. Power/electrical system
 - 2. Standby Diesel Generator System
 - 3. Lighting system
 - 4. Lightning protection system
 - 5. Grounding system
 - 6. Fire alarm and security system materials
 - 7. Control and instrumentation systems
 - 8. Connection of electrically powered mechanical equipment
 - 9. Heat trace systems for control valves
 - 10. Temporary construction power
 - 11. All incidentals necessary for a complete and fully operational electrical system.

1.04 WORKING CLEARANCES

- A. Working clearances around equipment requiring electrical services shall be verified by CONTRACTOR to comply with NEC requirements. Should there be apparent violations of clearances; the CONTRACTOR shall notify the ENGINEER before proceeding with connection or placing of equipment.

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BASIC ELECTRICAL REQUIREMENTS

- B. In the case of panelboards, safety switches and other equipment requiring wire and cable terminations, the CONTRACTOR shall ascertain that lug sizes and wiring gutters or space allowed for proper accommodation and termination of the wires and cables are adequate.

1.05 SAFETY EQUIPMENT

- A. CONTRACTOR shall provide, at the completion of the project and prior to turnover to OWNER, electrical equipment safety mats around each piece of interior electrical equipment with a voltage to ground greater than 50 volts. Mats shall be ¼-inch thick type 11 class 2, with a max voltage of 17,000 volts AC RMS. Mats shall meet ozone, flame, and oil resistance requirements.

1.06 WORKMANSHIP

- A. Workmanship under this Division shall be accomplished by persons skilled in the performance of the required task. All work shall be done in keeping with conventions of the trade. Work of this Division shall be closely coordinated with work of other trades to avoid conflict and interference.

1.07 PROTECTION OF ELECTRICAL EQUIPMENT

- A. Electrical equipment shall be protected from the weather, especially from water dripping or splashing upon it, at all times during shipment, storage and after installation. Should any apparatus be subjected to possible injury by water, it shall be thoroughly dried out and put through a dielectric test, at the expense of the CONTRACTOR, to ascertain the suitability of this apparatus. The results of the test shall be submitted to the ENGINEER and if the apparatus is found to be unsuitable, the CONTRACTOR shall replace it without additional cost to the OWNER.
- B. Electrical equipment space heaters and motor space heaters shall be energized during storage periods and prior to being placed into operation to prevent moisture and condensation from damaging internal components.
- C. Where indicated on the contract drawings, the CONTRACTOR shall supply a lockable steel cabinet for storing all project spare parts as listed and required within these specifications. Cabinet shall be sized sufficiently to house the spare parts plus an additional 20 percent spare capacity.
 - 1. Spare parts cabinets located within conditioned spaces such as electrical equipment rooms shall be NEMA 1.
 - 2. Spare parts cabinets located in unconditioned spaces such as pump rooms shall be NEMA 12.

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BASIC ELECTRICAL REQUIREMENTS

3. No spare parts cabinets shall be installed in hazardous areas or outdoors.

1.08 UTILITIES

- A. The electrical CONTRACTOR shall install a fully operational electrical service as described in the plans.
- B. Arrange with the utility company for the services and install the services in accordance with their requirements, regulations and recommendations.

1.09 WARRANTY

- A. The CONTRACTOR shall warranty all other electrical systems, materials and unless otherwise noted, workmanship to be free from defects for a period of one (1) year from the date of substantial completion, unless noted otherwise in specific sections. He shall correct all defects arising within this period upon notification by the OWNER or ENGINEER, without additional compensation.
- B. It is understood that the rights and benefits given the OWNER by the warranties found in the technical specifications are in addition to and not in derogation of any rights or benefits found in the special and general provisions of the contract.

1.10 TEMPORARY POWER AND LIGHTS DURING CONSTRUCTION

- A. It shall be the responsibility of the CONTRACTOR to provide and maintain adequate temporary power and lighting at all times during construction, so that the various other trades can accomplish their work in a flawless manner and to maintain at all times plant operations. Particular attention will be given to power and lighting for masonry, drywall, painting, tile work and any other finish work.

1.11 MATERIAL STANDARDS

- A. Material shall be new and comply with standards of Underwriters' Laboratories, Inc., where standards have been established for the particular product and the various NEMA, ANSI, ASTM, IEEE, AEIC, IPCEA or other publications referenced.

1.12 TEST EQUIPMENT

- A. The CONTRACTOR shall provide for its own personal use all test equipment and supplies deemed necessary by the ENGINEER at no extra cost to the OWNER. Test equipment shall not become the property of the OWNER. These supplies shall include but not be limited to the following: volt meters, amp meters, clamp-on ground rod test meter, light meters, generator load banks and temporary cables, watt

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BASIC ELECTRICAL REQUIREMENTS

meters, harmonic distortion test equipment, thermal image camera, megger tester, high pot test equipment, power quality analyzers, recording power meter, and oscilloscopes. These supplies will not become the property of the OWNER.

1.13 REFERENCES

- A. ANSI/NFPA 70 – National Electrical Code.
- B. ANSIC2 – National Electrical Safety Code.
- C. NEMA – National Electrical Manufacturer's Assoc.
- D. UL – Underwriters Laboratories
- E. NFPA – National Fire Protection Assoc.
- F. IEEE – The Institute of Electrical and Electronics Engineers
- G. IESNA – The Illuminating Engineering Society of North America
- H. NETA – International Electrical Testing Association
- I. API – American Petroleum Institute
- J. AGA – American Gas Association
- K. Recommended Standards for Water Works and Wastewater Facilities (10 State Standards) as published by Great Lakes – Upper Mississippi River Board of State Public Health and Environmental Managers.

1.14 SUBMITTAL

- A. Submit under provisions of Section 01300 the following certification:
 - 1. The CONTRACTOR installing all electrical work shall review and approve all electrical shop drawings prior to submittal to the ENGINEER for review. As part of the review, the installer shall certify the following:
 - a. I hereby certify that the (equipment) (material) (article) shown and marked in this submittal is in compliance with the contract drawings and specifications, can be installed in the allocated space, will be stored in accordance with the manufacturer's recommendation, will be installed per NEC, and is submitted for approval.

Certified by: _____ Date: _____

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BASIC ELECTRICAL REQUIREMENTS

- b. Contractor shall state clearly in each submittal any deviations from the contract documents, referencing applicable specification sections and reasoning for deviation. Deviations are contingent upon ENGINEER review and approval.
- B. Submit shop drawings and product data grouped to include complete submittal of related systems, products, and accessories in a single submittal to the requirements of Section 01300. No electrical work may be performed until shop drawings are approved. Submit shop drawings in accordance with the requirements of the respective division 16 specification section included as part of these project documents. Included are such things as:
 - 1. Low Voltage Power/Electrical System
 - a. Motor controllers
 - b. Power distribution equipment
 - c. Conduit and Conduit Fittings
 - d. Wire
 - e. Pull Boxes
 - f. Circuit Breakers
 - g. Disconnects
 - h. Fuses
 - i. Conduit Support Systems
 - j. Wiring Devices
 - k. Transformers
 - l. Surge Protection Equipment
 - m. Arc Flash Study
 - n. Breaker Coordination Study (BREAKERS OR FUSES WILL NOT BE APPROVED WITHOUT AN APPROVED COORDINATION STUDY)
 - 2. Lighting System
 - a. All Light Fixtures
 - 1) Computer Printout of Lighting Layout
 - 2) Sample Fixture (as directed by ENGINEER)
 - 3) IES Photometric Files
 - b. Poles and Foundations
 - 3. Miscellaneous Electrical Equipment
 - a. Miscellaneous Electrical Parts
 - 4. Drawings
 - a. Coordination drawing of all electrical areas
 - b. Conduit layout drawings
 - c. Duct drawings
 - d. As-Built Drawings
 - 5. Delegated Engineering
 - a. Lightning Protection System

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BASIC ELECTRICAL REQUIREMENTS

- 1) Drawings provided as part of this CONTRACT are diagrammatic in nature and intended for bidding purposes only. The CONTRACTOR shall contract with a SUBCONTRACTOR who is a member of the Lightning Protection Institute and certified by LPI to design and install lightning protection systems in accordance with LPI Standard 175 and NFPA 780.
- b. Fire Alarm System
 - 1) Drawings provided as part of this CONTRACT are diagrammatic in nature and intended for bidding purposes only. The CONTRACTOR shall contract with a SUBCONTRACTOR who is a licensed fire alarm contractor by the State of Florida and experienced with Potter fire alarm systems. The Delegated Fire Alarm Engineer shall design and install the complete fire alarm system and components in accordance with current edition of FBC, NFPA, OWNER Standards, and local AHJ requirements. All delegated engineering shall be signed and sealed by a Florida P.E.
- C. Mark dimensions and values in units to match those specified.

1.13 REGULATORY REQUIREMENTS

- A. Conform to applicable sections of the Building Code and all local rules, regulations and ordinances.
- B. Obtain permits and request inspections from authority having jurisdiction.

1.14 FINAL INSPECTION AND TESTING

- A. After the electrical installation is complete, the CONTRACTOR shall deliver to the ENGINEER the following information with his request for final inspection.
 1. One set of contract drawings marked to show all significant changes in equipment ratings and locations, alterations in locations of conduit runs, or of any data differing from the contract drawings. This shall include revised or changed panelboard and switchgear schedules.
 2. Certificates of final inspection from local authority.
 3. A tabulation of all motors listing their respective manufacturer, horsepower, nameplate voltage and current, actual running current after installation and overload heater rating.
- B. The electrical work shall be thoroughly tested to demonstrate that the entire system is in proper working order and in accordance with the plans and specifications. Each motor with its control shall be run as nearly as possible under operating conditions for a sufficient length of time to demonstrate correct alignment, wiring capacity,

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BASIC ELECTRICAL REQUIREMENTS

speed and satisfactory operation. All main switches and circuit breakers shall be operated, but not necessarily at full load. CONTRACTOR may be required during final inspection, at the request of the ENGINEER to furnish test instruments for use during the testing.

- C. All wiring shall be given a megger test using a 1000 Volt megger and a conductor continuity test. These tests shall be performed upon delivery to project site and after conductors are pulled, but before final connections are made. The ENGINEER shall be given two (2) days' written notice of the anticipated test date so that he may witness the test if so desired. In any event, the CONTRACTOR shall record the circuit designation and the megger reading on each phase. This written record shall be submitted to the ENGINEER prior to energization of associated equipment. The cost of this test or any retest caused by insufficient megger readings shall be the responsibility of the CONTRACTOR (All tests shall be completed in accordance with NETA Standards).

1.15 STAFFING

- A. The electrical CONTRACTOR shall provide a "Master Electrician" who has been deemed a "Master Electrician" by exam through the State, or any other local permitting authority as the electrical superintendent for the project. The electrical superintendent shall be on the project site any time any electrical work is performed by the CONTRACTOR.

1.16 AS-BUILT DRAWINGS

- A. The as-built drawings shall include detailed drawings of all duct banks, underground conduit, above ground conduit, power distribution equipment, PLC control panels, and control instrument drawings. The duct bank and conduit drawings shall indicate exact location of all duct banks, underground electrical wiring, and fiber optic cable.
 - 1. The location shall indicate the following:
 - a. Centerline location
 - b. Width / Cross section
 - c. Depth
- B. As-built drawings shall be furnished to the ENGINEER in AutoCAD 2018 and PDF format.

END OF SECTION 16010

SECTION 16055

POWER SYSTEM STUDIES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This specification includes a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.
- B. The specification includes a computer based, overcurrent protective device coordination study to confirm protective device ratings and ensure coordination between upstream and downstream breakers.
- C. The study shall include the entire electrical system (both existing and proposed) for each facility.
- D. CONTRACTOR shall coordinate with the utility electrical service provider to obtain up to date available fault current contribution in order to prepare the documents required by this specification.

1.03 DEFINITIONS

- A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.
- B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
- C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.
- D. SCCR: Short-circuit current rating.
- E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

SECTION 16055

POWER SYSTEM STUDIES

1.04 ACTION SUBMITTALS

- A. Provide all submittals in accordance with Section 01300.
- B. Product Data: For computer software program to be used for studies.
- C. Other Action Submittals: Submit the following submittals after the approval of system protective devices submittals. Submit three signed and sealed reports by a professional ENGINEER in the state of Florida and one complete electronic copy including all computer files.
 - 1. Arc-flash study input data, including completed computer program input data sheets.
 - 2. Arc-flash study report; signed, dated, and sealed by a qualified professional ENGINEER, licensed in the State the project is located.
 - a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from ENGINEER for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

1.05 INFORMATIONAL SUBMITTALS

- A. Provide all submittals in accordance with Section 01300.
- B. Qualification Data: Professional Engineer in the state of Florida.
- C. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.06 O&M SUBMITTALS

- A. Provide all operation and maintenance manuals in accordance with Section 01730.
- B. Maintenance procedures according to requirements in NFPA 70E shall be provided in the equipment manuals.

1.07 QUALITY ASSURANCE

- A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

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POWER SYSTEM STUDIES

- B. Arc-Flash Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
 - 1. The computer program shall be developed under the charge of a licensed professional ENGINEER who holds IEEE Computer Society's Certified Software Development Professional certification in the state of Florida.
- C. Arc-Flash Study Specialist Qualifications: Professional ENGINEER in charge of performing the study, analyzing the arc flash, and documenting recommendations, licensed in the state where the Project is located. All elements of the study shall be performed under the direct supervision and control of this professional ENGINEER.

PART 2 – PRODUCTS

2.01 COMPUTER SOFTWARE DEVELOPERS

- A. Software Developers: Subject to compliance with requirements, provide software by one of the following:
 - 1. SKM Systems Analysis, Inc. (Power Tools for Windows)
- B. Comply with IEEE 1584 and NFPA 70E.
- C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

2.02 SHORT-CIRCUIT STUDY REPORT CONTENT

- A. Executive Summary.
- B. Study descriptions, purpose, basis and scope.
- C. One-line diagram, showing the following:
 - 1. Protective device designations and ampere ratings.
 - 2. Cable size and lengths.
 - 3. Transformer kilovolt ampere (kVA) and voltage ratings.
 - 4. Motor and generator designations and kVA ratings.
 - 5. Switchgear, switchboard, motor-control center and panelboard designations.
- D. Study Input Data: As described in "Power System Data" Article.
- E. Short-Circuit Study Output:
 - 1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
 - a. Voltage.
 - b. Calculated symmetrical fault-current magnitude and angle.
 - c. Fault-point X/R ratio.

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POWER SYSTEM STUDIES

- d. No AC Decrement (NACD) ratio.
 - e. Equivalent impedance.
 - f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
 - g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.
- F. Incident Energy and Flash Protection Boundary Calculations:
- 1. Arcing fault magnitude.
 - 2. Protective device clearing time.
 - 3. Duration of arc.
 - 4. Arc-flash boundary.
 - 5. Working distance.
 - 6. Incident energy.
 - 7. Hazard risk category.
 - 8. Recommendations for arc-flash energy reduction.
- G. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of the computer printout.

2.03 ARC-FLASH WARNING LABELS

- A. Comply with requirements in Section 16075 "Identification for Electrical Systems." Produce a 3.5-by-5-inch (76-by-127-mm) thermal transfer label of high-adhesion polyester for each work location included in the analysis.
- B. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:
- 1. Location designation.
 - 2. Nominal voltage.
 - 3. Flash protection boundary.
 - 4. Hazard risk category.
 - 5. Incident energy.
 - 6. Working distance.
 - 7. Engineering report number, revision number, and issue date.
 - 8. PPE required.
- C. Labels shall be machine printed, with no field-applied markings and applied prior to startup and commissioning activities.
- D. Arc flash warning labels shall be applied to existing and proposed equipment per this specification and NFPA 70E. Where existing equipment labels are associated with a study dated prior to 5 years from the date of this study or the accuracy of the information noted in the label is rendered inaccurate by the results of this study, the existing labels shall be replaced.

PART 3 – EXECUTION

SECTION 16055

POWER SYSTEM STUDIES

3.01 EXAMINATION

- A. Examine project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. New overcurrent protective devices shall not be approved until completion of the arc-flash study.

3.02 SHORT-CIRCUIT STUDY

- A. Perform study following the general study procedures contained in IEEE 399.
- B. Calculate short-circuit currents according to IEEE 551.
- C. Base study on the device characteristics supplied by device manufacturer.
 - 1. Service Entrance: Type XHHW-2, single conductors in raceway.
- D. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for the Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.
- E. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage ac systems.
- F. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and single line-to-ground fault at each of the following applicable equipment:
 - 1. Electric utility's supply termination point
 - 2. Low-voltage switchgear
 - 3. Motor-control centers
 - 4. Standby generators and automatic transfer switches
 - 5. Branch circuit panelboards
 - 6. Control Panels

3.03 PROTECTIVE DEVICE COORDINATION STUDY

- A. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.
 - 1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.
 - 2. Calculate the maximum and minimum interrupting duty (5 cycles to 2 seconds) short-circuit currents.
 - 3. Calculate the maximum and minimum ground-fault currents.

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POWER SYSTEM STUDIES

- B. Comply with IEEE 141 and IEEE 242 recommendations for fault currents and time intervals. (Comply with NEC for selective coordination NFPA 70; 240.12, 700.27, 701.18).
- C. Transformer Primary Overcurrent Protective Devices:
 - 1. Device shall not operate in response to the following:
 - a. Inrush current when first energized.
 - b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
 - c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
 - 2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.
- D. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.
- E. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:
 - 1. Tabular Format of Settings Selected for Overcurrent Protective Devices:
 - a. Device tag.
 - b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
 - c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
 - d. Fuse-current rating and type.
 - e. Ground-fault relay-pickup and time-delay settings.
 - 2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
 - a. Device tag.
 - b. Voltage and current ratio for curves.
 - c. Three-phase and single-phase damage points for each transformer.
 - d. No damage, melting, and clearing curves for fuses.
 - e. Cable damage curves.

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POWER SYSTEM STUDIES

- f. Transformer inrush points.
 - g. Maximum fault-current cutoff point.
- F. Provide completed data sheets for setting of overcurrent protective devices bound in a 3-ring binder.

3.04 ARC-FLASH HAZARD ANALYSIS

- A. Comply with NFPA 70E and its Annex D for hazard analysis study.
- B. Use the short-circuit study output and the field-verified settings of the overcurrent devices.
- C. Calculate maximum and minimum contributions of fault-current size.
 - 1. The minimum calculation shall assume that the contribution from all sources is at a minimum and shall assume no motor load.
 - 2. The maximum calculation shall assume a maximum contribution from all sources and shall assume motors to be operating under full-load conditions.
- D. Calculate the arc-flash protection boundary and incident energy at locations in the electrical distribution system where personnel could perform work on energized parts.
- E. Include medium- and low-voltage equipment locations. Safe working distances shall be specified for calculated fault locations based on the calculated arc-flash boundary, considering incident energy of 1.2 cal/sq.cm.
- F. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:
 - 1. Fault contribution from induction motors should not be considered beyond three to five cycles.
 - 2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g., contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).
- G. Arc-flash computation shall include both line and load side of a circuit breaker as follows:
 - 1. When the circuit breaker is in a separate enclosure.

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POWER SYSTEM STUDIES

2. When the line terminals of the circuit breaker are separate from the work location.
- H. Instantaneous trip settings for equipment rated 1,200 amps or greater shall have their instantaneous trip settings set lower than the available arcing current based on the results of this study.

3.05 POWER SYSTEM DATA

- A. Obtain all data necessary to conduct the arc-flash hazard analysis.
 1. Verify completeness of data supplied on the one-line diagram on Drawings. Call discrepancies to the attention of the OWNER and ENGINEER.
 2. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
 3. For existing equipment, whether or not relocated, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers.
- B. Gather and tabulate the following input data to support coordination study. Comply with recommendations in IEEE 1584 and NFPA 70E as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the ENGINEER in charge of performing the study.
 1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
 2. Obtain electrical power utility impedance at the service.
 3. Power sources and ties.
 4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in per cent, and phase shift.
 5. For reactors, provide manufacturer and model designation, voltage rating and impedance.
 6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
 7. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
 8. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
 9. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
 10. Motor horsepower and NEMA MG 1 code letter designation.

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POWER SYSTEM STUDIES

11. Low-voltage cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
12. Medium-voltage cable sizes, lengths, conductor material, and cable construction and metallic shield performance parameters.

3.06 LABELING

- A. Apply one arc-flash label for 600-V ac, 480-V ac, and applicable 208-V ac for each of the following applicable locations:
 1. Transfer switches
 2. Switchboards
 3. Panelboards
 4. Variable frequency drives
 5. Control panels
 6. Disconnects

3.07 APPLICATION OF WARNING LABELS

- A. Install the arc-fault warning labels under the direct supervision and control of the arc-flash study specialist.
- B. Labels shall be applied prior to any startup and commissioning activities.

END OF SECTION 16055

SECTION 16060

GROUNDING AND BONDING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. For definitions of grounding and bonding terms see NFPA 70.

1.02 SUMMARY

- A. Section includes grounding and bonding systems and equipment.
 - 1. Underground distribution grounding.
 - 2. Ground bonding common with lightning protection system.
 - 3. Foundation steel electrodes.

1.03 ACTION SUBMITTALS

- A. Provide all submittals in accordance with Section 01300.
- B. Product Data: For each type of product indicated.

1.04 INFORMATIONAL SUBMITTALS

- A. Provide all submittals in accordance with Section 01300.
- B. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1. Test wells.
 - 2. Ground rods.
 - 3. Ground rings.
 - 4. Grounding arrangements and connections for separately derived systems.
- C. Field quality-control reports.

1.05 O&M SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 01730 and include the following:
 - a. Instructions for periodic testing and inspection of grounding features at test wells, ground rings, and grounding connections for separately derived systems based on NETA MTS.
 - 1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
 - 2) Include recommended testing intervals.

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GROUNDING AND BONDING

1.06 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Burndy; Part of Hubbell Electrical Systems.
 - 2. ERICO International Corporation.
 - 3. Harger Lightning and Grounding.
 - 4. ILSCO.
 - 5. O-Z/Gedney; A Brand of the EGS Electrical Group.
 - 6. Robbins Lightning, Inc.
 - 7. Or Engineer approved equal

2.02 SYSTEM DESCRIPTION

- A. Complete grounding system including connections to proposed equipment and structures and interconnection with existing grounding system according to these specifications and the contract drawings.

2.03 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.
- D. Grounding and Bonding Conductors
 - 1. All raceways and equipment shall be provided with an equipment grounding conductor as shown on the drawings. When the equipment grounding conductor is not shown on the drawings, provide an equipment grounding conductor per Table 250.122 of the NEC.
 - 2. All service entrance equipment shall be provided with a grounding electrode conductor between the service entrance ground and the grounding electrode system as shown on the drawings. When the grounding electrode conductor

SECTION 16060

GROUNDING AND BONDING

is not shown on the drawing, provide a grounding electrode conductor per Table 250.66 of the NEC.

3. Main bonding jumper installed between the service entrance ground and neutral and shall be sized per Table 250.66 of the NEC.
4. System bonding jumper installed between the separately derived system ground and neutral and shall be sized per Table 250.66 of the NEC.

2.04 CONNECTORS

- A. Listed and labeled by a Nationally Recognized Testing Laboratory (NRTL) acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.05 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet (19 mm by 3 m) min.
- B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.
 1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches (1200 mm) long.
 2. Backfill Material: Electrode manufacturers recommended material.

PART 3 – EXECUTION

3.01 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 4/0 AWG minimum.
 1. Bury at least 24 inches (600 mm) below grade.
 2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

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GROUNDING AND BONDING

- D. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.
 - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.
- E. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.02 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.
- C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.
- D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation.

3.03 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners,

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GROUNDING AND BONDING

heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

- C. Water Heater, Heat-Tracing, and Anti-frost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- E. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- F. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.04 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor and install in conduit.
- C. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. When service grounding is not detailed on the drawings, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

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- D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes shall be at least 12 inches (300 mm) deep, with cover.
 - 1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- F. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.
- H. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of area.
 - 1. Install copper conductor not less than No. 2/0 AWG or as shown on the drawing for ground ring and for taps to building steel.
 - 2. Bury ground ring not less than 24 inches (600 mm) from building's foundation.
- I. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least 20 feet (6.0 m) long. If reinforcing is in multiple pieces, connect together by the usual steel tie wires or exothermic welding to create the required length.
- J. Grounding Electrode Conductors: Install grounding electrode conductors sized as seen on the Drawings and according to NFPA requirements from equipment enclosures or dedicated equipment grounding points to the nearest ground grid.

3.05 FIELD QUALITY CONTROL

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GROUNDING AND BONDING

- A. Perform tests and inspections.
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81 and NETA Standards.
 - 4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
 - 5. Prepare test and inspection reports.
- B. Grounding system will be considered defective if it does not pass tests and inspections.
- C. Report measured ground resistances that exceed the following values:
 - 1. Power and lighting equipment or system with capacity of 1000 kVA and less: 5 ohms.
 - 2. Power and lighting equipment or system with capacity more than 1000 kVA: 3 ohms.
 - 3. Power distribution units or panelboards serving electronic equipment: 3 ohm(s).
 - 4. Substations and pad-mounted equipment: 5 ohms.
 - 5. Manhole grounds: 10 ohms.
- D. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION 16060

SECTION 16071

HANGERS AND SUPPORTS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.

1.03 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.04 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified Florida registered professional ENGINEER, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operation weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for the Project, with a minimum structural safety factor of five times the applied force.

1.05 ACTION SUBMITTALS

- A. Provide all submittals in accordance with Section 01300.
- B. Product data for the following:
 - 1. Steel slotted support systems.
 - 2. Nonmetallic slotted support systems.

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HANGERS AND SUPPORTS

- C. Shop Drawings: Signed and sealed by a qualified professional ENGINEER in the state of Florida. Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze hangers: Include product data for components.
 - 2. Steel slotted channel systems: Include product data for components.
 - 3. Nonmetallic slotted channel systems: Include product data for components.
 - 4. Equipment supports.

1.06 INFORMATIONAL SUBMITTALS

- A. Welding Certificates

1.07 O&M SUBMITTALS

- A. Submittal should be in accordance with section 01730.

1.08 QUALITY ASSURANCE

- A. WELDING: Qualify procedures and personnel according to AWA D1.1/D1.1M, "Structural Welding Code- Steel."
- B. Comply with NFPA 70.

1.09 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolts inserts into bases. Concrete, reinforcement, and framework requirements are specified together with concrete Specifications.
- B. Coordinate installation of roof mounted electrical with structural and architectural specification and drawings.

PART 2 – PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Allied Tube & Conduit
 - b. Cooper B-Line, Inc.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.

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- f. Unistrut; Atkore International.
 - g. Wesanco, Inc.
 - h. Or approved equal
 - 2. Metallic Coatings: Hot dip galvanized after fabrication and applied according to MFMA-4.
 - 3. Painted Coatings: Manufacturers standard painted coating applied according to MFMA-4.
 - 4. Channel Dimensions: Selected for applicable load criteria.
- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch—(14-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c., in at least 1 surface.
- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, INC.
 - c. Fabco Plastics Wholesale Limited.
 - d. Seasafe, Inc.
 - e. Or approved equal.
 - 2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
 - 3. Fitting and Accessory Materials: Same as channels and angles, except metal items maybe stainless steel.
 - 4. Rated Strength: Selected to suit applicable load criteria.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- 1. Provide cable strain relief for manufacturer provided cables where installation is intended to be vertically in free air. Support grips shall be sized for the cable and shall prevent the cables from being damaged by the process or installation, while ensuring maintenance activities are not inhibited.
- D. Conduit and Cable Support Devices shall be as indicated below (unless noted otherwise in drawings):
- 1. PVC Conduit – PVC, stainless steel, or fiberglass in areas corrosive to stainless steel
 - 2. RGS Conduit – galvanized steel
 - 3. Aluminum Conduit – stainless steel
 - 4. PVC Coated RGS – stainless steel, fiberglass in areas corrosive to stainless steel
 - 5. EMT – painted or galvanized steel

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- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- F. Structured Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Hilti, Inc.
 - 2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.
 - 5) Or Approved Equal
 - 2. Mechanical-Expansion Anchors: Insert-wedge type, stainless steel, for use in hardened Portland cement concrete with tensions, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Cooper B-Line, Inc.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti, Inc.
 - 4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 - 6) Or Approved Equal
 - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MMS Type 18; complying with MFMA-4 or MSS SP-58.
 - 4. Beam Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 6. Toggle Bolts: All-steel springhead type.
 - 7. Hanger Rods: Threaded steel.

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HANGERS AND SUPPORTS

2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel, shop or field fabricated to fit dimensions of supported equipment.

PART 3 – EXECUTION

3.01 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and system except if requirements in this Section are more stringent.
- B. Maximum, Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacing less than stated in NFPA 70. Minimum rod size shall be $\frac{3}{8}$ inch in diameter.
- C. Provide cable strain relief for manufacturer provided cables where installation is intended to be vertically in free air. Support grips shall be sized for the cable and shall prevent the cables from being damaged by the process or installation, while ensuring maintenance activities are not inhibited.
- D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with single-bolt conduit clamps.

3.02 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90kg).
- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.

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3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 4. To Existing Concrete
 - a. Expansion anchor fasteners.
 - b. Powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100mm) thick.
 5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 6. To Light Steel: Sheet metal screws.
 7. Items Mounted to Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panel boards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Cut, fit, and replace miscellaneous metal supports accurately in location, alignment and elevation to support and anchor electrical materials and equipment.
- B. Field Welding: Comply with AWS D1.1/D1.1M.

3.04 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches (100mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi (20.7-MPa) 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements as specified in the contract documents.
- C. Anchor equipment to concrete base.
 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instruction, and directions furnished with items to be embedded.
 2. Install anchor bolts to elevations required for proper attachment to supported equipment.

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3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.05 PAINTING

- A. Touch-up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05mm).
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 16071

SECTION 16075

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Identification for raceway and metal-clad cable.
 - 2. Identification for conductors of power, communication, and control cable.
 - 3. Underground-line warning tape.
 - 4. Warning labels and signs.
 - 5. Instruction signs.
 - 6. Equipment identification labels.
 - 7. Miscellaneous identification products.

1.03 ACTION SUBMITTALS

- A. Provide all submittals in accordance with Section 01300.
- B. Product Data: For each electrical identification product indicated.
- C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.04 INFORMATIONAL SUBMITTALS

- A. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.05 O&M SUBMITTALS

- A. Provide operation and maintenance data in accordance with Section 01730.
- A. Submittal should contain transportation information.
- B. Submittal should contain storage information.

1.06 QUALITY ASSURANCE

- A. Comply with ANSI A13.1, ANSI C2, and ANSI Z635.4.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.145

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IDENTIFICATION FOR ELECTRICAL SYSTEMS

1.07 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, shop drawings, manufacturer's wiring diagrams, Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.
- E. Install all signs and labels horizontal (level) and consistent for similar equipment and panels.

PART 2 – PRODUCTS

2.01 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

2.02 CONDUCTORS, COMMUNICATION, AND CONTROL CABLE IDENTIFICATION MATERIALS

- E. Aluminum Wraparound Marker Labels: Cut from 0.014-inch thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.
- F. Self-laminating vinyl labels with printed 3/16-inch identification protected by translucent lamination adhered to cables or conductors with permanent acrylic tape.

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IDENTIFICATION FOR ELECTRICAL SYSTEMS

Resistance to chemical or other solvents, water, dirt, and oils. UL approved and RoHS compliant.

2.03 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
 - 1. Minimum width: 3/16 inch.
 - 2. Tensile Strength: 50lb, minimum.
 - 3. Temperature Range: Minus 40 to plus 185 deg F.
 - 4. Color: Black, except where used for color-coding.
- B. Paint: Paint materials and application requirements are specified in Division 9 painting Sections.

2.04 EQUIPMENT IDENTIFICATION PRODUCTS

- A. Stainless Steel Tags:
 - 1. Minimum size: 1-inch by 2-inch
 - 2. Text: Two lines of 3/16-inch text
 - 3. Text: Laser engraved or pressed
- B. Phenolic Nameplates:
 - 1. Minimum size: 2-inch by 4-inch
 - 2. Text: Two lines of 1/2-inch text
 - 3. Color: Black writing over white background

PART 3 – EXECUTION

3.01 APPLICATION

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A: Identify with snap-around label.
 - 1. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, snap-around, color-coding bands:
 - 1. Snap-Around Labels: Slit, pre-tensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
 - 2. Fire Alarm System: Red.
 - 3. Fire-Suppression Supervisory and Control System: Red and yellow.
 - 4. Combined Fire Alarm and Security System: Red and blue.
 - 5. Security System: Blue and yellow.
 - 6. Mechanical and Electrical Supervisory System: Green and blue.
 - 7. Telecommunication System: Green and yellow.
 - 8. Control Wiring: Green and red.

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IDENTIFICATION FOR ELECTRICAL SYSTEMS

- C. Power, Control, Instrumentation, and Branch Circuit Identification: Where cables or conductors terminate on terminal blocks or equipment, use wrap around vinyl sleeves with pre-printed labels.
1. Cables and conductors shall be identified with a tag on each end indicating its opposite end termination location.
 2. Line 1 shall indicate the cable or circuit number found in the conduit and cable schedule or panelboard circuit for contractor supplied and field routed cables and conductors not found in the conduit and cable schedule. For example: "P-PP-6001" for circuits in the schedule or "LP-1-24" for panelboard circuits.
 3. Line 2 shall indicate the opposite end location termination point with equipment designation, terminal block designation, and terminal number. For example: "CP-1600, TB1-24".
- D. Power-Circuit Conductor Identification: For primary and secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and hand holes use metal tags. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.
1. Metal Tags: Brass or aluminum, 2-inch by 2-inch by 0.05 inch, with stamped legend, punched for use with self-locking nylon tie fastener.
- E. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape. Identify each ungrounded conductor according to source and circuit number.
1. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- F. Conductor Color Code Identification: Where the premises wiring system has branch circuits supplied from more than one nominal voltage system, each ungrounded conductor of a given branch circuit shall be identified by color coded tape or cable insulation at all termination, connection or splice points.
- G. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.
1. Write-On Tags: Polyester tag, 0.015-inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.
 2. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
- H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.
 4. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

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IDENTIFICATION FOR ELECTRICAL SYSTEMS

- I. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway. During backfilling of trenches install continuous underground-line warning tape directly above line at 12 inches above duct. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
 1. Description:
 - a. Permanent, bright-colored, continuous-printed, polyethylene tape.
 - b. Not less than 6 inches wide by 4 mils thick.
 - c. Compounded for permanent direct-burial service.
 - d. Embedded continuous metallic strip or core.
 - e. Printed legend shall indicate type of underground line.
- J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
 1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
 2. Comply with NFPA 70 and 29 CFR 1910.145.
 3. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
 4. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.
 5. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.
 - a. Warning label and sign shall include, but are not limited to, the following legends:
 - b. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - c. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
- K. Instruction Signs:
 1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with ENGINEER/OWNER APPROVED instructions where

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IDENTIFICATION FOR ELECTRICAL SYSTEMS

needed for system or equipment operation. Instructions are needed for all equipment unless otherwise noted.

- a. Signs shall be engraved, laminated acrylic or melamine plastic, minimum 1/16-inch thick for signs up to 20 sq. in. and 1/8-inch thick for larger sizes.
 - b. The engraved legend shall be ½ -inch white letters on brown face and punched or drilled for mechanical fasteners.
 - c. The signs shall be installed with stainless hardware.
2. Emergency Operating Instructions: Install emergency operating instruction signs at equipment used for power transfer, safety shutdown, or any other locations requiring operation in an emergency.
 - a. Signs shall be engraved, laminated acrylic or melamine plastic, minimum 1/16-inch thick for signs up to 20 sq. in. and 1/8-inch thick for larger sizes.
 - b. The engraved legend shall be ½ -inch white letters on red face and punched or drilled for mechanical fasteners.
 - c. The signs shall be installed with stainless hardware.
- L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:
 - a. Indoor and Outdoor Equipment: Use engraved, laminated acrylic or melamine labels, punched or drilled for screw mounting. Adhesive labels are unacceptable. Identification labels shall have black letters on a white background. Unless otherwise indicated, provide a single line of text with 1/2-inch high letters on 1 1/2-inch high label; where 2 lines of text are required, use labels 2-inches high. Mount labels with stainless hardware. (Labels for field mounted equipment shall include the name of the equipment, and the location from which power is fed. See example below:
 - 1) Main Station Control Panel SCP-1
 - a) Fed from LP-1
 - 2) RAS Pump
 - a) Fed from SWBD-1 via TX-1
 - b. Elevated Components: Increase the size of the labels and letters to those appropriate for viewing from the floor.
 2. Equipment to Be Labeled:
 - a. Identification labeling of some items listed below may be required by individual Sections or by NFPA 70.
 - b. Panelboards, electrical cabinets, and enclosures.
 - c. Transformers.
 - d. Disconnect switches.
 - e. Motor starters.
 - f. Push-button stations.
 - g. Voice and data cable terminal equipment.
 - h. Monitoring and control equipment.

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IDENTIFICATION FOR ELECTRICAL SYSTEMS

- i. Uninterruptible power supply equipment.
- j. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.
- k. Control systems
- l. Field mounted control devices
- m. Field mounted instruments

3.02 INSTALLATION PRACTICES

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- D. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
 - 1. Color shall be factory applied or, for sizes LARGER than No. 10 AWG if authorities having jurisdiction permit, field applied.
 - 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - 3. Colors for 480/277-V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 - 4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
 - 5. Where the premises wiring system has branch circuits supplied from more than one nominal voltage system, the color codes used to identify each phase, neutral (if applicable) and ground conductor throughout the system shall be permanently posted at each branch-circuit panelboard or similar branch-circuit distribution equipment. Provide factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- E. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- F. Painted Identification: Prepare surface and apply paint according to Section 09900.

END OF SECTION 16075

SECTION 16120

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.

1.03 ACTION SUBMITTALS

- A. Submit the following in accordance with Section 01300:
 - 1. Product data for each type of product

1.04 INFORMATIONAL SUBMITTALS

- A. Submit the following in accordance with Section 01300:
 - 1. Qualification data: for testing agency
 - 2. Field quality-control reports
 - 3. Standard test record sheets

1.05 O&M SUBMITTALS

- A. Submittal should be in accordance with section 01730.

1.06 QUALITY ASSURANCE

- A. Conductors shall meet the requirements of NFPA 70 and be listed and labeled by UL.

PART 2 – PRODUCTS

2.01 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements provide products by use of the following:
 - 1. Alpha Wire.
 - 2. Belden Inc.
 - 3. Encore Wire Corporation.

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LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

4. General Cable Technologies Corporation.
 5. Southwire Incorporated.
- B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658. Unless specifically shown on the plans as aluminum.
- C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2, Type XHHW-2, RHW-2 Low Smoke, SOW and Type SO.
- D. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC, Type SO with ground wire.

2.02 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems, Inc.
 2. Gardner Bender.
 3. Hubbell Power Systems, Inc.
 4. Ideal Industries, Inc.
 5. Ilsco; a branch of Bardes Corporation.
 6. NSi Industries LLC.
 7. O-Z/Gedney; a brand of the EGS Electrical Group.
 8. 3M; Electrical; Markets Division.
 9. Tyco Electronics.
- B. Description: Factory-fabricated connectors and splices of size, capacity rating, material, type, and class for application and service indicated.

2.03 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

PART 3 – EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

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- B. General Branch Circuits in building for lighting and receptacles: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. All water and wastewater facilities:
 - 1. Feeders concealed in concrete, below slabs-on-grade, and underground: Type XHHW-2, single conductors in raceway.
 - 2. Branch Circuits concealed in ceilings, walls, and partitions of an air-conditioned space: Type THHN-THWN, single conductors in raceway metal-clad cable, Type MC.
 - 3. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and underground: Type XHHW-2, single conductors in raceway.
 - 4. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire mesh, strain relief device at terminations to suit application.
 - 5. Class 1 Control Circuits: Type XHHW-2, in raceway.
 - 6. Class 2 Control Circuits: Type XHHW-2, in raceway.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Division 16 prior to pulling conductors and cables.
- C. Use manufacturers-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufactures recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means; including fish tape, cable, rope, and blanket-weave wire/cable grips that will not damage cables or raceway.
- E. Support cables according to Section 16071 "Hangers and Supports for Electrical Systems".

3.04 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B. All torque tightening equipment shall be calibrated before use with calibration records available for inspection.

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LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

- B. Make splices, terminations and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.05 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 16075 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor and identify as spare conductor.

3.06 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 16131, "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.07 FIRESTOPPING

- A. Apply fire stopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to the project specifications.

3.08 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Record all results and submit to engineer for approval. Certify compliance with manufacturer's test parameters, in the absence of Manufacturer's published data; certify compliance with the table listed in NETA Acceptance Testing Specification.
 - 2. All testing must be carried out by competent persons.
 - 3. NETA Acceptance Testing Specification is the minimum level of testing that will be required on all projects with the most relevant inspection and test procedures extracted as listed below. The following list includes additional tests that will be required unless stated otherwise.
 - a. Pre-connection
 - 1) Visual mechanical inspection.

SECTION 16120

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

- 2) Perform resistance measurements through bolted connections with a low resistance DC Ohm meter or an insulation resistance test meter.
 - 3) Continuity of all protective conductors to be recorded using a low resistance DC Ohmmeter or an insulation resistance test meter.
 - 4) Check continuity of all conductors and verify correct cable connections.
 - 5) Check polarity of all conductors.
 - 6) Perform insulation resistance test on each conductor with respect to ground and all adjacent conductors using an insulation resistance test meter. Each conductor must be tested for 1 minute.
 - 7) Verify uniform resistance of all parallel conductors.
- b. Post-connection
- 1) Test and record the impedance at the supply origin.
 - 2) Test and record the ground fault loop impedance between all live conductors and ground at the furthest extents of each final circuit. This test is to be completed using a fault loop Impedance tester and all results must be in compliance with the Circuit Protective Device (CPD) limits from the Manufacturer.
 - 3) Test and record the operating trip time of all GFI and GFCI's devices to ensure compliance with NEC and Manufacturer's published data. This test is to be completed using a GFCI test meter.
 - 4) Other functional testing may be listed here if required.
- B. Test and Inspection Reports: Prepare a written report to record the following:
1. Procedures used.
 2. List of test personal with resumes.
 3. Submit all test results on the enclosed test forms, see form to follow.
 4. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- C. Cables will be considered defective if they do not pass tests and inspections.

(FORM TO FOLLOW)

END OF SECTION 16120

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

SHEET NUMBER

RESTRICTIONS (EQUIPMENT VULNERABLE TO TESTING):

Deviations from Code or Specifications:									

TESTERS/INSTRUMENTS			
TYPE	BRAND	MODEL	CALIBRATION DATE
INSULATION			
CONTINITY			
LOOP IMPEDANCE			
GFCI TESTER			
OTHER			

POST-COMMISSIONING TESTING COMPLETED BY (BLOCK LETTERS) SIGNATURE: DATE OF TESTING:

SECTION 16125

FREEZE PROTECTION

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Drawings and general provisions of the Contract, including JEA General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. This Section includes electric heat tracing requirements for typical piping systems, including piping, valves and accessories. The CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified or required to furnish and install the complete electric heat trace systems.
- C. CONTRACTOR shall install electric heat trace, insulation, and cladding on all small-bore pilot tubing of tank fill control valve PSV-101 in accordance with this specification and Section 15081.

1.02 RELATED SPECIFICATIONS

- A. Specification 15081 – Piping Insulation

1.03 ACTION SUBMITTALS

- A. Submit the following in accordance with Section 01300:
 - 1. Submit the manufacturer's technical product data, materials, ratings, material safety data sheets and installation instructions for each type of product and related materials.
 - 2. Installation Drawings: Complete assembly, layout and installation drawings with clearly marked dimensions.
 - 3. Electric heat trace systems shall be designed using industry standard software packages and include the following calculations:
 - a. Heat loss, service temperatures, and ambient temperatures
 - b. Service voltage and voltage drop
 - c. Heating cable type and quantities with watts / foot
 - d. Circuit breaker and feeder sizing
 - 4. The vendor shall provide heat-tracing isometric drawings at the OWNER's request.

1.04 INFORMATIONAL SUBMITTALS

- A. Submit the following in accordance with Section 01300:
 - 1. Field quality-control reports
 - 2. Standard test record sheets

SECTION 16125

FREEZE PROTECTION

1.05 O&M SUBMITTALS

- A. Include operation and maintenance data in accordance with Section 01730.

1.06 CODES, APPROVALS, STANDARDS

- | | | |
|----|---------------|---|
| A. | FM | FM Approvals LLC |
| B. | IEEE 515 | Institute of Electrical and Electronics Engineers |
| C. | NEC | US National Electric Code (NFPA 70) |
| D. | NECA 202-2013 | Installing and Maintaining Industrial Heat Trace |
| E. | NEMA | National Electrical Manufacturers Association |
| F. | UL 746B | Underwriters Laboratories, Inc |
| G. | ANSI | American National Standards Institute |

1.06 QUALITY ASSURANCE AND QUALIFICATIONS

- A. Manufacturer's Qualifications: Provide electric heat trace systems from firms regularly engaged in the manufacturing of electric heat trace products, whose products have been in satisfactory use in similar services for not less than 3 years.
- B. Installer's Qualifications: Use a single firm with at least 5 years successful installation experience on projects with electric heat trace systems similar to that required for this project.

1.07 WARRANTY

- A. All materials, equipment, and products furnished and installed under this section shall include a one-year manufacturer's warranty from the date of installation.
- B. Installation of the system furnished and installed under this section shall include a one-year CONTRACTOR's installation warranty from the date of installation.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Electric heat trace systems shall be furnished as a complete system by a single supplier. Components from different suppliers intended to serve as a complete system will not be accepted.
- B. Furnish products and materials from one of the following suppliers:
 - 1. Chromalox
 - 2. Nvent
 - 3. Thermon
 - 4. Emerson

SECTION 16125

FREEZE PROTECTION

2.02 SELF-REGULATING HEATING CABLES

- A. All heat-tracing systems for use at temperatures up to a continuous exposure (maintain) of 302°F (150°C) and intermittent exposure temperature of 420°F (215°C) shall use a self-regulating heating cable.
- B. Self-regulating heating cable shall vary its power output relative to the temperature of the surface of the pipe or the vessel. The cable shall be designed such that it can be crossed over itself and cut to length in the field.
- C. Self-regulating heating cable shall be designed for a useful life of 20 years or more with "power on" continuously.
- D. All cables shall be capable of passing a 1.6 kV dielectric test for one minute after undergoing a 10 ft-lb. impact (IEEE 515-1997 test 4.1.8).
- E. The heating cable shall consist of two 16 AWG or larger nickel-plated copper bus wires, embedded in a self-regulating polymeric core that controls power output so that the cable can be used directly on plastic or metallic pipes. Cables shall have a temperature identification number (T-rating) without the use of thermostats of the following.
- F. A GFCI Class B ground-fault protection device set at 30 mA, with a nominal 100-ms response time, shall be used to protect each 120VAC feeder circuit.
- G. The heating cable shall have a tinned copper braid wire with a cross-sectional area being equal to or greater than conductor cross-sectional area. The braid shall be protected from chemical attack and mechanical abuse by a modified polyolefin or fluoropolymer outer jacket.

2.03 THERMOSTATS

- A. The system shall be controlled by a 0-255°F adjustable ambient sensing thermostat. The thermostat shall be supplied with a 40°F setting from the factory.
- B. Thermostat shall be electromechanical rated for 120VAC line voltage.
- C. Where the heat tracing circuit current exceeds thermostat or switch rating, a contactor shall be used.

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FREEZE PROTECTION

2.04 TERMINATION AND END SEAL KITS

- A. All connection kits used to terminate heating cables, including power connectors, splices, tees, and connectors shall be approved for the respective area classification and approved as a system with the particular type of heating cable in use.
- B. In order to keep connections dry and corrosion resistant, connection kits shall be constructed of nonmetallic, electrostatic, charge-resistant, glass-filled, engineered polymer enclosure rated TYPE 4X.
- C. Terminals shall be spring clamp wire connection type to provide reliable connection, maintenance-free operation, and ease of reentry.
- D. Heating cable terminations shall use cold-applied materials and shall not require the use of a heat gun, torch, or hot work permit for installation.
- E. Components shall be rated to a minimum installation temperature of -20°F and maximum pipe temperature of 250°F .
- F. The connection kit system shall be complete with integral LED power indicating light to serve as complete power, splice, or tee connection for up to three heating cables.

PART 3 – EXECUTION

3.01 GENERAL

- A. Piping systems and equipment shall be installed complete and commissioned prior to application of any electric heat trace systems.
- B. Electric heat trace conductor shall be installed per manufacturer's recommendations prior to installation of insulation and lagging.
- C. Electric heat trace systems shall be tested as specified prior to commissioning of heat trace system.
- D. Circuits serving electric heat trace systems shall be provided with ground-fault (GF) detection approved to UL1053.
- E. The system shall have FM, UL, CSA, ETL (or equivalent) approval for Class I, Division 2, Groups A, B, C, D and Class I, Zone 2, Group IIB+H2 when using a solid-state switching devices.
- F. Enclosure types shall be as follows:

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FREEZE PROTECTION

1. Indoors: TYPE 12 painted steel
2. Outdoors: TYPE 4/3R painted steel (noncorrosive environments)
3. Outdoors: TYPE 4X/3RX stainless steel (corrosive environments)

3.02 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.
- B. General Branch Circuits in building for lighting and receptacles: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

3.03 CONDUCTOR INSULATION AND WIRING METHODS

- A. Water and wastewater facilities:
 1. Feeders concealed in concrete, below slabs-on-grade, and underground: Type XHHW-2, single conductors in raceway.
 2. Branch Circuits concealed in ceilings, walls, and partitions of an air-conditioned space: Type THHN-THWN, single conductors in raceway metal-clad cable, Type MC.
 3. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and underground: Type XHHW-2, single conductors in raceway.
 4. Class 1 Control Circuits: Type XHHW-2, in raceway.
 5. Class 2 Control Circuits: Type XHHW-2, in raceway.

3.04 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Division 16 prior to pulling conductors and cables.
- C. Use manufacturers-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufactures recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means; including fish tape, cable, rope, and blanket-weave wire/cable grips that will not damage cables or raceway.
- E. Support cable raceway systems according to Section 16071 "Hangers and Supports for Electrical Systems".

3.05 CONNECTIONS

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FREEZE PROTECTION

- A. Tighten electrical connectors and terminals according to manufacturer's published torque tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B. All torque tightening equipment shall be calibrated before use with calibration records available for inspection.

3.06 IDENTIFICATION

- A. Identify conductors, cables, and equipment according to Section 16075 "Identification for Electrical Systems."

3.07 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 16131, "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.08 FIRESTOPPING

- A. Apply fire stopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to the project specifications.

3.09 FIELD QUALITY CONTROL

- A. Circuit Testing
 - 1. Perform each visual and mechanical inspection and electrical tests stated in NETA Acceptance Testing Specification. Record all results and submit to engineer for approval. Certify compliance with manufacturer's test parameters, in the absence of manufacturer's published data; certify compliance with the table listed in NETA Acceptance Testing Specification.
 - 2. Pre-connection testing:
 - a. Visual mechanical inspection.
 - b. Check continuity and polarity of all conductors and verify correct cable connections using a low resistance DC ohmmeter or insulation resistance test meter.
 - c. Perform a one minute insulation resistance test on each conductor with respect to ground and all adjacent conductors using an insulation resistance test meter. Parallel conductors shall have uniform resistance results.
 - 3. Post-connection
 - a. Test and record the impedance at the supply origin.

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- b. Test and record the ground fault loop impedance between all live conductors and ground at the furthest extents of each final circuit. This test is to be completed using a fault loop Impedance tester and all results must be in compliance with the Overcurrent Protective Device (OCPD) limits from the manufacturer.
- c. Test and record the operating trip time of all GFI and GFCI's devices using a GFCI test meter to ensure compliance with NEC and manufacturer's published data.

B. Heat Trace System Testing

- 1. Field tests for self-regulating, power limiting, series constant wattage and constant wattage (MI) heater cables shall include but are not limited to the following.
- 2. Testing shall be done in accordance with the latest IEEE Std. 515 test section and applicable manufacturer's standards.
- 3. Insulation resistance shall be measured upon receiving, after installation, and after commissioning. Readings shall be taken from heating device conductors to metallic braid, metallic sheath, or other equivalent electrically conductive material with a 500 Vdc test voltage per manufacturer's recommendations.
- 4. The readings obtained shall satisfy the minimum acceptable readings per IEEE Std 515-2011 otherwise the heater cable is not acceptable and shall be replaced.
- 5. Field megohmmeter tests shall be recorded for each heater cable, and certified reports shall be submitted to the OWNER and ENGINEER.

END OF SECTION 16125

SECTION 16130
RACEWAYS AND BOXES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Metal conduits, tubing, and fittings.
 - 2. Nonmetal conduits, tubing, and fittings.
 - 3. Metal wireways and auxiliary gutters.
 - 4. Nonmetal wireways and auxiliary gutters.
 - 5. Surface raceways.
 - 6. Boxes, enclosures, and cabinets.
 - 7. Handholes and boxes for exterior underground cabling.

1.03 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.
- D. EMT: Electrical Metallic Tubing
- E. PVC: Polyvinyl Chloride Conduit Schedule 40, Schedule 80
- F. LFMC: Liquidtight Flexible Metallic Conduit

1.04 ACTION SUBMITTALS

- A. Provide all submittals in accordance with Section 01300.
- B. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- C. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.05 INFORMATIONAL SUBMITTALS

- A. Provide all submittals in accordance with Section 01300.
- B. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

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1. Structural members in paths of conduit groups with common supports.
 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- C. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, include those for internal components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.

1.06 O&M SUBMITTALS

- A. Submit operation and maintenance data in accordance with section 01730.

1.07 QUALITY ASSURANCE

- A. Source Limitations: Obtain equipment within same product category, from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.

1.08 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to replace or replace raceways and boxes that fail in materials or workmanship within specified warranty period.
1. Warranty Period: One year from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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1. AFC Cable Systems, Inc.
 2. Allied Tube & Conduit.
 3. Anamet Electrical, Inc.
 4. Electri-Flex Company.
 5. O-Z/Gedney.
 6. Picoma Industries.
 7. Republic Conduit.
 8. Robroy Industries.
 9. Southwire Company.
 10. Thomas & Betts Corporation.
 11. Western Tube and Conduit Corporation.
 12. Wheatland Tube Company.
 13. or Approved Equal.
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. ARC: Comply with ANSI C80.5 and UL 6A.
- E. IMC: Comply with ANSI C80.6 and UL 1242.
- F. PVC-Coated Rigid Conduit
1. Comply with NEMA RN 1.
 2. Coating Thickness: 0.040 inch (1 mm), minimum.
- G. EMT: Comply with ANSI C80.3 and UL 797.
- H. FMC: Comply with UL 1; zinc-coated steel or aluminum.
- I. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- J. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 2. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: compression.
 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
- K. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

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RACEWAYS AND BOXES

2.02 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Anamet Electrical, Inc.
 - 3. Arnco Corporation.
 - 4. CANTEX Inc.
 - 5. CertainTeed Corporation.
 - 6. Condux International, Inc.
 - 7. Electri-Flex Company.
 - 8. Kraloy.
 - 9. Electrical Products.
 - 10. Niedax-Kleinhuis USA, Inc.
 - 11. RACO; Hubbell.
 - 12. Thomas & Betts Corporation.
 - 13. or Approved Equal.
- B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. See Evaluations for descriptions of nonmetallic conduit types.
- D. ENT: Comply with NEMA TC 13 and UL 1653.
- E. RNC: Type EPC-40-PVC, or EPC-80-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- F. LFNC: Comply with UL 1660.
- G. Rigid HDPE: Comply with UL 651A.
- H. Continuous HDPE: Comply with UL 651B.
- I. Coilable HDPE: Preassembled with conductors or cables and complying with ASTM D 3485.
- J. RTRC: Comply with UL 1684A and NEMA TC 14.
- K. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- L. Fittings for LFNC: Comply with UL 514B.

2.02 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper B-Line, Inc.

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RACEWAYS AND BOXES

2. Hoffman.
 3. Mono-Systems, Inc.
 4. Square D.
 5. or Approved Equal.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 for interior or Type 4X stainless steel for exterior unless otherwise indicated, and sized according to NFPA 70.
1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Hinged type for NEMA 1 and hinged, flanged-and-gasketed type for NEMA 4X unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

2.04 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Allied Moulded Products, Inc.
 2. Hoffman.
 3. Carlon Electrical Products.
 4. Niedax-Kleinhuis USA, Inc.
 5. or Approved Equal.
- B. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Description: Fiberglass polyester or PVC, extruded and fabricated to required size and shape, and having hinged cover with captive screws.
- D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

2.05 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Adalet.
 2. Cooper Technologies Company; Cooper Crouse-Hinds.
 3. EGS/Appleton Electric.
 4. Erickson Electrical Equipment Company.

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5. FSR Inc.
 6. Hoffman.
 7. Hubbell Incorporated.
 8. Kraloy.
 9. Milbank Manufacturing Co.
 10. Mono-Systems, Inc.
 11. O-Z/Gedney.
 12. RACO; Hubbell.
 13. Robroy Industries.
 14. Spring City Electrical Manufacturing Company.
 15. Stahlin Non-Metallic Enclosures.
 16. Thomas & Betts Corporation.
 17. Wiremold / Legrand.
 18. or Approved Equal.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy or aluminum to match raceway type, Type FD, with gasketed cover.
- E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.
- G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover, unless otherwise noted.
- I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep), unless otherwise noted.
- J. Gangable boxes are prohibited, unless specifically noted.
- K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 4X Stainless Steel for outdoor locations, Type 12 for indoor locations, with continuous-hinge cover with flush latch unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 2. Nonmetallic Enclosures: Fiberglass.
 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- L. Cabinets:

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RACEWAYS AND BOXES

1. NEMA 250, Type 4X Stainless Steel for outdoor locations, Type 12 for indoor locations, with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.06 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. General Requirements for Handholes and Boxes:
 1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. NewBasis.
 - d. Oldcastle Precast, Inc.
 - e. Quazite: Hubbell Power System, Inc.
 - f. Synertech Moulded Products.
 - g. Or approved equal.
 2. Standard: Comply with SCTE 77.
 3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
 4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
 5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 6. Cover Legend: Molded lettering, as required to identify system indicated on the drawings.
 7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
 8. Handholes 24-inches wide by 24-inches long by 24-inches deep and larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.
- C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of fiberglass unless otherwise noted.
 1. Manufacturers:
 - a. Lindsay Precast
 - b. Armorcast Products Company

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- c. Carson Industries LLC
 - d. NewBasis
 - e. Nordic Fiberglass, Inc
 - f. Oldcastle Precast, Inc; Christy Concrete Products
 - g. Quazite: Hubbell Power System, Inc; Hubbell Power Systems
 - h. Synertech Moulded Products
 - i. Or Approved Equal
2. Standard: Comply with SCTE 77.
 3. Color of Frame and Cover: Gray.
 4. Handholes shall be designed for flush burial with open bottom placed on $\frac{3}{4}$ -inch broken stone or gravel compacted to manufacturer's requirements, unless otherwise indicated.
 5. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
 6. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 7. Cover Legend: Molded lettering, as required to identify system indicated on the drawings.
 8. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
 9. Handholes 24-inches long by 24-inches deep and larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.
- D. Concrete Precast Manholes:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Jensen Precast
 - b. Lindsay Precast
 - c. Durastress
 - d. Advanced Concrete Products
 - e. Or Approved Equal.
 2. Reinforcing Bar: ASTM A615 Grade 60 Rebar, bending and placement shall comply with latest ACI standards.
 3. Concrete shall have a 28 day compressive strength of 4500 PSI.
 4. Lateral pressure shall account for active coefficient of 0.3 with applied bearing pressure of 500 PSF.
 5. Frame and Cover: Diamond plate, slip resistant, hot dipped galvanized, double door, hinged, with tamper proof safety lock and recessed bar handles.
 6. Manholes shall be designed for flush burial or no more than six inches above finished grade, with closed bottom placed on $\frac{3}{4}$ -inch broken stone or gravel compacted to manufacturer's requirements.
 7. Cover Legend: Molded lettering, as required to identify system indicated on the drawings (i.e. Electric, Power, Communications, Control).
 8. Conduit Entrance Provisions: Thin wall knockout area with 4-inch duct terminators in each face.
 9. Grounding: Sleeve for ground rod and internal #2/0 awg ground ring with structural steel and rebar ground bonding.
 10. Accessories: One (1) 1-inch cable pulling iron in each face, four (4) $\frac{1}{2}$ -inch threaded embeds for cable rack attachment provisions in each wall face, and sump pump pit.

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RACEWAYS AND BOXES

2.07 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 - 1. Tests of materials shall be performed by an independent testing agency.
 - 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional ENGINEER in the State of Florida shall certify tests by manufacturer.
 - 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 – EXECUTION

3.01 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed Conduit: PVC Coated aluminum rigid conduit (ARC)
 - 2. Concealed Conduit, Aboveground: RNC, Type EPC-40-PVC, unless otherwise indicated on drawings.
 - 3. Underground Conduit: RNC, Type EPC-40-PVC when concrete encased, Type EPC-80-PVC when direct buried.
 - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC unless otherwise indicated on drawings.
 - 5. Connection between structures (Including between ground storage tanks and stair platforms): LFMC unless otherwise indicated on drawings. Power level 120VAC and above LFMC between rigid conduit sections or between rigid conduit and equipment shall have an insulated ground jumper installed between insulated ground bushings.
 - 6. Boxes and Enclosures, Aboveground: NEMA 250, Type 4X Stainless steel unless otherwise indicated on drawings.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed, Not Subject to Physical Damage: ARC.
 - 2. Exposed, Not Subject to Severe Physical Damage: ARC.
 - 3. Exposed and Subject to Severe Physical Damage: ARC. Raceway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Gymnasiums.
 - 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 - 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 - 6. Damp or Wet Locations: ARC unless otherwise noted.

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7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4X stainless steel in institutional and commercial kitchens and damp or wet locations, unless otherwise noted.
 8. Corrosive environments (i.e. hypochlorite storage area): Type EPC-80-PVC
- C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20. Insulated grounding bushings where applicable.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- G. Install surface raceways only where indicated on Drawings.
- H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.02 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- E. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

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- F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- G. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- H. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Arrange raceways to keep a minimum of 3 inches of concrete cover in all directions.
 - 4. Do not embed threadless fittings in concrete unless specifically approved by ENGINEER for each specific location.
 - 5. Some authorities having jurisdiction may not permit nonmetallic tubing in fire-rated slabs in subparagraph below.
 - 6. Change from ENT to GRC before rising above floor.
- I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- J. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- K. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- L. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- M. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- N. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- O. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Clean and cap underground raceways designated as spare above grade alongside raceways in use.
- P. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a

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flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

- Q. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground raceway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.
- R. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- S. Expansion-Joint Fittings:
 - 1. Provide expansion joint fitting any time conduit systems cross building expansion joints or structural expansion joints.
 - 2. Provide expansion fittings as recommended by the manufacturer of the conduit.
 - 3. Provide expansion fittings per NFPA 70.
 - 4. Formula in first subparagraph below provides about 15 percent safety factor (extra expansion-contraction capability).
 - 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- T. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
 - 3. Provide a separate ground jumper for all liquid tight flexible power level conduits runs utilizing insulated grounding bushings sized as follows:
 - a. $\frac{3}{4}$ to 1-inch conduit - #12 awg insulated ground
 - b. 1 $\frac{1}{4}$ to 2-inch conduit - #8 awg insulated ground
 - c. 2 $\frac{1}{2}$ to 6-inch conduit - #4 awg insulated ground
- U. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- V. Provide a flat surface for a raintight connection between boxes and cover plate or supported equipment and box.
- W. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.
- X. Locate boxes so that cover or plate will not span different building finishes.

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RACEWAYS AND BOXES

- Y. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- Z. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- AA. Set metal floor boxes level and flush with finished floor surface.
- BB. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.03 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:
 - 1. Excavate trench bottom to provide firm and uniform support for conduit.
 - 2. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction per 95 percent modified proctor density.
 - 3. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor. Wrap conduit with 2 coats of 3M Scotch Wrap or Approved Equal.
 - a. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
 - 4. Underground Warning Tape: Comply with requirements in Section 16075 "Identification for Electrical Systems."

3.04 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 16131 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.05 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 16130

SECTION 16131

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
 - 2. Sleeve-seal systems.
 - 3. Sleeve-seal fittings.
 - 4. Grout.
 - 5. Silicone sealants.
- B. Related Requirements:
 - 1. For penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items, use UL listed assemblies for the type and installation applied.

1.03 ACTION SUBMITTALS

- A. Submit in accordance with Section 01300:
 - 1. Product data for each type of product.

1.04 INFORMATIONAL SUBMITTALS

- A. Submittals are in accordance with section 01300.

1.05 O&M SUBMITTALS

- A. Submit operation and maintenance data in accordance with section 01730.

1.06 QUALITY ASSURANCE

- A. Source Limitations: Obtain equipment within same product category, from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NFPA 70.

SECTION 16131

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 2 – PRODUCTS

2.01 SLEEVES

- A. Wall Sleeves:
 - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40. (For use with grounding electrode conductors only.)
- D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.
- E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- F. Sleeves for Rectangular Openings:
 - 1. Material: Galvanized sheet steel.
 - 2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.02 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. CALPICO, Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.
 - e. Proco Products, Inc.
 - f. or Approved Equal.
 - 2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 3. Pressure Plates: Stainless steel.
 - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

SECTION 16131

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

2.03 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Presealed Systems.
 - b. or Approved Equal.

2.04 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.05 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 – EXECUTION

3.01 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 07900 "Joint Sealants."
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

SECTION 16131

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install steel pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.03 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 16131

SECTION 16140

WIRING DEVICES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Snap switches and wall-box dimmers.

1.03 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

1.04 ACTION SUBMITTALS

- A. Submit all shop drawings in accordance with Section 01300.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.
- D. Field quality-control test reports.

1.05 INFORMATIONAL SUBMITTALS

- A. Submittal should be in accordance with section 01300.

1.06 O&M SUBMITTALS

- A. Submit operation and maintenance data in accordance with Section 01730. For wiring devices include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.07 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

SECTION 16140

WIRING DEVICES

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.08 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1.09 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace or replace wiring devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.02 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 5351 (single), 5352 (duplex).
 - b. Hubbell; HBL5351 (single), CR5352 (duplex).
 - c. Leviton; 5891 (single), 5352 (duplex).
 - d. Pass & Seymour; 5381 (single), 5352 (duplex).

2.03 GFCI RECEPTACLES

A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; GF20.
 - b. Pass & Seymour; 2084.

SECTION 16140

WIRING DEVICES

2.04 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
 - b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
 - c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
 - d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

2.05 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Dry Finished or Unfinished Spaces: Stainless steel.
 - 3. Material for Damp Locations: Cast aluminum with spring-loaded lift cover and listed and labeled for use in "wet locations."
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

2.06 FINISHES

- A. Color: Wiring device catalog numbers in Part 2 herein do not designate device color.
 - 1. Wiring Devices Connected to Normal Power System: Brown, unless otherwise indicated or required by NFPA 70 or device listing.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
 - 1. Take steps to ensure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.

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WIRING DEVICES

4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
- D. Device Installation:
1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
 6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 8. Tighten unused terminal screws on the device.
 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.02 IDENTIFICATION

- A. Comply with Division 16 Section "Identification for Electrical Systems."
1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

SECTION 16140

WIRING DEVICES

3.03 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. Test Instruments: Use instruments that comply with UL 1436.
 - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
- B. Tests for Convenience Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 5 percent or higher is not acceptable.
 - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 16140

SECTION 16150
ELECTRIC MOTORS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General Conditions and Division 01 Specification Sections, apply to this Section

1.02 SUMMARY

- A. Section includes general requirements for single-phase and polyphase electric motors for use in the water and wastewater environments.

1.03 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices and features to be compatible with the following:
 - 1. Motor controllers
 - 2. Torque, speed, and horsepower requirements of the load
 - 3. Ratings and characteristics of supply circuit and required control sequence

1.04 ACTION SUBMITTALS

- A. Submit shop drawings in accordance with Section 01300

1.05 INFORMATIONAL SUBMITTALS

- A. Provide all submittals in accordance with Section 01300.

1.06 O&M SUBMITTALS

- A. Submit operation and maintenance data in accordance with Section 01730.

1.07 REFERENCES

- A. ANSI/AFBMA 9-1990, Load Ratings and Fatigue Life for Ball Bearings
- B. ASTM B117-90, Test Method of Salt Spray (Fog) Testing
- C. IEEE Standard 85-1973, IEEE Standard Test Procedure for Airborne Sound Measurements on Rotating Electric Machinery
- D. IEEE Standard 112-1991, IEEE Standard Test Procedure for Polyphase Induction Motor and Generators
- E. IEEE Standard 841-1994, IEEE Standard for Petroleum and Chemical Industry - Severe Duty
- F. NEMA MG 13 -1984, Frame Assignments for Alternating Current Integral Horsepower Induction Motors

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ELECTRIC MOTORS

G. NEMA MG 1-1993, Motors and Generators

1.08 PROJECT CONDITIONS

- A. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
- B. Altitude: Not exceeding 6600 feet

1.09 SPARE PARTS

- A. Furnish spare parts that match components installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Manufacturer standard recommended spare parts and consumables.

1.10 WARRANTY

- A. All equipment supplied under this section shall be warranted for a period of one (1) year by the MANUFACTURER. Warranty period shall commence as outlined in Section 01740 and JEA General Conditions.
- 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 OWNER.
- C. The MANUFACTURER'S warranty period shall run concurrently with the CONTRACTOR'S warranty period. No exception to this provision shall be allowed.
- D. The CONTRACTOR shall be fully responsible for proper storage of motors prior to placing in service in accordance with the manufacturers' recommendations and instructions. Any problem with motors at startup due to mishandling or by not adhering to the manufacturers' recommendations for storage will be the sole responsibility of the contractor. All costs to repair the motors due to any mishandling or improper storage will be at no cost to the owner, the supplier, or the manufacturer of the motor, but shall be entirely the responsibility of the CONTRACTOR.

PART 2 – PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.
- C. Comply with IEEE 841 for severe-duty motors.

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ELECTRIC MOTORS

2.02 DESIGN STANDARDS

- A. Indoor motors shall be 3 phase induction machines rated continuous duty at 60 HZ, single voltage with across-the-line full voltage start, unless otherwise noted.
- B. Production AC motors are available in 56 through 5811 frames at speeds of 3600, 1800, 1200, and 900RPM.
- C. Stock AC motors are available in 56T through 447T frames 1-200HP at speeds of 3600, 1800 and 1200RPM, 480 Volt designs.
- D. Motors comply with the frame size assignments of NEMA MG 13-1984.
 - 1. Any motors that require special modifications, such as "TZ" shafts or special "D" flanges shall be noted clearly in the submittals with spare recommendations from the manufacturer.
 - 2. All motors that are not standard NEMA 1964 re-rate "T" frame motors shall be factory painted blue with pink conduit boxes attached to be clearly identified to the owner. At installation, the Contractor shall paint the motors to the owner's choice of color.
- E. NO IEC MOTORS WILL BE ALLOWED.
- F. Motor manufacturer shall be an active member of NEMA.
- G. Motor manufacturer shall have experience in the design and manufacture of similar products for a minimum of 10 years. Buy-out or private labeled motors are not acceptable.
- H. All fractional to 2 HP direct current (DC) motors shall be either permanent magnet or shunt wound design with a constant torque speed range or 20:1
- I. Acceptable motor manufacturers will be
 - 1. US Motors
 - 2. General Electric
 - 3. Reliance or
 - 4. ENGINEER approved equal.

2.03 ENCLOSURES

- A. All indoor general-purpose horizontal motors shall be ODP and meet specification NEMA MG-1, unless otherwise noted.
- B. All outdoor general-purpose horizontal motors shall be TEFC and meet specification IEEE 841, unless otherwise noted.
- C. All motors in hazardous locations shall be Division One explosion proof, as defined by UL, meeting the Class and Group as required by the hazard.

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ELECTRIC MOTORS

2.04 SERVICE CONDITIONS

- A. Motor are suitable for continuous duty operation without de-rating under the project conditions.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor. Motors may be constant or variable torque as required to meet the conditions of the load being serviced.
- C. Suitable for use in indoor or outdoor applications involving severe duty conditions such as high humidity or chemical laden, corrosive or salty atmospheres as applicable.
- D. Motors are capable of successfully accelerating inertia loads equal to what is specified in section 12.54 of NEMA MG 1 1993. Variable Frequency Drive (VFD) or Full voltage, across-the-line starting.

2.05 ELECTRICAL DESIGNS

- A. Motors shall be NEMA Design B as defined in section 1.17.1.2 of NEMA MG 1-1993, unless specifically noted requiring different motor curves.
- B. Motors shall operate successfully at rated load under the combinations of voltage and frequency variations specified in section 12.44 of NEMA MG 1-1993.
- C. Motors shall operate successfully under running conditions at rated load and frequency when voltage unbalance at the motor terminals does not exceed 1%.
- D. Motors shall be premium efficient designs that exceed the efficiency values in Table 1 of IEEE Standard 841-1994. Efficiency testing is done in accordance with IEEE standard 112-1991, sub-clause 6.4 Method B. The nominal efficiency, $\frac{3}{4}$ load efficiency and guaranteed minimum efficiency, are stamped on the motor's nameplate.
- E. Motors shall utilize a non-hygroscopic, chemical and humidity resistant insulation system. The thermal rating of the system is Class F as defined in section 1.66 on NEMA MG1-1993.
- F. The stator windings for 1-200HP and under 600 volts are random or form wound with copper wire utilizing inverter grade insulation system that meets and exceeds NEMA MG1-1993 Part 31.
- G. Stator is double dipped and baked in varnish to form a heavy build that exceeds the test criteria of moisture resistance per NEMA MG-1.
- H. When operated at rated horsepower, voltage and frequency, the temperature rise of the stator winding does not exceed 80C when measured by winding resistance.

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ELECTRIC MOTORS

- I. Motors shall utilize the inverter grade insulation system which consists of at a minimum Class F or better insulation materials with additional phase insulating material, extra end-turn bracing and Class H spike resistant wire. The resultant system shall withstand 2000-volt transients without premature motor failure and have no cable limitations in motor application.
- J. All motors connected to a VFD, shall include ceramic bearings or grounding isolation rings.
- K. Motors shall operate successfully under inverter running conditions at rated load with variation in the voltage or the frequency not exceeding the following conditions:
 - 1. +/-10 percent rated voltage at rated constant volts/hertz ratio except for specific torque boost situations.
 - 2. Motors shall operate successfully under running conditions at rated load and volts/hertz ratio when the voltage unbalance at the motor terminals does not exceed one percent.
- L. Inverter Operating Characteristics - With rated volts/hertz ratio applied, motor performance shall be as follows for critical operating characteristics:
 - 1. Torque – Motors shall meet or exceed the minimum locked rotor (starting) and breakdown torque specified in NEMA Standard MG 1, Part 12 for Design B for the rating specified when on sine wave power.
 - 2. Currents – Maximum overload current shall be 150 percent of nameplate for 60 seconds or 175 percent for 3 seconds.
- M. Motors shall be rated for a 1.15 service factor on sine wave power and 1.0 service factor on VFD power.

2.06 MECHANICAL DESIGN

- A. Motors are equipped with ball bearings have AFBMA C/3 clearances and shall be the same size on both ends (with exception of 440T frame - minimum 6318 on Drive end bearing).
- B. Bearings are regreasable without disassembling the fan or fan cover and provide for the elimination of purged grease through fittings extending beyond the fan cover. Polyurea thickened grease shall be supplied.
- C. Inner bearing caps are provided for bearing retention and to prevent harmful amounts of lubricant from entering the motor interior.
- D. For direct coupled motors, stabilized bearing temperature shall not exceed a temperature rise of 45 degrees C for 4 and 6 pole motors and a maximum temperature rise of 50 degrees C for 2 pole motors as measured by a thermocouple on the surface of the bearing house.
- E. Bearings provide for an L-10 life of 100,000 hours per ANSI/AFBMA 9-1990 based on NEMA belting application limits per NEMA MG1-1993, section 14.41.

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- F. Enclosures have a degree of protection rated for the installation location (per NEMA MG-1 1993 and IEEE 841). Bearing isolators are provided on all 143 to 5811 'T' frame motors to minimize entrance of moisture and contaminants into the bearing chamber. Motors shall be capable of field retrofit of an opposite drive end endshield bearing isolator.
- G. Condensation drain holes are provided at the low points in the end brackets and are supplied with corrosion resistant, breather drain plugs.
- H. Frame, brackets, fan cover and conduit box are a minimum of grade 25 cast iron.
- I. Rotor cage construction shall be of cast aluminum. The maximum permissible shaft runout at the end of the shaft extension of the assembled motor shall be:
 - 1. 0.875 to 1.6250-inch diameter inclusive TIR < 0.001 6.10.2 over 1.626 to 6.50-inch diameter, TIR, 0.0015 (ball bearing) and 0.002 (roller bearing).
- J. Motor mounting feet, when placed on a flat granite surface, shall not exceed 0.005" between the granite surface and the motor feet at each mounting bolt hole.
- K. A drilled and tapped hole is provided in the motor frame on the same side as the conduit box for grounding purposes.
- L. Ventilating fans, where applicable, are of non-sparking conductive plastic material. Most ratings use bi-directional fans. On ratings where uni-directional fans are used, the rotation of the fan is indicated by a permanent label on the outside of the motor.
- M. Conduit box is diagonally split, rotatable in 90-degree increments, and twice the volume as specified in Section 11.06.2 of NEMA MG1-1993. A ground lug is provided in the box. Gaskets are provided between the conduit box and frame and between conduit box base and cover providing a moisture resistant barrier.
- N. Shouldered eyebolts with a minimum safety factor of 10 are provided for motor lifting.
- O. All fastening hardware is hex-head bolts or socket head cap screws with a grade 5, zinc/cadmium plating.
- P. Motor cast iron components are oxide primed and painted with vinyl phenolic paint to surpass 250-hour salt spray test per ASTM B117-90.
- Q. Motor nameplate is stainless steel and secured with 4 stainless steel drive pins. Nameplates are capable of meeting 720-hour salt spray test per ASTM B117-90. Each nameplate incorporates National Electrical Code requirements, requirements of section 10.40 of NEMA MG1-1993 and the following:
 - 1. AFBMA bearing ID
 - 2. Manufacture date code
 - 3. Compliance with IEEE Standard 841-1994, where applicable
 - 4. Enclosure rating
 - 5. Motor weight
 - 6. Guaranteed minimum efficiency

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7. Maximum space heater surface C temperature, if provided, when operating at rated voltage in a 40C ambient
 8. Balance
 9. NEMA MG1 Part 31
 10. "Inverter Duty Rated" – where applicable
- R. Machined frame to end shield joints are protected by an application of 2 part epoxy before assembly.

2.07 AIRBORNE SOUND

- A. Motor sound power level when measured at a no load condition shall not exceed 90 dBA when determined in accordance with IEEE Standard 85-1973.

2.08 VIBRATION

- A. Motor vibration measured in any direction on the bearing housing meets the levels listed below when tested per section 12.08 of NEMA MG1-1993:
1. Unfiltered vibration at rated voltage and frequency does not exceed 0.08 in/s peak velocity for 2, 4 and 6 pole motors and .06 in/s peak velocity for 8 pole motors.
 2. Filtered vibration does not exceed 0.05 in/s peak velocity at a frequency of 2f (twice line frequency)
 3. Unfiltered axial vibration does not exceed 0.06 in/s peak velocity on bearing housing (does not apply to roller bearings)

2.09 ACCESSORIES

- A. Winding thermostats shall be in each phase of the motor. There shall be one per phase, NC, connected in series with leads terminating in the auxiliary outlet box.
- B. For vertical hollow shaft motors, a ball-type non-reversing ratchet shall be provided to prevent back-spin of the pump and motor. Maximum reverse rotation shall be limited to 5 degrees or arc.
- C. Stabilizing bushings shall be provided on all vertical hollow shaft motors applied to pumps with mechanical seals. All 3600 RPM hollow shaft motors shall be provided with stabilizing bushings.
- D. Motors 20 HP and above shall be started on soft starts or variable frequency drives, unless noted otherwise.
- E. Each motor over 20 HP shall be equipped with a suitably sized space heater to prevent condensation from forming while the motor is not running. The space heater shall be 120V, single phase with leads terminating in the auxiliary outlet box.
- F. All motors shall be provided with suitable coupling for connection to mechanical loads.

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2.10 SINGLE-PHASE MOTORS

- A. Motors larger than 1/2 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Capacitor start, inductor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/2 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal protection device shall automatically reset when motor temperature returns to normal range.
- F. Provide a separate termination box for the thermal protection connections. This box may be shared with a motor heater, if required.

PART 3 – EXECUTION

3.01 PRODUCTION TESTS

- A. The following tests are to be performed on all motors, and submitted with shop drawings:
 - 1. Measurement of winding resistance
 - 2. No load readings of current, power, and speed at rated voltage and frequency
 - 3. Mechanical vibration checks as described in 8.1, using either elastic or rigid mount
 - 4. High potential test in accordance with section 12.03 of NEMA MG1-1993
 - 5. All tests shall be certified tests from the factory.
- B. The following test information is recorded and inserted in the motors' conduit box.
 - 1. Winding Resistance
 - 2. No load current, voltage and speed
 - 3. The following five unfiltered vibration readings, measured as described in 8.1: drive end (horizontal, vertical, and axial) and opposite drive end (horizontal and vertical)
- C. The Manufacturer shall submit certification that all motors comply with NEMA Premium Efficiency Standards.

3.02 FIELD STARTUP TESTS

- A. The following tests are to be performed on all motors prior to startup and commissioning under the direction of a manufacturer authorized service representative:
 - 1. Measurement of winding resistance

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ELECTRIC MOTORS

2. No load readings of current, power, and speed at rated voltage and frequency
 3. Mechanical vibration checks as described in 8.1, using either elastic or rigid mount
 4. High potential test in accordance with section 12.03 of NEMA MG1-1993
 5. Rotational checks
 6. Power conductor insulation resistance test prior to making motor terminations.
- B. The CONTRACTOR shall submit certification that all motors have been tested in accordance with these specifications and are ready for startup and commissioning.
- C. Submit formal report to ENGINEER including documentation of all field test results for review and approval prior to startup and commissioning.

3.03 DEMONSTRATION

- A. CONTRACTOR shall engage a factory-authorized service representative to train OWNER's maintenance personnel to adjust, operate, and maintain all motors furnished and installed as shown in the contract documents.

END OF SECTION 16150

SECTION 16231

DIESEL ENGINE DRIVEN GENERATOR

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. Scope of work shall include furnish and installation of a complete packaged diesel engine generator set in accordance with these specifications
- B. Generator remote I/O control panel described in this section shall be furnished by or under the direction of the Control System Integrator. CONTRACTOR shall be responsible for coordination between generator supplier, control panel fabricator, system integrator, and others as required for a complete and fully operational system.
- C. Each packaged engine generator set shall include a subbase fuel belly tank in accordance with these specifications.

1.02 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.
- B. Section 16120 – Low Voltage Electrical Power Conductors
- C. Section 16710 – Communications Cabling
- D. Section 16900 – Control System Integrator
- E. Section 16910 – Control Panel Construction
- F. Section 16930 – Process Loop Description

1.03 EQUIPMENT DESCRIPTION

- A. Self-contained diesel engine-generator set
 - 1. Complete skid mounted engine generator set package unit consisting of the following for a complete and operating system:
 - a. Engine
 - b. Generator
 - c. Auxiliary systems
 - d. Generator control panel
 - e. Sound attenuated aluminum enclosure
 - f. Stainless steel silencer
 - g. UL 2085 listed fuel storage tank (may be remote tank from generator)
 - h. Access platforms and stairs
- B. Manufacturers:
 - 1. The four preapproved vendors by JEA purchasing are Ring Power (Caterpillar), Zabatt Power Systems (AKSA), Generac, and Cummins.

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DIESEL ENGINE DRIVEN GENERATOR

2. Diesel engine-generators shall be the specified model of the latest commercial design with all necessary controls.
3. The manufacturing facility shall be ISO 9001 certified
4. Engine-generators shall meet all EPA regulations.

1.04 SUBMITTALS

- A. All submittals specified herein shall be in accordance with Section 01300.
- B. ACTION SUBMITTALS
 1. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:
 - a. Thermal damage curve for generator.
 - b. Sub-Transient Reactance...ETC
 - c. Time-current characteristic curves for generator protective device.
- C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 1. Dimensioned outline plan and elevation drawings of engine-generator set, fuel tank, access platforms and stairs, and other components specified.
 2. Enclosure Structural Design Calculations: Signed and sealed by a qualified professional ENGINEER licensed in the State of Florida. Design and calculations shall be in accordance with Florida Statutes, FBC, and these specifications.
 3. Platform and Access Stair Structural Design Calculations: Signed and sealed by a qualified professional ENGINEER licensed in the State of Florida. Design and calculations shall be in accordance with Florida Statutes, FBC, and these specifications.
 4. Vibration Isolation Base Details: Signed and sealed by a qualified professional ENGINEER licensed in the State of Florida. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.
 5. Wiring Diagrams: Power, signal, and control wiring.
 6. Generator supplier shall submit a motor starting analysis based on the identified loads shown in the Contract documents.
- D. INFORMATIONAL SUBMITTALS
 1. Qualification Data: For installer, manufacturer, and testing agency.
 2. Source quality-control test reports.
 - a. Certified summary of prototype-unit test report.
 - b. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
 - c. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.
 - d. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
 - e. Report of sound generation.

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- f. Report of exhaust emissions showing compliance with applicable regulations.
- g. Certified Torsional Vibration Compatibility: Comply with NFPA 110.
- 3. Field quality-control test reports.
- 4. Warranty: as specified in this Section.

E. O&M SUBMITTALS

- 1. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01730 include the following:
 - a. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
 - b. Verification that the fuel tank is full, following all tests and start-up procedures required under this contract.

1.05 SPARE PARTS

- A. Furnish spare parts that match components installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 - 2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
 - 3. Indicating Lights: Two of each type and color installed.
 - 4. Relays: Two of each type and style installed.
 - 5. Terminal Blocks: 10 percent spare terminal blocks installed within the equipment. These are installed and not shipped loose.
 - 6. One quart of finish paint and brush shall be provided with each equipment package for field touchup painting.
 - 7. Furnish 10 percent spare breakers in low voltage panelboard.
 - 8. Furnish (1) spare set of consumables for the first year of operation including fuel filters, oil filters, and air filters.

1.06 WARRANTY STANDARDS

- A. The MANUFACTURER shall provide a two (2) year standard standby generator warranty and an additional three (3) year platinum plus standby generator warranty. Labor, materials, and travel for the warranty period repair will be paid by manufacturer during normal business hours. Warranty shall not be limited by runtime hours. Warranty shall cover all equipment and items furnished by the generator supplier for the packaged engine generator set regardless of the origin of the equipment.
- B. Generator enclosure manufacturer shall provide its standard 2-year warranty.
- C. Fuel tank manufacturer shall provide its standard 30-year warranty.

PART 2 – PRODUCTS

SECTION 16231

DIESEL ENGINE DRIVEN GENERATOR

2.01 GENERATOR REQUIREMENTS

A. Rating

1. Each engine-generator set shall be capable of producing rated output at rated generator RPM when equipped with necessary operating accessories such as air cleaners, lubricating oil pump, fuel transfer pump, radiator fan, jacket water pump, governor, alternating current generator and exciter.
2. Standby duty rated at the EKW, KVA required by contract documents.
3. Generator (Alternator) shall be brushless type, rated at .8 PF lagging, three phase, 60 Hertz, 480, 208 or 240 volts with 12-leads capable of being reconnected to provide the following nominal system voltages defined by IEEE Std. 241:
 - a. 3-phase, 4-wire, 480Y/277 volts, wye connected
 - b. 3-phase, 4-wire, 208Y/120 volts, wye connected
 - c. 3-phase, 4-wire, 240/120 volts, delta connected (L3-N is a "high Leg" 208V not 120V)
4. Unit shall be sized at 110 percent to operate the loads indicated on the project drawings simultaneously, with pumps being started in sequence unless specified otherwise. Unit shall be rated such that each pump, upon start-up, will not experience greater than 20% instantaneous voltage dip, also considering auxiliary power requirements. Responsibility for sizing generator shall lie with the generator supplier. The rating shown on the drawings is based on estimated motor starting kVA ratings and resulting step voltage drops in addition to the running load and serves as the basis for bidding. Alternatives are subject to pre-approval 14 days prior to bid. The supplier shall provide independent calculations of the required rating including step voltage drops.
5. Operating ambient temperature range of 7 °F to 105 °F.
6. Directly connected to the engine flywheel housing with flex coupling.
7. Unit shall be compliant and labeled in accordance with UL 2200.
8. Unit shall be compliant and labeled in accordance with NFPA 110
9. Generator shall be engine driven, single bearing, continuous duty, salient pole, and synchronous type with amortisseur windings. It shall be of the drip-proof type, entirely self-contained with only line leads brought out for loading connections. Generator insulation used shall be NEMA Class H such that generator life will match that of the prime mover. Generator shall be designed so all components are accessible with a minimum amount of labor.
 - a. The maximum voltage dip (including any instantaneous voltage dip) during starting shall be 20 percent.
 - b. The maximum frequency dip (including any instantaneous frequency dip) during starting shall be 20 percent.
10. A vacuum pressure impregnation (VPI) process shall be utilized on form wound stator windings.
11. The Supplier shall provide a stator coil pitch, coil distribution, and skew to minimize the total harmonic distortion (THD) to less than 5 percent.
12. Generator supplier shall coordinate with the CONTRACTOR regarding the harmonic content of the electrical system. As required, the alternator shall be oversized as part of the contract price as part of this coordination.
13. Stator winding shall be 2/3 pitch (67 percent).

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14. An automatic voltage regulator with 3-phase sensing shall be provided. The regulator shall have over excitation protection. A static voltage adjuster shall be provided to use with automatic synchronizer.
 - a. Voltage regulator shall be modular construction, replaceable as an assembly and shall provide regulation for single unit operation within plus or minus 2 percent from rated voltage at any steady state load between "no load" and "full load."
 15. Generator shall have static excitation systems, which shall incorporate silicon control rectifiers to provide alternator field excitation. Static excitation system shall have capacity to provide 150 percent of required excitation at rated load and rated voltage. Static excitation system shall incorporate circuitry to permit voltage build-up from residual magnetism. Field flashing from a separate source is not acceptable.
 16. Voltage level and voltage gain control shall be provided and easily accessible for normal operating adjustments. Voltage level control shall have a minimum range of plus or minus 5 percent from rated voltage. Provide voltage adjustment instruction and generator schematic wiring diagram permanently attached on inside of exciter assembly.
 17. Certain applications may require the use of a permanent magnet generator. The generator supplier shall be responsible for recommending this type of alternator where circumstances warrant its use.
 18. Generator drive shall be free from critical torsional vibration within the operating speed range.
 19. Generator neutral shall be closed.
- B. Generator Control Panel
1. Automatic generator starting electronic modular control panel in a metal enclosure. Starting section shall automatically start engine upon failure of normal source through starting contacts in the automatic transfer switch. Transfer unit shall serve to operate as follows: Failure of normal supply shall cause its voltage sensitive relay to close a normally open contact initiating starting cycle of diesel engine. Closing of this contact shall cause power to be fed to a throttle solenoid, which picks up, opening fuel rack and energizing starting motor through one of its contacts. As generator voltage approaches normal, relay coil in the cranking panel shall pick up, opening starting circuit through one of its contacts, thereby disconnecting starting motor from the rest of the circuit. Lack of oil pressure or over-temperature of cooling system will cause second relay in cranking panel to be energized, as normal alternator voltage is approached, causing starting cycle to be terminated immediately. Should engine fail to start for any reason, a time delay relay in cranking panel limits its cranking period to 30 seconds. A push-button switch mounted on cranking panel shall allow engine to be further cranked at the operator's discretion. Resumption of normal power shall open engine starting contacts in the automatic transfer switch and shall cause engine to shut down after 5-minute delay. Each engine-generator shall have a digital type generator-mounted control panel and shall be supplied with vibration isolators of the type suitable to isolate the control panel from the engine-generator vibration.
 2. The control system features shall include but not be limited to the following:
 - a. Automatic generator loading and unloading for open load transfer.

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- b. Automatic synchronizing – The automatic synchronizing scheme shall be designed to select and synchronize the engine-generator unit across each switch.
 - c. Dead load dead bus transfer system
 - d. VAR/PF control
 - e. Engine Speed Control
 - f. Isochronous or droop mode
 - g. Automatic/Manual Start-Stop with the following safety shutdowns
 - 1) Over-speed protection and indicator
 - 2) Low lube oil pressure protection and indicator
 - 3) High coolant temperature protection and indicator
 - 4) Over-crank protection and indicator
 - 5) Low coolant level protection
 - 6) Engine Control Switch (Three Position: Stop - Manual - Auto)
 - 7) Indicator/ Display Test Switch
 - 8) Digital Voltage Adjust (plus 10 percent - 25 percent Range)
 - h. METERING
 - 1) AC voltmeter
 - 2) AC amp meter
 - 3) Frequency meter:
 - 4) Ammeter/Voltmeter phase selector switch four position (Phase 1,2,3, and Off)
- 3. Two normally open dry contacts that will close when the engine is running and open when engine is stopped.
 - 4. Generator control section shall be 600 volt, with amperage sized to match pump station service and shall include a 3 pole generator circuit breaker with shunt trip. Shunt trip shall be actuated by any of the engine safety devices.
 - 5. Emergency stop push button to shut the engine down regardless of the switch position.
 - 6. Fuel pressure monitored by ECU / generator control panel.
 - 7. Tachometer.
 - 8. Greenleaf data converter EFC 420.1 for fuel level and leak detection.
 - 9. Dry contacts rated 120 volts, AC, 5 amps shall be provided for annunciation of all safety shutdowns, and all control panels mounted visual indicators. Safety shutdowns and control panel visual indicators shall include all items required by NFPA 110 Level 1. Dry contacts shall close on safety shutdown or when visual indicators are illuminated and open when the condition is cleared. In addition, a common alarm (generator alarm) contact shall be provided that closes when any of the above-mentioned contacts close. The common alarm contact shall open when all conditions are cleared. In accordance with the NFPA requirements, alarm module shall be a dc system.
 - 10. All items shall be included as part of the control system. The generator control panel shall be assembled, wired, and tested in the supplier's shop.
 - 11. The control panel shall have adequate clearance from the engine to permit engine maintenance without moving the control panel.
 - 12. Automatic Exerciser:
 - a. Supplier will provide an automatic exerciser for each unit. This exerciser will automatically start, transfer load, run, transfer load back, and cool down unit on a weekly basis for a minimum of one hour for water treatment and wastewater treatment facilities. Operating schedule must

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be fully adjustable both on length and frequency. The automatic exerciser must be provided by the same manufacturer who provides the controls and is a part of the controls package.

- C. Engine-Generator Interface to JEA SCADA system
1. The following I/O from the engine-generator set control panel shall be set up for interface with a generator distributed I/O control panel. The generator distributed I/O control panel will feed the generator status information to the main station control panel equipment over PROFINET. Contacts from the generator shall be prewired and labeled to connect with the Greenleaf EFC-420.1 data converter and automatic transfer switch contacts.
 2. The following digital I/O shall be incorporated into the generator control panel GCP-1 for interconnection with the third party supplied Generator Remote I/O Panel GIO-1:
 - a. Generator Running
 - b. Generator Fault
 - c. Generator Auto Status
 - d. Generator Breaker Closed
 - e. Generator Remote Stop
 - f. Generator Overcrank
 - g. Generator Max Runtime
 - h. Generator Underspeed
 - i. Generator Low Coolant Temp
 - j. Generator High Coolant Temp
 - k. Generator Low Coolant Level
 - l. Generator Low Oil Pressure
 - m. Battery Charger AC Power Fail
 - n. Battery Charger Fault
 - o. Battery Voltage Warning
 - p. Fuel Leak
 - q. Fuel Level Low
 - r. Fuel Level High
 - s. Greenleaf Converter Fault
 3. The following analog I/O shall be incorporated into the generator control panel:
 - a. Fuel Level
- D. Generator Remote I/O Panel GIO-1
1. The Bill of Material below is the list of the devices to be provided and installed as part of the generator remote I/O panel. The list provides the main components and equipment to be furnished, but it is not all inclusive. The control panel fabricator shall furnish additional components or equipment as required to meet the control intent of the contract documents. Refer to Section 16910 for additional requirements.
 2. Generator remote I/O panel shall be located adjacent to the generator.
 3. The generator remote I/O panel shall be powered from a 120VAC source from the main station control panel SCP-1.
 4. Enclosure shall have a thermostatically controlled anti-condensation heater, switched enclosure LED light, and convenience receptacle installed.

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5. Approved Panel Bill of Materials (modify as required to meet specific facility design intention).

Manufacturer	Part Number	Description
Siemens	6ES5710-8MA11	DIN rail 35 mm, length: 483 mm, for 19" cabinets
Siemens	6ES7153-4BA00-0XB0	IM 153-4 High Feature for ET 200M, PROFINET
Siemens	6ES7193-6AR00-0AA0	Bus Adapter 2xRJ45
Siemens	6ES7195-1GA00-0XA0	DIN rail for active bus modules, 482 mm (19")
Siemens	6ES7195-7HA00-0XA0	Active bus module for power supply and interface module 153
Siemens	6ES7195-7HB00-0XA0	Active bus module for 2 modules 40 mm wide
Siemens	6ES7321-1FH00-0AA0	Digital input 16 DI, 120/230 V AC; isolated
Siemens	6ES7331-7KF02-0AB0	Analog input 8AI; 14-bit; 20ms; isolated
Siemens	6ES7392-1AJ00-0AA0	Front connector, 20-pin, with screw contacts
Siemens	6ES7392-1AM00-0AA0	Front connector, 40-pin, with screw contacts
Siemens	6ES7400-1TA01-0AA0	UR1, central controller/expansion device; 18 slots, K bus
Siemens	6ES7307-1BA01-0AA0	PS 307; AC 120/230V, DC 24V, 2A

2.02 ENGINE REQUIREMENTS

- A. Diesel engine shall be heavy-duty type to meet EPA regulations.
- B. Arranged for direct connection to an alternating current generator and shall be the product of a manufacturer regularly engaged in the building of full diesel engines. Engine shall be a current model which has been in regular production for at least three years. Engine shall develop sufficient brake horsepower, net at rated RPM, corrected to sea level barometric pressure (29.92 in. HG) and 110 degrees F, to operate generator continuously at its rated output with all losses included without undue heating, vibration or wear. Diesel engine shall be water cooled four cycle compression ignition diesel. The engine exhaust manifold shall have an expanded metal guard spread sufficiently away from hot parts.
- C. Engine shall meet the required capacity when operating on No. 2 diesel and B20 bio diesel, where applicable.
- D. Engine shall be supplied with electronic governor capable of 0.25 percent speed regulation from no load to full rated load for isochronous regulation of engine speed. Belt-driven or velocity governors are not acceptable.
- E. Engine shall be equipped with a pressure lubrication system supplying oil to all surfaces requiring lubrication. Circulation shall be by a positive displacement pump. Lubrication system shall include a full flow strainer, oil filter, and an oil cooler of sufficient capacity to properly cool all lubrication oil circulated, and level indicator or dipstick.
- F. Engine shall have an individual mechanical injection pump and injection valve for each cylinder, any one of which may be removed and replaced from parts stock.

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Injection pumps and injection valves shall not require adjustment in service. Fuel injection pumps shall be positive action, constant-stroke pumps, actuated by a cam driven by gears from the engine crankshaft.

- G. Fuel lines between injection pump and valves shall be heavy seamless tubing; and, to eliminate irregularity of fuel injections, shall be of the same length for all cylinders.
- H. Fuel system shall be equipped with replaceable fuel filter elements which may be easily removed without breaking any fuel line connections or disturbing the fuel pumps or any other part of the engine. Provide easily serviceable fuel/water separator/filter ahead of other fuel filters.
- I. All fuel filters shall be conveniently located in accessible housing, ahead of injection pumps so that fuel will have been thoroughly filtered before it reaches the pumps. No screens or filters requiring cleaning or replacement shall be used in injection pump or injection valve assemblies.
- J. Engine shall be equipped with a built-in gear-type engine-driven fuel transfer pump, capable of lifting fuel against a head of twelve feet, for supplying fuel through filters to injection pump at constant pressure.
- K. Engine shall be provided with suitable safety controls to automatically stop the unit when low oil pressure, water temperature or engine speed exceeds safe limits. Pilot lights shall be provided to visually indicate the cause of engine shut down. Pilot lights shall operate off battery circuit and shall be on engine generator control panel. Provide contacts for remote engine failure annunciation.
- L. Engine shall be equipped with radiator and blower fan of sufficient capacity for cooling engine when diesel electric set is delivering full rated load in an ambient temperature of 125 degrees F. Air flow restriction from radiator shall not exceed 0.5 inches water. Engine shall have a thermostat integral with jacket water circuit to maintain water at proper operating temperature. Engine shall have a belt driven centrifugal type water circulating pump for circulating water through cooling system.
- M. Provide one or more engine mounted dry type air cleaners of sufficient capacity to protect working parts of the engine from dust and grit.
- N. Engine shall be equipped with an oil/ vapor recovery container or box that meets EPA regulations. The intent of the recovery system is to not allow the blow by waste to escape into the atmosphere or soak the radiator coils, as well as be a possible housekeeping issue around the engine-generator.
- O. Water cooled diesel engine, sized for generator set.
- P. All engine exhaust emissions shall meet EPA requirements for standby power generation.
- Q. Engine starting system shall include an electric motor start system including dc starting motor, required voltage battery pack and rack, cables, and battery charger.

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1. For engine-generator sets rated 750 kW and above, a redundant electric starting motor shall be provided.
- R. The batteries shall be of the lead acid type. The battery shall be sized to provide the specified number of starts, cranking time at firing speed (five 10 second cranks) at any ambient between minimum (7 °F) and maximum (105 °F) design ambient temperatures, with final discharge voltage, exceeding minimum control power supply voltage requirements. Batteries shall be lead acid type complete with cables and rack. Battery shall be rated in accordance with requirements of engine manufacturer. Batteries shall be located for easy removal and servicing.
- S. Battery Charger:
1. Current limiting battery charger to automatically charge batteries.
 2. Charger shall be dual charge rate with automatic switching to boost rate when required.
 3. Charger shall be mounted at rear of engine-generator set inside the enclosure.
 4. Control wire connection between starting and safety circuits shall be pre-connected before arriving at job site.
 5. The service powered battery charger shall float charge the battery pack and shall be solid-state, full wave bridge rectified type, using silicon controlled rectifiers for power control. The battery charger shall be suitable for the required voltage, and current, battery pack type, shall have a dc output circuit breaker, floating voltage equalization, equalizing timer, a ground detection system, a voltage relay to activate low battery voltage alarms at the engine-generator control panel, and battery charger failure which shall alarm at the engine-generator control panel.
- T. Cooling System:
1. Engine shall be cooled with a unit-mounted radiator cooling system complete with:
 - a. Radiator
 - b. expansion tank
 - c. water pump
 - d. belt-driven fan
 - e. fan guard
 - f. thermostatic temperature control
 - g. high water temperature cutout
 - h. electric jacket water heater
 2. The jacket water heater shall be sized for Northeast Florida climate and shall maintain jacket water at 90 F in an ambient temperature of 30 degrees F.
 3. The jacket water heater shall be thermostatically controlled, if "acorn" type heaters with nonadjustable thermostats are provided then they shall not be oversized to waste energy or burn up hoses and shall be single phase, 60 Hertz, and applicable voltage.
 4. All jacket water heaters hoses shall be silicone type.
 5. All jacket water heaters hoses shall have shut off valves at engine, supply and return as to allow maintenance personnel to swap out hoses without draining all the fluids.

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6. The radiator shall be sized to handle the cooling of the engine and all other accessories required for proper operation in the North Florida Region.
7. The fan shall draw air over the engine and discharge through the radiator.
8. The radiator coils shall be 100% dipped in Bronze-Glow (husky coil coat) to provide additional protection on coils for all units do to the corrosive atmosphere at JEA water and wastewater facilities.
9. The cooling system shall be filled with a permanent antifreeze mixture of 50 percent ethylene glycol type with rust inhibitor.

2.03 ENCLOSURE/ SILENCER

- A. Complete diesel engine generator set including control panel, engine starting batteries and fuel oil tank shall be enclosed in a factory assembled water protective, sound attenuated aluminum enclosure.
 1. Enclosure for units with greater than 250 kW nominal capacities shall be of the walk-in type and shall be of the drop over configuration, suitable for pad mounting or on base fuel storage tanks. Minimum distance from engine-generator and generator to end wall shall not be less than 3'-0" for walk in type enclosures. The complete engine-generator set shall be enclosed in a modular, walk-in type, weatherproof enclosure. The enclosure shall provide 6 ft. minimum head clearance and 24 inches minimum walk around clearance on sides not including radiator. The enclosure will consist of two sidewalls, two end walls, louvers, and roof.
 2. The enclosure shall be made of anodized marine grade aluminum white panels. Doors shall be lockable by padlock with stainless steel hardware for access to the engine-generator, controls, and accessories. Doors shall also provide easy accessibility for maintenance. Enclosures shall be polished. Supplier will remove all advertising and labels on the exterior of any enclosure. Drop over type enclosures shall have a rubber gasket under it with a rubber cement type adhesive to keep gasket in place to prevent water intrusion into enclosure as well as keep engine fluids from leaking out.
 3. The enclosure shall be constructed of removable side panels and end panels. All fasteners and hardware used in construction of the enclosure shall be stainless steel. The enclosure shall be braced as necessary to support the silencer and designed to withstand 150-mph wind without damage. All bracing and reinforcing members shall be integral to the enclosure. Roof penetrations for the installation of the silencer shall have a gasket to prevent the entrance of rain. The unit shall have continuous hinged side doors each side and continuous hinged doors at control end, equipped with pad lockable hardware for ease of engine maintenance and a three-point latch system. Doors shall be a minimum of 36-inches. There shall be an expanded metal grating or a punched louvered radiator core guard installed - flush with the enclosure panels in front for the radiator grill, and fixed, punched louvered air intake ports on the enclosure sides and rear for proper air circulation within the housing provide lifting eyes and spreader bar reinforcement for crane unloading. A stainless steel handle mounted at the control panel entry door.
 4. The louvers shall be screened from the inside to prevent the entry of insects. The enclosure shall have all penetrations gasketed or sealed to prevent the entry of rodents. "Rain Resistant" louvers, as manufactured by Ruskin or Cesco, vertical air turning plenums, or equal shall be provided to prevent the

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entrance of rain when the unit is operating and the wind direction is at 90 degrees to the air intake at 120 mph. The entire enclosure, except for the louvered openings, shall be provided with noise suppression insulation mechanically secured and fastened.

5. Enclosures shall be provided with noise suppression insulation and air plenums designed to provide a sound level of mechanical noise of 86 dB (A) at 15 feet from any point of the enclosure. Minimum of two industrial LED fixtures from Columbia Lighting model LXEM4-40ML-RFA-EDU, spring wound timer light switch, prewired distribution circuit, power panel, and duplex receptacles shall be conveniently provided in the enclosure. The light switches shall be located inside enclosure access doors and receptacles shall be provided near generator control panel. Provisions shall be made for mounting batteries and rack inside the enclosure. The generator breaker, generator control panel, distribution (lights, jacket water heater, etc.) power breaker panel, batteries and accessories shall be located in the enclosure. Engine-generator supplier shall provide and install a 240/120V transformer adequately sized to handle all enclosure loads from service voltage. Transformer shall be fed from a facility provided 480VAC service via a generator supplier provided disconnect inside the enclosure.
6. All engine oil and coolant drains shall be piped to outside of enclosure with shutoff valves and shall have threaded stainless steel or aluminum caps. The threaded drain lines shall be labeled on the outside of the enclosure with an aluminum label with aluminum or stainless rivets.
7. Enclosure shall be Phoenix Products, Advanced Manufacturing & Power Systems, or Fidelity Manufacturing.
8. Power Supply:
 - a. Each engine-generator set will be provided with a single 480V ac power supply by others capable of being rewired for lower voltages.
 - b. Each engine-generator shall be provided with a power panel sized to power the required loads inside the enclosure by the Supplier as specified herein. The engine starting and controls will operate from the dc-powered batteries specified herein.
 - c. Each engine-generator unit shall have a 120V ac, single phase, 60 Hz, panel with main overcurrent protection device, and shall be mounted inside the enclosure and shall be isolated from engine-generator vibration. The Supplier shall determine the number of branch circuit breakers required and furnish additional of 10% spares. Circuits must be labeled in panel. The power panel shall be prewired to all engine-generator accessories, including but not limited to the following:
 - 1) Enclosure intake and exhaust louvers.
 - 2) Engine-generator starting system (battery charger).
 - 3) Engine electric jacket water heater.
 - 4) Enclosure lights and receptacles.
9. Each engine-generator unit shall be furnished with complete exhaust system including a stainless steel exhaust silencer, all-stainless steel piping, all-stainless expansion joints and accessories as required for a complete operating system.
10. The exhaust silencer shall be chamber type, of all-welded Type 304L stainless steel construction with all stainless steel hardware and fasteners.
 - a. The silencer shall be of the side inlet type

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- b. Secured in position at no less than 4 points
 - c. The silencer shall be supported by a welded 304 or 316 stainless angle iron cradle; silencer shall be bolted or strapped to cradle and then bolted to the roof support members mounted inside the roof of the enclosure for a horizontal mounting on top of the enclosure.
 - 11. The silencer shall be sized so that the backpressure at rated capacity of the engine does not exceed one half the supplier's maximum allowable backpressure. The silencer shall be suitable for critical type silencing and shall be a Maxim "Model M51" or equal.
 - 12. All exhaust piping shall be Type 304L, Schedule 10S stainless steel, and the exhaust shall discharge horizontally at the silencer outlet, with 45-degree bevel cut with a stainless expanded metal bird screen.
 - 13. The intake of the silencer shall connect to the flexible exhaust connection by stainless steel pipe. Size as required by engine manufacturer. A flexible stainless steel exhaust adapter, 18 inch minimum length, shall be furnished for mounting between the engine and silencer. The flexible exhaust connection as specified shall mount directly on exhaust manifold and shall be mounted so that no weight is exerted on the manifold at any time.
 - 14. Platform, access stairs, and handrail to the generator enclosure shall be constructed of aluminum 6061-T6. All components shall meet current Florida building code and all applicable safety codes. The stair and platform drawings and calculations shall be signed and sealed by a professional ENGINEER in the State of Florida.
- B. Instrument transformers, instruments, and associated devices:
- 1. Current Transformers. Current transformer mechanical and thermal limits shall be coordinated with the momentary and short time ratings of the switching device with which JEA utilizes. The thermal ratings shall be based on a short-circuit duration of 1 second or greater. The minimum current transformer accuracy rating shall be C200.
 - 2. Voltage Transformers. Voltage transformer shall have a rating of not less than 500 volt-amperes on a thermal basis and a capability of withstanding a secondary short-circuit for not less than 1 second. Each transformer shall be provided primary and secondary fuses. The primary fuses shall be adequately rated for the transformer inrush and load current, and they shall have an interrupting capacity equal to or greater than the maximum short-circuit momentary current rating required. The connections from the main buses to primary of the voltage transformer shall be capable of carrying the rated short-circuit current for a minimum of 1 second.

2.04 FUEL SYSTEM / TANK

- A. Each engine-generator unit shall be furnished with a complete fuel system, including engine-driven fuel pump, fuel filter/ water separator, engine supply and return line, all stainless steel flexible connections, manual fire-safe shutoff valves, and anti-siphon valve in accordance with Chapter 22.13 of NFPA 30, Section 7 of PEI/RP200-13, and Section 11.2 of NFPA 30A. All items shall be suitable for the specified fuel. The engine-driven fuel pump shall transfer the fuel from the fuel storage tank to the engine-generator. The fuel system shall be furnished with any equipment required

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for the engine to supply or return any unused portion of fuel back to the fuel storage tank with any level in the tank.

1. JEA Maintenance and Environmental Departments including the JEA Project Manager must be notified by supplier between 45 and 30 days, and again between 72 and 48 hours in advance of above ground fuel storage tanks shipments greater than 550 gallons. All requirements of DEP's 62-762 for Aboveground Storage Tank Systems must be followed.
- B. All manual stainless steel fire-safe shutoff valves and a filter / water separator shall be provided on the fuel supply line. The shutoff valve and the filter/ water separator shall be located upstream from the flexible connection at the engine-generator for generators mounted on a fuel tank.
- C. All manual stainless steel fire-safe shutoff valves on separate standalone fuel storage tanks shall be mounted in the vertical position on the outside of the generator enclosure, before any solenoid or anti-siphon valve and shall be welded.
- D. There shall be no shutoff valves on any fuel return line.
- E. There shall be an anti-siphon valve downstream of the manual stainless steel fire-safe shutoff valve on all fuel tanks 551 gallons and above as required per FDEP. All anti-siphon valves must be adjustable and sized for exact rise and run of fuel piping per the site conditions.
- F. Fuel system shall be equipped with replaceable fuel filter elements, which may be easily removed without breaking any fuel line connections or disturbing the fuel pumps or any other part of the engine.
- G. All fuel filters shall be conveniently located, ahead of injection pumps so that fuel will have been thoroughly filtered before it reaches the pumps. No screens or filters requiring cleaning or replacement shall be used in injection pump or injection valve assemblies. The combination fuel filter/separator shall be a manifold unit with shutoff valves and shall be installed on the fuel supply line between the fuel storage tank and the engine driven pump and shall as manufactured by Racor or equal.
- H. The manual fire safe shutoff shall be ball valve of a three-piece design, with stainless steel body and end caps, stainless steel ball and stem, reinforced Teflon seats and seals, and socket welding ends. Valves shall be of fire safe design and shall utilize secondary metal seating surfaces to ensure shutoff if the primary seats are destroyed by fire. Fire safe ball valves shall be Contromatics or Jamesbury.
- I. Fuel oil cooler shall be supplied if the engine fuel system absorbs heat from the unit injectors and surrounding jacket water. The fuel cooler shall be radiator mounted, air-cooled to cool the return fuel as required to maintain proper fuel operating temperature. The cooler shall utilize the airflow from the radiator fan for cooling. Any coils shall be 100% dipped in Bronze Glow (husky coil coat) to protect against corrosion.
- J. Storage tanks shall be insulated secondary containment aboveground storage tank system for flammable and combustible liquids shall be vehicle impact protected and

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projectile resistant and must meet UL 2085 standards. Tank shall be a steel tank housed in a double containment concrete vault/tank and supplied by Phoenix Products, Convault, Advanced Manufacturing & Power Systems (AMPS), or Fidelity Manufacturing.

1. The tank shall be tested to and listed (and carry UL/ULC labels) for the following:
 - a. UL – 2085, two-hour furnace fire test and two hour simulated pool fire test for insulated tank.
 - b. UL –2085 insulated and protected secondary containment aboveground tanks for flammable and combustible liquids.
 - c. UL – 2085 ballistic and vehicle impact test for protected tank.
 - d. The tank shall withstand bullet resistance tests in compliance with UFC Section (79-7).
 - e. The tank shall be supplied with flood resistant tie-down brackets/hurricane hold-down restraints.
2. Steel Tank Construction:
 - a. Steel tank shall be made of 3/16-inch-thick steel. The steel tank shall hold the liquid fuel. The tank shall be made in accordance with UL Standard 2085 and ULC Standard S601 covering all aspects of tank fabrication including material specification, fabrication, welding and testing. The steel tank's exterior shall be coated with primer and paint for protection against corrosion.
 - b. At the fabrication shop, the tank shall undergo a 24-hour pressure test at 5 psig.
 - c. Secondary Containment:
 - 1) The steel tank shall be wrapped with a minimum of ¼ inch thick Styrofoam (foam) insulation and an impervious barrier of 30 MIL high density polyethylene membrane (poly). The 30 MIL poly shall provide containment for a fuel leak through the steel tank. A leak detector pipe terminating in the secondary containment shall provide positive-proof that the tank is not leaking.
 - 2) The 30 MIL poly shall shield and protect the steel tank exterior from coming in direct contact with the concrete and thus minimize the potential of tank external corrosion.
 - d. Concrete Vault:
 - 1) The tank and secondary containment shall then be encased in a 6-inch-thick reinforced concrete vault. The 6 inches of concrete shall be poured on all sides, bottom, and top of the tank in one step and be monolithic. This process assures that there are no joints and no heat sinks in the concrete to carry heat from a fire into the primary containment.
 - e. All double wall standalone tank coatings shall be approved by a JEA representative.
3. The double wall tank shall have a sloped top if exposed to weather conditions as to allow rainwater to run off. All standalone tanks if mounts are available shall be secured to concrete slab with stainless steel anchor bolts and washers.

K. All above ground fuel storage tanks shall meet or exceed UL2085 standards.

L. Rupture basin with 110 percent capacity.

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- M. Engine-generator sets up to 150kW shall have a subbase tank designed with minimum capacity to provide 75 hours continuous operation of the engine-generator at 100 percent load, up to 500 gallons maximum capacity. The subbase tank shall be of welded steel construction throughout and shall be constructed to permit access to the electrical stub up area.
- N. Engine-generator sets 150kW or greater shall be furnished with an approved above ground fuel storage tank with a minimum storage capacity to provide 60 hours continuous operation of the engine-generator at 100 percent load.
- O. Foundations and tank dimensions shown within the contract documents are based on preliminary information. CONTRACTOR shall coordinate specific requirements with the generator / fuel tank supplier during shop drawing review. Should the tank dimensions required to meet the specifications vary from the basis of design shown on the plans, the generator manufacturer, tank manufacturer, the supplier, and CONTRACTOR shall coordinate to determine a recommended foundation size for the tank and any hardware and appurtenances. The minimum foundation size shall match the dimensions of the tank plus three feet in all directions. The foundation shall be designed with the same material and spacings as shown on the structural details. Final ENGINEER approval of the foundation size and layout shall be provided during the shop drawing process. Tank shall be located as per details shown on the structural drawings.
- P. Access stairs and platforms shall be provided for access to the generator enclosure and fuel tank at elevations greater than 36-inch from grade. Built in steps are acceptable for elevations less than 36-inch from grade. The access steps, stairs, handrail, and platform to the tank or generator shall be constructed of aluminum 6061-T6. All components shall meet current Florida building code and all applicable safety codes. The CONTRACTOR shall coordinate the tank and stair location to ensure access stair and tank are located on the foundation.
- Q. The fuel storage tank shall be provided with the following items:
 - 1. Vent cap
 - 2. Primary Vent shall not exceed height of enclosure for sub base tanks.
 - 3. Emergency vents
 - 4. EFG-8000I Greenleaf fuel level gauge
 - 5. EFC-420.1 4-20mA data converter
 - 6. Manual fuel stick with gallons to inch laminated conversion chart
- R. The fuel storage tank shall be provided with the following connections:
 - 1. Fuel supply
 - 2. Fuel return
 - 3. Fill with camlock fitting and cap with stainless steel or aluminum fittings and 5 GL minimum overspill containment box
 - 4. Back up mechanical Kruger fuel level gauge
 - 5. Vent
 - 6. Primary tank emergency vent
 - 7. Low and high-level switches (From Greenleaf EGG-8000I Level Transducer)
 - 8. Interstitial leak detection

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9. Secondary tank emergency vent
 10. Secondary tank Mechanical Krueger leak gauge
 11. Placard set stating size, fuel fill, vent, emergency vent, combustible, no smoking and diesel on two sides and near fuel fill.
- S. The fuel storage tank shall have controls that include but not limited to the following:
1. Greenleaf Solar Gauge EFG-8000-I with EFC -420.1 4-20 mA data converter. The gauge shall monitor fuel level in gallons, interstitial leak, high, and low fuel level.
 - a. The EFC-420.1 4-20 mA data converter shall be mounted inside the generator control panel and shall be wired to the EFG-8000I gauge and output feeds to SCADA, via generator distributed I/O panel, shall include analog signals for continuous level monitoring and digital signals for leak, low level, and high-level detection.
 - b. All electrical runs shall be in either rigid or non-metallic liquid tight conduit.
 - c. The EFG-8000-I gauge shall be mounted on the outside of the enclosure if on a base tank less than 500 gallons and at fuel fill end. All penetrations through enclosure shall be weather tight. For no or low light conditions EFG-12V is required for the EFG-8000-I gauge.
 - d. For all standalone fuel storage tanks, the EFG-8000-I gauge shall be mounted at eye level at the fuel fill end of the fuel tank. All conduits going from the EFG-8000-I gauge to the EFC-420.1 data converter in the generator control panel shall be aluminum grade with aluminum or stainless Unistrut with clamps securely attached to the concrete slab. No penetrations shall be made into the above ground fuel storage tank.
 2. Level gauge, capable of measuring the fuel level without the engine running.
- T. Tank fill connection and level gauge shall be accessible for personnel at ground level through a lockable door in or outside the enclosure. A fill spill containment box shall be sized for 5 – 10 gallons and provided for containment of spillage during tank fill.
1. Pad lockable overflow fuel fill port and caps with stainless steel hasp.
 2. Spring type plunger fuel fill port drain
- U. A suitable sized vent connection and vent cover shall be provided for the storage tank vent. The vent cover shall be installed outside the enclosure. The cover shall have an aluminum body, screen over the outlet, and shall prevent rain from entering the vent line.
- V. A suitable sized emergency vent connection and emergency vent shall be provided for the primary and secondary fuel storage tank. Each emergency vent shall be installed outside the enclosure and shall be designed as required to relieve excessive internal pressure caused by fire exposure.
- W. Primary vent shall not exceed height of enclosure for subbase tank and shall not block engine exhaust pipe.
- X. All flexible diesel fuel piping inside enclosure or at engine-generator shall meet SAE 100R17 hose with stainless connections to prevent against rupture, corrosion and fire. All threaded connections shall utilize Hercules Chemical Company Inc. Multipurpose heavy Teflon "Tape Dope" and "Megaloc and or Real-tuff".

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- Y. The diesel fuel piping shall be standard weight (Schedule 40) 316 stainless steel with socket welded fittings per ASTM standards. At the option of the supplier, use Schedule 40 316 stainless steel with welded fittings. All piping shall be welded and done by a certified pipe welder. Where threaded union is required, use Hercules Chemical Co. "Megaloc or Real-tuff" all-purpose pipe dope on all stainless steel threaded connections. Vendor/ CONTRACTOR must warranty all piping connections to be free of any leaks, drips or weeping for one year.
- Z. Above ground fuel storage tanks that have fill box openings over 60 inches above grade shall have aluminum or stainless steel stairs and platform at the fuel port. Larger base tanks/ enclosures that have a walk-in type enclosure shall have access stairs or ladders that are located on two sides of the enclosure / base tank made of aluminum or stainless steel. The stairs/ platform shall be secured to concrete slab using stainless anchor bolts and washers.
- AA. Supplier shall provide 90 percent of fuel for rated tank capacity for any and all turnkey installations by supplier. Fuel shall be number 2 off road ultra-low sulfur diesel. Fuel delivery shall take place prior to load bank test. Supplier shall treat fuel with Hydro Clean made by Gulf Select.

2.05 SHOP PAINTING

- A. All components of each engine-generator unit, including engine, fuel storage tank (if applicable), alternator, piping, and valves shall be shop primed and finish painted prior to shipment to the site. The paint shall be suitable to an outdoor environment and shall be approved by JEA. Stainless steel, nonferrous, and nonmetallic surfaces shall not be painted.
 - 1. Fuel storage tank with ferrous metal (base tanks) shall be surface prepared to protect all surfaces from corrosive environment at JEA facilities. Metal shall be solvent cleaned on all surfaces to be coated utilizing approved system by JEA Facilities Operations. The entire pipe fittings and nipples on the tank shall be powder-coated to protect them from corrosion. Coating not required on 304 / 316 stainless steel penetrations are used.

PART 3 – EXECUTION

3.01 FACTORY ACCEPTANCE TESTING

- A. The drive and generator shall be completely factory assembled and tested by the Supplier to prove that they are assembled correctly, and capable of meeting the net generator output kVA rating. All other components and support systems shall be thoroughly inspected by the Supplier prior to shipment. All control system shall be tested to verify correctness of assembly and operation, applicable high potential test before and after load runs, and applicable standard tests. The integrity and proper connection of all electrical circuits shall be verified.
- B. The tests shall consist of specified capacity loading changes (25 percent, 50 percent, 75 percent and 100 percent of primary duty kW) under a resistive load bank for a minimum of 4 continuous hours total and demonstrate that each safety shutdown

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device is working properly. The Supplier shall submit copies of the onsite tests prior to start of warranty. Shop tests shall be performed at the manufacturer's facility.

- C. The Supplier shall notify the ENGINEER and OWNER at least one week prior to the shop test. The ENGINEER and OWNER reserve the right to witness the shop test.
- D. If such tests indicate specified performance has not been met, the Supplier shall pay the cost of all corrective measures and additional tests until such time as tests demonstrate that specified performance has been met.

3.02 OPERATING CONDITIONS

- A. Each engine-generator unit will be used as a power unit when the utility-supplied power fails and shall provide the specified minimum nominal standby capacity for the duration of 60 - 75 hours minimum at full load.
- B. The unit shall be capable of being started, synchronized to the system and loaded to the full rating of the unit without dependence upon ac auxiliary power for a minimum of five minutes. The voltage shall remain +/-10 percent unless stated otherwise.
- C. Each engine-generator unit shall be suitable for "black start" conditions and shall automatically start and connect to electrical loads when initiated from an automatic transfer switch.

3.03 FIELD START UP AND TESTING

- A. Prior to acceptance of the installation, each unit shall be tested at the job site to show it is free of any defects and will start automatically and be subjected to full resistive load test at rated capacity, 0.8 power factor, with enclosure using dry type load banks. Supplier shall provide startup personnel to train personnel and witness the tests. Testing by Supplier shall be for a period of four continuous hours and shall be done in the presence of the JEA representative.
 - 1. The supplier shall furnish the services of one or more technical service representatives to assist in the installation of new engine-generators. The service representatives shall be technically competent; factory trained; experienced in the installation and operation of the equipment; and authorized by the supplier to perform the work stipulated.
 - 2. Supplier will start up and service the engine-generators utilizing its own technicians and will not subcontract any start up work out.
 - 3. For new engine-generators, the Supplier shall also furnish the field services of direct representatives of the manufacturers of auxiliary equipment which has rotating parts, or which may require field inspection and adjustment to assure proper operation.
 - 4. The technical service representatives shall furnish written certification to ENGINEER and OWNER that equipment has been inspected, adjusted, and passed load bank test by them or under direction and that it is ready for service. All written certification must be duplicated, and one copy left onsite in the Manual-Pak maintenance folder and the other electronically sent to the

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DIESEL ENGINE DRIVEN GENERATOR

ENGINEER and JEA Project Manager in Facilities Operation and Maintenance.

5. The duties of technical service representatives may include, but may not be limited to the followings:
 - a. Providing technical advice to assist a CONTRACTOR in installing the equipment.
 - b. Inspection and testing the equipment after installation and directing any changes or adjustments required to assure proper operation. The engine-generator unit shall be field tested by the field service representative(s) for compliance with the specified requirements. The tests shall include but not necessarily limited to the followings:
 - 1) Ability to start connects to and brings up a dead bus.
 - 2) Net output at design conditions.
 - c. Providing technical direction during startup and initial operation of the equipment.
 - d. Directing the correction of any design or manufacturing errors.
 - e. Instructing JEA's personnel in the operation and maintenance of the equipment.
 - f. Providing services required as a condition to providing warranties and guarantees specified.
6. Service Representatives and Technicians required for installation and start-up are included in the initial engine-generator pricing.
 - a. Technical Service Representative includes all expenses including, but not limited to, small tools and consumables, travel, meals, per diem, salaries, benefits, overheads, etc.
7. The load bank will be capable of definite and precise incremental loading and shall not be dependent on the generator control instrumentation to read amperage and voltage of each phase. Rather, the test instrumentation will serve as a check of the generator set meters.
8. Correct amount and grade of crank case oil, coolant, and other fluids necessary for initial testing and operations shall be supplied with each unit.
9. On completion of the installation, the initial inspection for correct installation and start-up shall be performed by a factory-trained representative of manufacturer. At the time of start-up, operating instructions and maintenance procedures shall be thoroughly explained to the operating personnel.
 - a. In addition to equipment specified, each generator shall be equipped with all standard equipment as specified by the manufacture for this model and shall include but not be limited to the following necessary items:
 - 1) Initial filling of oil and antifreeze.
 - 2) Shrink wrap applied to the product to ensure a clean finish.
 - 3) During the start-up, the technician shall record the following information and provide to the OWNER for his records:
 - a) Operating Voltage
 - b) Hz
 - c) Phase
 - d) kW
 - e) KVA
 - f) Connected load (Amperage)
 - g) Package information consisting of:
 - i Generator and engine make

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DIESEL ENGINE DRIVEN GENERATOR

- ii Generator and engine model
 - iii Generator and engine serial number
 - iv Start-up date
- 10. Prior to acceptance, any defects, which become evident during this test, shall be corrected by Supplier at no additional expense to JEA.
- 11. Vendor must coordinate all start up and testing activities with the ENGINEER and OWNER. After installation is completed by others and normal power is available, the vendor must perform a one (1) day start-up including the use of building load. The start-up technician will instruct all necessary personnel how to operate and maintain the equipment in accordance to the manufacturer's requirements.
- 12. The Supplier's representative shall provide training for up to 4 hours for JEA in the proper operation of the equipment. The supplier shall provide at no additional cost to JEA any and all software and data ports to communicate with engine-generator EMC panels.

END OF SECTION 16231

SECTION 16289

LOW-VOLTAGE SURGE PROTECTION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.
- B. Related Requirements:
 - 1. Section 16441 "Panelboards" for factory installed SPDs.

1.03 DEFINITIONS

- A. In: Nominal discharge current.
- B. MCOV: Maximum continuous operating voltage.
- C. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.
- D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.
- D. OCPD: Overcurrent protective device.
- E. SCCR: Short-circuit current rating.
- F. SPD: Surge protective device.
- G. VPR: Voltage protection rating.

1.04 ACTION SUBMITTALS

- A. Provide all submittals in accordance with Section 01300.
- B. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 - 2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, $I_{nominal}$ ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

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LOW-VOLTAGE SURGE PROTECTION

1.05 INFORMATIONAL SUBMITTALS

- A. Provide all submittals in accordance with Section 01300.
- B. Field quality-control reports.
- C. Sample Warranty: For manufacturer's special warranty.

1.06 O&M SUBMITTALS

- A. Provide all submittals in accordance with Section 01730.
- B. Maintenance Data: For SPDs to include in maintenance manuals.

1.07 QUALITY ASSURANCE

- A. Source Limitations: Obtain equipment within same product category, from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.

1.07 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: One year from date of Substantial Completion.

1.08 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
 - 1. Advanced Protection Technologies Inc. (APT).
 - 2. Eaton Corporation, (Innovative Technology.)
 - 3. Emerson Electric Co. (Liebert)
 - 4. Schneider Electric Industries SAS.
 - 5. Siemens Industry, Inc.
 - 6. Surge Suppression, Inc

SECTION 16289

LOW-VOLTAGE SURGE PROTECTION

7. Total Protection Solutions

PART 2 – PRODUCTS

2.01 GENERAL SPD REQUIREMENTS

- A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. All Surge Protective Devices (SPDs) shall be tested and listed to the latest edition of ANSI/UL 1449-2006. "Manufactured in accordance with UL 1449" is not equivalent to being listed to ANSI/UL 1449-2006 and does not meet the intention of this specification
- D. MCOV of the SPD shall be the nominal system voltage.
- E. SPD units shall be UL 1283 Listed as an Electromagnetic Interference Filter and marked accordingly.
- F. Provide SPDs with the following modes of protection:
 - 1. Three-Phase, Four Wire systems: 10 Modes: L1-L2, L2-L3, L3-L1, L1-N, L2-N, L3-N, L1-G, L2-G, L3-G, N-G
 - 2. Three-Phase, Three Wire systems: 6 Modes: L1-L2, L2-L3, L3-L1, L1-G, L2-G, L3-G
 - 3. Single-Phase, Three Wire Systems: 6 Modes: L1-L2, L2-N, N-L1, L1-G, L2-G, N-G

2.02 SERVICE ENTRANCE AND TRANSFER SWITCH SUPPRESSOR

- A. SPDs: Listed under UL 1449, Type 1.
 - 1. SPDs with the following features and accessories:
 - a. Integral disconnect switch and overcurrent protection.
 - b. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
 - c. Indicator light display for protection status.
 - d. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status.
 - e. Digital Display Surge counter that counts the number of surges the device has experienced since installation.
 - f. Audible alarm
- B. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 240kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

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LOW-VOLTAGE SURGE PROTECTION

- C. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, 208Y/120 V or 240/120 V, three-phase, four-wire circuits shall not exceed the following:
 - 1. Line to Neutral: 1200 V for 480Y/277 V; 700 V for 208Y/120 & 240/120 V.
 - 2. Line to Ground: 1200 V for 480Y/277 V; 1200 V for 208Y/120 & 240/120 V.
 - 3. Line to Line: 2000 V for 480Y/277 V 1000 V for 208Y/120 & 240/120 V.
- D. Protection modes and UL 1449 VPR for 240/120 V, single-phase, three-wire circuits shall not exceed the following:
 - 1. Line to Neutral: 700 V.
 - 2. Line to Ground: 1000
 - 3. Line to Line: 1000 V.
- E. SCCR: Equal or exceed 200 kAIC.
- F. Nominal Discharge Current (In) Rating: 20 kA.

2.03 SWITCHBOARD, PANELBOARD AND MCC SUPPRESSORS

- A. SPDs: Comply with UL 1449, Type 2.
 - 1. Include LED indicator lights for power and protection status.
 - 2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
 - 3. Include Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status
- B. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 100 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
- C. Protection modes and UL 1449 VPR for grounded wye circuits with, three-phase, four-wire circuits shall not exceed the following:
 - 1. Line to Neutral: 1200 V for 480Y/277 V or 700 V for 208Y/120 V & 240/120 V.
 - 2. Line to Ground: 1200 V for 480Y/277 V or 700 V for 208Y/120 V & 240/120 V.
 - 3. Neutral to Ground: 1200 V for 480Y/277 V or 700 V for 208Y/120 V & 240/120 V.
 - 4. Line to Line: 2000 V for 480Y/277 V or 1200 V for 208Y/120 V & 240/120 V.
- D. Protection modes and UL 1449 VPR for 240/120-V, single-phase, three-wire circuits shall not exceed the following:
 - 1. Line to Neutral: 600V.

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LOW-VOLTAGE SURGE PROTECTION

2. Line to Ground: 600V.
 3. Neutral to Ground: 600V.
 4. Line to Line: 1000V.
- E. SCCR: Equal or exceed 100K AIC min or per the one-line diagram
- F. Nominal Discharge Current (In) Rating: 20 kA
- G. Sinewave Tracking/Frequency Responsive Capability.
1. SPDs installed to protect Switchboards, Panelboards or MCCs serving sensitive electronic equipment shall utilize voltage independent, frequency responsive dedicated Sinewave Tracking circuitry to mitigate the effects of switching or ringing surges.
 - a. Sensitive Electronic Equipment shall include, but is not limited to:
 - 1) Variable Frequency Controllers
 - 2) Lighting with Electronic Ballasts
 2. EMI/RFI filtering specifically will not be considered as equal to sinewave tracking.
 3. Devices with Sinewave Tracking circuitry shall be tested in accordance with the latest edition of IEEE C62.41.2 for a Category A Ring Wave (2000 volt – 67 amp ring wave)
 - a. The maximum amplitude shall be less than 50V peak deviation from the insertion point of the surge on the sine wave to the peak of the transient.

2.04 ENCLOSURES

- A. Indoor Enclosures: NEMA 250, Type 1.
- C. Outdoor Enclosures: NEMA 250, Type 4X.

2.05 CONDUCTORS AND CABLES

- A. Power Wiring: Same size as SPD leads, complying with Section 16120 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Comply with NECA 1.
- B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD. DO NOT WIRE DIRECT TO PANEL BUS

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LOW-VOLTAGE SURGE PROTECTION

- C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
- D. Use crimped connectors and splices only. Wire nuts are unacceptable.
- E. Wiring:
 - 1. Power and Control Wiring: Comply with wiring methods in Section 16120 "Low-Voltage Electrical Power Conductors and Cables."

3.02 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.
 - 1. Compare equipment nameplate data for compliance with Drawings and Specifications.
 - 2. Inspect anchorage, alignment, grounding, and clearances.
 - 3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
- B. An SPD will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.03 STARTUP SERVICE

- A. Complete startup checks according to manufacturer's written instructions.
- B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests and reconnect them immediately after the testing is over.
- C. Energize SPDs after power system has been energized, stabilized, and tested.

END OF SECTION 16289

SECTION 16410

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes:
 - 1. Fusible Switches
 - 2. Non-fusible switches
 - 3. Molded Case Circuit Breakers (MCCBs)
 - 4. Enclosures

1.03 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels. Coordinate with other disciplines to ensure installation does not impact constructability and meets installation requirements of the contract documents and manufacturer's recommendations.

1.04 ACTION SUBMITTALS

- A. Provide shop drawings in accordance with Section 01300 for the following:
 - 1. Plans, elevations, sections, details, and weights.
 - 2. Wiring Diagrams: For power, signal, and control wiring.
- B. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.
 - 1. Enclosure types and details.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 4. Include evidence of NRTL listing for series rating of installed devices.
 - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
 - 6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.05 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

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ENCLOSED SWITCHES AND CIRCUIT BREAKERS

- B. Manufacturer's catalog information and standard datasheets

1.06 O&M SUBMITTALS

- A. Submit operation and maintenance data in accordance with Section 01730.

1.07 QUALITY ASSURANCE

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.

1.08 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
 - 2. Altitude: Not exceeding 3,300 feet.

1.09 SPARE PARTS

- A. Furnish spare parts that match components installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 - 2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
 - 3. Indicating Lights: Two of each type and color installed.
 - 4. Relays: Two of each type and style installed.
 - 5. Terminal Blocks: 10 percent spare terminal blocks installed within the equipment. These are installed and not shipped loose.

1.010 WARRANTY

- A. Manufacturer's Warranty:
 - 1. Warranty Period: One year from date of Substantial Completion. Manufacturer agrees to repair or replace equipment that fail in materials or workmanship within specified warranty period.

SECTION 16410

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 2 – PRODUCTS

2.01 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Type HD, Heavy Duty, Single Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Type HD, Heavy Duty, Double Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 - 5. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
 - 6. Hook stick Handle: Allows use of a hook stick to operate the handle.
 - 7. Lugs: Mechanical type, suitable for number, size, and conductor material.
 - 8. Service-Rated Switches: Labeled for use as service equipment.

2.02 NON-FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Type HD, Heavy Duty, Single Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

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ENCLOSED SWITCHES AND CIRCUIT BREAKERS

- C. Type HD, Heavy Duty, Double Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 4. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
 - 5. Hook stick Handle: Allows use of a hook stick to operate the handle.
 - 6. Lugs: Mechanical type, suitable for number, size, and conductor material as indicated in the Drawings for the line side and load side power terminations.

2.03 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents. Breaker shall be suitable for service entrance and shall be 100% rated.
- C. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
 - 1. Instantaneous trip.
 - 2. Long- and short-time pickup levels.
 - 3. Long- and short-time time adjustments.
 - 4. Ground-fault pickup level, time delay, and I^2t response.
- D. Features and Accessories (provide only when shown on the drawings as required):
 - 1. Standard frame sizes, trip ratings, and number of poles.
 - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
 - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
 - 4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
 - 5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.

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ENCLOSED SWITCHES AND CIRCUIT BREAKERS

6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
7. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
8. Breaker status, including "Closed", "Tripped", and "Opened", shall be monitored by a discrete input to the OWNERs PLC.
9. Alarm Switch: One normally open contact that operates only when circuit breaker has tripped.
10. Surge Protection: Furnish surge protection devices on the load side of the main service breaker in accordance with Section 16289 – Low Voltage Surge Protection. SPDs shall be factory wired and integral to the main service breaker enclosure. All SPDs shall be monitored by a discrete input the OWNERs PLC.
11. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
12. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
13. Electrical Operator: Provide remote control for on, off, and reset operations.

2.04 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 1. Indoor, Conditioned Dry and Clean Locations: NEMA Type 1.
 2. Line side shall be bottom entry.
 3. Load side shall be top entry.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Install fuses in fusible devices.
- D. Comply with NECA 1.

SECTION 16410

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

3.03 IDENTIFICATION

- A. Comply with requirements in specification 16075 "Identification for Electrical Systems".
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.
 - 3. Service entrance equipment shall be labelled by the manufacturer or installation contractor with nominal system voltage, available fault current, OCPD clearing time, and date label was applied. Where arc flash labels are also applied, the required information can be distributed between the labels.

3.04 FIELD QUALITY CONTROL

- A. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- B. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges based on results of specification 16055 "Power System Studies".
- C. Instantaneous trip settings for equipment rated 1,200 amps or greater shall have their instantaneous trip settings set lower than the available arcing current based on the results of specification "16055 Power System Studies".

END OF SECTION 16410

SECTION 16415
TRANSFER SWITCHES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes transfer switches rated 600 V and less, including the following:
 - 1. Automatic transfer switches.

1.03 ACTION SUBMITTALS

- A. Shop Drawings in accordance with specification 01300 "Submittals" including dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.
- B. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Field quality-control test reports.

1.05 O&M SUBMITTALS

- A. Submit operation and maintenance data in accordance with specification 01730.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification. An authorized ATS technician employed by the ATS manufacturer shall perform startup service and basic operational training for the owner or an owner's representative following ATS installation.
- B. Source Limitations: Obtain automatic transfer switches and remote annunciator and control panels through one source from a single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

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TRANSFER SWITCHES

- D. Comply with NEMA ICS 1.
- E. Comply with NFPA 70.
- F. Comply with NFPA 99.
- G. Comply with NFPA 110.
- H. Comply with UL 1008 unless requirements of these Specifications are stricter.

1.07 PROJECT CONDITIONS

- A. Equipment shall be rated for the project site environmental conditions.

1.08 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

1.09 WARRANTY

- A. Manufacturer's Warranty:
 - 1. Warranty Period: One year from date of Substantial Completion. Manufacturer agrees to repair or replace transfer switches that fail in materials or workmanship within specified warranty period.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Automatic Transfer Switches with Bypass Isolation:
 - a. ASCO G07ADTBA31600N5XC
 - 1) Include Optional Accessories as follows:
6C,6D,14A1,14B1,14T,14U,14V,18B,18G,31Z,
73AC1,82C,82E,99,150BT1
 - b. Or engineer approved equal.

2.02 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

- A. Switch and enclosure arrangements shall be as indicated in the project documents and shall be front accessible only capable of being placed against a wall. Provide side wireways and top hat wireways as required to facilitate circuit installation and terminations.
- B. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

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- C. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
 - 1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.
- D. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.
- E. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- F. Electrical Operation: Accomplish by a non-fused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.
- G. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - 1. Switch Action: Double throw; mechanically held in both directions.
 - 2. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.
- H. Heater: Equip switches exposed to outdoor temperatures and humidity, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater. Finger safe fuse pullers shall be provided for fuses feeding heater circuits.
- I. Surge Protection: Furnish surge protection devices on the load side of the transfer switch in accordance with Section 16289 – Low Voltage Surge Protection. SPDs shall be factory wired and integral to the transfer switch enclosure. Rating shall be 65kA per mode.
- J. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.
- K. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Division 16 Section "Electrical Identification."
 - 1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated in the Drawings.

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2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated in the Drawings.
3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

2.03 AUTOMATIC TRANSFER SWITCHES

- A. Enclosure:
 1. Indoor: NEMA 1
 2. Outdoor: NEMA 3RX, 316 SS with 3-Point Door Handle Operated Latch
- B. Comply with Level 1 equipment according to NFPA 110.
- C. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.
- D. Switch Configuration: Custom configuration shall include normal terminal lugs and load terminal lugs located at the top of the enclosure. Emergency terminal lugs shall be at the bottom of the enclosure.
- E. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.
- F. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.
- G. Digital communication interface matched to capability of remote annunciator or annunciator and control panel. Communications with station PLC SCADA system located in SCP-1 via ProfiNet communications.
- H. Transfer Switches Based on Molded-Case-Switch Components: Comply with NEMA AB 1, UL 489, and UL 869A.
- I. Automatic Transfer-Switch Features:
 1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
 2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
 3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
 4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss

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of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.

5. Test Switch: Simulate normal-source failure.
6. Switch-Position Pilot Lights: Indicate source to which load is connected.
7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
 - a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 120 VAC.
9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 24 VDC minimum.
11. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
12. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 60 minutes. Factory settings are for 7-day exercise cycle, 30-minute running period, and 5 minute cool down period. Exerciser features include the following:
 - a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
 - b. Push-button programming control with digital display of settings.
 - c. Integral battery operation of time switch when normal control power is not available.

2.04 BYPASS ISOLATION SWITCHES

- A. A two-way bypass-isolation switch shall provide manual bypass of the load to either source and permit isolation of the automatic transfer switch from all source and load power conductors. All main contacts shall be manually driven.
- B. Power interconnections shall be silver-plated copper bus bar. The only field installed power connections shall be at the service and load terminals of the bypass-isolation switch. All control inter-wiring shall be provided with disconnect plugs.
- C. Separate bypass and isolation handles shall be utilized to provide clear distinction between the functions. Handles shall be permanently affixed and operable without opening the enclosure door. Designs requiring insertion of loose operating handles or opening of the enclosure door to operate are not acceptable.

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- D. Bypass to the load-carrying source shall be accomplished with no interruption of power to the load (make before break contacts). Designs which disconnect the load when bypassing are not acceptable. The bypass handle shall have three operating modes: "Bypass to Normal," "Automatic," and "Bypass to Emergency." The operating speed of the bypass contacts shall be the same as the associated transfer switch and shall be independent of the speed at which the manual handle is operated. In the "Automatic" mode, the bypass contacts shall be out of the power circuit so that they will not be subjected to fault currents to which the system may be subjected.
- E. The isolation handle shall provide three operating modes: "Closed," "Test," and "Open." The "Test" mode shall permit testing of the entire emergency power system, including the automatic transfer switches with no interruption of power to the load. The "Open" mode shall completely isolate the automatic transfer switch from all source and load power conductors. When in the "Open" mode, it shall be possible to completely withdraw the automatic transfer switch for inspection or maintenance to conform to code requirements without removal of power conductors or the use of any tools.
- F. When the isolation switch is in the "Test" or "Open" mode, the bypass switch shall function as a manual transfer switch.
- G. Designs requiring operation of key interlocks for bypass isolation or transfer switches which cannot be completely withdrawn when isolated are not acceptable.

2.05 SOURCE QUALITY CONTROL

- A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Annunciator and Control Panel Mounting (when required or shown on drawings): Flush in wall, unless otherwise indicated.
- B. Identify components according to specification 16075 "Identification for Electrical Systems".
- C. Coordinate and set field-adjustable intervals and delays, relays, and engine exerciser clock in accordance with OWNER requirements.

3.02 CONNECTIONS

- A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended

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by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary, to accommodate required wiring.

- B. Ground equipment according to specification 16060 "Grounding and Bonding".
- C. Connect wiring according to specification 16120 "Low Voltage Electrical Power Conductors" and specification 16710 "Communications Cabling".

3.03 FACTORY ACCEPTANCE TESTING

- 1. Submit factory acceptance test reports for review and approval prior to shipping equipment.
- 2. Testing shall include manufacturer's standard shop testing procedures and documentation of equipment meeting or exceeding UL standards and the requirements of the project design documents.

3.04 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Tests and Inspections:
 - 1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
 - a. Check for electrical continuity of circuits and for short circuits.
 - b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
 - c. Verify that manual transfer warnings are properly placed.
 - d. Perform manual transfer operation.
 - 4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
 - a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
 - b. Simulate loss of phase-to-ground voltage for each phase of normal source.
 - c. Verify time-delay settings.
 - d. Verify pickup and dropout voltages by data readout or inspection of control settings.
 - e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.

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- f. Perform contact-resistance test across main contacts and correct values exceeding 500 micro-ohms and values for 1 pole deviating by more than 50 percent from other poles.
 - g. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
- 5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
 - a. Verify grounding connections and locations and ratings of sensors.
- C. Coordinate tests with tests of generator and run them concurrently.
- D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- E. Remove and replace malfunctioning units and retest as specified above.

3.05 DEMONSTRATION

- A. Engage a factory-authorized service representative to train OWNER's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment for one 8-hr man-day exclusive of travel and lodging time.

END OF SECTION 16415

SECTION 16429

SWITCHBOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Service and distribution switchboards rated 600 V and less.
 - 2. Transient voltage suppression devices.
 - 3. Disconnecting and overcurrent protective devices.
 - 4. Instrumentation.
 - 5. Control power.
 - 6. Accessory components and features.
 - 7. Identification.

1.03 ACTION SUBMITTALS

- A. Submit all information in accordance with Section 01300.
- B. Product Data: For each type of switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
- C. Shop Drawings: For each switchboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
 - 5. Detail utility company's metering provisions with indication of approval by utility company.
 - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 7. Include schematic and wiring diagrams for power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Field Quality-Control Reports:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.

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3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.05 O&M SUBMITTALS

- A. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01730 "Operation and Maintenance Data," include the following:
 1. Routine maintenance requirements for switchboards and all installed components.
 2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 3. Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.06 SPARE PARTS

- A. Furnish spare parts that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Potential Transformer Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
 2. Control-Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
 3. Fuses and Fusible Devices for Fused Circuit Breakers: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 4. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 5. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 6. Indicating Lights: Equal to 10 percent of quantity installed for each size and type, but no fewer than one of each size and type.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.
- B. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

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- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Comply with NEMA PB 2.
- F. Comply with NFPA 70.
- G. Comply with UL 891.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.
- B. Remove loose packing and flammable materials from inside switchboards and install temporary electric heating (250 W per section) to prevent condensation. Contractor to provide all required temporary wiring for heaters.
- C. Handle and prepare switchboards for installation according to NEMA PB 2.1.

1.09 PROJECT CONDITIONS

- A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.
- B. Environmental Limitations:
 - 1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry work above switchboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - 2. Rate equipment for continuous operation under the service conditions listed below.
- C. Service Conditions: NEMA PB 2, usual service conditions, as follows:
 - 1. Ambient temperatures within limits specified.
 - 2. Altitude not exceeding 6600 feet (2000 m).
- D. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify ENGINEER and OWNER no fewer than 10 working days in advance of proposed interruption of electric service.
 - 2. Indicate method of providing temporary electric service.
 - 3. Do not proceed with interruption of electric service without approval of ENGINEER and OWNER.
 - 4. Comply with NFPA 70E.

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SWITCHBOARDS

1.10 COORDINATION

- A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete housekeeping pads with actual equipment provided. Cast anchor-bolt inserts, concrete, reinforcement, and formwork requirements are specified within the concrete specifications and the project drawings.

1.11 WARRANTY

- A. Manufacturer shall provide a warranty in accordance with these specifications and JEA specifications for all equipment, components, and materials furnished as part of this specification for a period of one year from Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS

- A. Subject to compliance with requirements, provide product by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. Square D; a brand of Schneider Electric.
 - 3. Or Engineer Approved Equal
- B. Front-Connected, Front-Accessible Switchboards:
 - 1. Main Devices: Draw-out
 - 2. Branch Devices: Panel mounted
 - 3. Sections front and rear aligned
- C. Nominal System Voltage: As Shown on the One-Line Diagram
- D. Main-Bus Continuous: As shown on the One-Line Diagram
- E. Indoor Enclosures: Steel, NEMA 250, Type 1.
- F. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.
- G. Barriers: Between adjacent switchboard sections.
- H. Insulation and isolation for main bus of main section and main and vertical buses of feeder sections.

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- I. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.
 - 1. Set back from front to clear circuit-breaker removal mechanism.
 - 2. Removable covers shall form top, front, and sides. Top covers at rear shall be easily removable for drilling and cutting.
 - 3. Bottom shall be insulating, fire-resistive material with separate holes for cable drops into switchboard.
 - 4. Cable supports shall be arranged to facilitate cabling and adequate to support cables indicated, including those for future installation.
- J. Buses and Connections: Three phase, four wire unless otherwise indicated.
 - 1. Phase and Neutral Bus Material: Hard-drawn copper of 98 percent conductivity, silver-plated, with tin-plated aluminum or copper feeder circuit-breaker line connections.
 - 2. Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with mechanical connectors for outgoing circuit conductors as shown in the Drawings. Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position.
 - 3. Ground Bus: Minimum-size required by UL 891, hard-drawn copper of 98 percent conductivity, equipped with mechanical connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.
 - 4. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
 - 5. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
 - 6. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.
- K. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.
- L. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components including instruments and instrument transformers.

2.02 SURGE PROTECTION DEVICES

- A. Provide Surge Protection Devices (SPDs) in accordance with Section 16289 "LOW-VOLTAGE SURGE PROTECTION" as indicated on the one-line diagram or Switchboard Schedule.
- B. SPDs shall be fault monitored by a discrete input to the OWNERS PLC.

2.03 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

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1. Thermal Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous Trip Circuit Breakers: Magnetic trip element with front-mounted, field adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field replaceable rating plug or electronic trip; and the following field adjustable settings:
 - a. Instantaneous trip.
 - b. Long and short time pickup levels.
 - c. Long and short time time adjustments.
 - d. Ground fault pickup level, time delay, and I^2t response.
4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. Integrally Fused Circuit Breakers: Thermal magnetic trip element with integral limiter style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
6. GFCI Circuit Breakers: Single and two pole configurations with Class A ground fault protection (6-mA trip).
7. Ground Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground fault protection (30 mA trip).
8. Molded-Case Circuit Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - d. Ground Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time delay settings, push-to-test feature, and ground fault indicator.
 - e. Zone Selective Interlocking: Integral with electronic trip unit; for interlocking ground fault protection function.
 - f. Communication Capability: Circuit breaker mounted communication module with functions and features compatible with power monitoring and control system when specifically shown on the control drawings.
 - g. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 - h. Breaker status, including "Closed", "Opened", and "Trip", shall be monitored by a discrete input to the OWNERs PLC.
 - i. Kirk Key Interlock when specifically shown on the drawings.

2.04 INSTRUMENTATION

- A. Instrument Transformers: IEEE C57.13, NEMA EI 21.1, and the following:
 1. Potential Transformers: IEEE C57.13; 120 V, 60 Hz, single secondary; disconnecting type with integral fuse mountings. Burden and accuracy shall be consistent with connected metering and relay devices.

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2. Current Transformers: IEEE C57.13; 5 A, 60 Hz, secondary; bar or window type; single secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
- B. Multifunction Digital Metering Monitor as shown on the One-Line Diagram.
 1. Mounting: Display and control unit semi flush.
 2. Siemens SENTRON PAC4200, Part #7KM4212-0BA00-2AA0

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Receive, inspect, handle, and store switchboards according to NEMA PB 2.1.
- B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.
- C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Referenced NECA and NEMA standards in first paragraph below include similar requirements. See "Testing and Inspecting" Article in the Evaluations.
- B. Install switchboards and accessories according to NEMA PB 2.1.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.
- D. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.
- E. Install filler plates in unused spaces of panel mounted sections.
- F. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.
 1. Set field adjustable trip settings and ranges in accordance with the Contract Documents and Section 16055 "Power System Studies".
- G. Comply with NECA 1.

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3.03 IDENTIFICATION

- A. Identify field installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 16075 "Identification for Electrical Systems."
- B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section 16075 "Identification for Electrical Systems."
- C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 16075 "Identification for Electrical Systems."
- D. Nameplates and identification shall be in accordance with identification shown in Drawings and Conduit and Conductor Schedules.
- E. Submit a spreadsheet of all identification for review and approval prior to labelling equipment.

3.04 FIELD QUALITY CONTROL

- A. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- B. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units onsite, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Switchboard will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
 - 1. Supplier field test and inspection reports shall be submitted to OWNER and ENGINEER for review and approval prior to startup and commissioning of equipment.

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3.05 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in "Overcurrent Protective Device Coordination Study".
- C. Instantaneous trip settings for equipment rated 1,200 amps or greater shall have their instantaneous trip settings set lower than the available arcing current based on the results of specification "16055 Power System Studies".

3.06 PROTECTION

- A. Temporary Heating: Apply temporary heat, to maintain temperature according to manufacturer's written instructions, until switchboard is ready to be energized and placed into service.

3.07 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories, and to use and reprogram microprocessor-based trip, monitoring, and communication units.

END OF SECTION 16429

SECTION 16441

PANELBOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.
 - 3. Electronic-grade panelboards.

1.03 DEFINITIONS

- A. SVR: Suppressed voltage rating.
- B. SPD: Surge Protection Device

1.04 ACTION SUBMITTALS

- A. Provide submittals in accordance with Section 01300.
- B. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- C. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 6. Include wiring diagrams for power, signal, and control wiring.

1.05 INFORMATIONAL SUBMITTALS

- A. Provide submittals in accordance with Section 01300.
- B. Qualification Data: For qualified testing agency.
- C. Field Quality-Control Reports:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.

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3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- D. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing indicating the connected load for each breaker in accordance with the NEC. Schedule to be typed and dated.

1.06 O&M SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01730 "Operation and Maintenance Data," include the following:
 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.07 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Keys: Two spares for each type of panelboard cabinet lock.
 2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Provide spare breakers as shown in the schedules on the drawings
 3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.08 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NEMA PB 1.
- E. Comply with NFPA 70.

1.09 DELIVERY, STORAGE, AND HANDLING

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- A. Store in accordance with the manufacturer's recommendations.
- B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations:
 - 1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding minus 22 deg F (minus 30 deg C) to plus 104 deg F (plus 40 deg C).
 - b. Altitude: Not exceeding 6600 feet (2000 m).
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
 - 1. Ambient temperatures within limits specified.
 - 2. Altitude not exceeding 6600 feet (2000 m).
- C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by OWNER or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify ENGINEER and OWNER no fewer than 10 working days in advance of proposed interruption of electric service.
 - 2. Do not proceed with interruption of electric service without ENGINEER and OWNER's written permission.
 - 3. Comply with NFPA 70E.

1.11 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.12 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace surge protection devices that fail in materials or workmanship within specified warranty period.

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1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: see plan sheet panel schedule for enclosure types and mounting.
 1. Provide rated enclosures as shown below unless otherwise indicated on plans:
 - a. Indoor Dry and Clean Locations: NEMA, Type 1.
 - b. Indoor Damp or Wet Locations: NEMA, Type 4X.
 - c. Indoor Corrosive Locations: NEMA, Type 4X Fiberglass
 - d. Outdoor Locations: NEMA, Type 4X
 - e. Wash-Down Areas: NEMA, Type 4X 316 stainless steel
 - f. Other Wet or Damp Indoor Locations: NEMA, Type 4X.
 - g. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA, Type 12.
 - h. For conditions not addressed above, provide rated enclosures for environmental conditions at installed locations.
 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
 5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
 6. Finishes:
 - a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Galvanized steel unless indicated otherwise on panel schedule.
 - c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components. (Only required with the relative humidity is above 90% and the electrical room or space is not conditioned.)
 7. Directory Card: Inside panelboard door, mounted in transparent card holder. All breaker text to be typed and dated. Directory card shall include the source of supply to the panelboard. Directory card shall include typed contact information for the electrical CONTRACTOR.
- B. Incoming Mains Location: Top or bottom per CONTRACTOR's installation method unless specifically indicated on the drawings.
- C. Phase, Neutral, and Ground Buses:
 1. Material: Hard-drawn copper, 98 percent conductivity.
 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

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3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
 4. Neutral Bus: 100% of the phase bus capacity unless otherwise indicated.
 5. Extra-Capacity Neutral Bus (when shown on the drawings): Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
 6. Split Bus: Vertical buses divided into individual vertical sections.
- D. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material: Hard-drawn copper, 98 percent conductivity.
 2. Main and Neutral Lugs - Mechanical type.
 3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
 4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 5. Sub-feed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 6. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 7. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.
- E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.
- F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.02 PERFORMANCE REQUIREMENTS

- A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 2. Provide SPD devices per Section 16289.

2.03 DISTRIBUTION PANELBOARDS

- A. Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. Siemens Energy & Automation, Inc.
 3. Square D; a brand of Schneider Electric.
- B. Panelboards: NEMA PB 1, power and feeder distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.

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- D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
- F. Branch Overcurrent Protective Devices: Fused switches.

2.04 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. Siemens Energy & Automation, Inc.
 - 3. Square D; a brand of Schneider Electric.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains as shown on the drawings
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Provide Door-in-Door Construction with concealed hinges; secured with flush latch with tumbler lock; keyed alike.
- F. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.05 ELECTRONIC-GRADE PANELBOARDS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Current Technology; a subsidiary of Danahar Corporation.
 - 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 3. Liebert Corporation.
 - 4. Siemens Energy & Automation, Inc.
 - 5. Square D; a brand of Schneider Electric.
- B. Panelboards: NEMA PB 1; with factory-installed, integral SPD; labeled by an NRTL for compliance with UL 67 after installing SPD.
- C. Doors: Provide Door-in-Door Construction with Secured with vault-type latch with tumbler lock; keyed alike.
- D. Main Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.
- E. Branch Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.

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- F. Buses:
 - 1. Copper phase and neutral buses; 200 percent capacity neutral bus and lugs.
 - 2. Copper equipment and isolated ground buses.

2.06 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. Siemens Energy & Automation, Inc.
 - 3. Square D; a brand of Schneider Electric.
- B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and $I^2 t$ response.
 - 3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 - 4. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 - 5. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
 - 6. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
 - 7. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - d. Ground-Fault Protection: Integrally mounted or Remote-mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - e. Communication Capability: as shown on the controls drawings when specifically indicated.
 - f. Shunt Trip: as shown on the drawings.
 - g. Undervoltage Trip: as shown on the drawings.
 - h. Auxiliary Contacts: Where shown on the drawings, two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.

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- i. Alarm Switch: Where shown on the drawings, single-pole, normally open contact that actuates only when circuit breaker trips.
 - j. Key Interlock Kit: Where shown on the drawings, externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
 - k. Zone-Selective Interlocking: Where shown on the drawings, integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
 - l. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
 - m. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in off position.
 - n. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.
- C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
- 1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Section 16491 "Fuses."
 - 2. Fused Switch Features and Accessories: Standard ampere ratings and number of poles.
 - 3. Auxiliary Contacts: When shown on the drawings provide two normally open and normally closed contact(s) that operate with switch handle operation.

2.07 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

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- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Equipment Mounting:
- C. Floor Mounted panelboards on concrete bases, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete in the project specifications. If no concrete is specified use 3000 psi.
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
 - 2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - a. Install anchor bolts to elevations required for proper attachment to panelboards.
 - 4. Attach panelboard to the vertical finished or structural surface behind the panelboard.
- D. Wall/Rack Mounted:
 - 1. Mount to wall/rack using unistrut with bolts/mounting hardware approved by the structural ENGINEER or architect.
- E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- F. Mount panelboards such that the highest operator is less than 78" above finished floor.
- G. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- H. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- I. Install filler plates in unused spaces.
- J. Stub a minimum of four 1-inch (27-GRC) empty conduits but not less than 25% of the combined cross sectional area of the all other live conduit from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub a minimum of four 1-inch (27-GRC) empty conduits but not less than 25% of the combined cross sectional area of the all other live conduit into raised floor space or below slab not on grade. This is for recessed panelboards only.
- K. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- L. Comply with NECA 1.

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3.03 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 16075 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 16075 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 16075 "Identification for Electrical Systems."

3.04 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- D. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- E. Panelboards will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

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- A. Adjust moving parts and operable component to function smoothly and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in the "Overcurrent Protective Device Coordination Study."
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
 - 1. Measure as directed during period of normal system loading.
 - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
 - 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.06 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 16441

SECTION 16461

LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following types of dry-type distribution transformers rated 600 V and less, with capacities up to 1000 kVA.

1.03 ACTION SUBMITTALS

- A. Provide all submittals in accordance with Section 01300.
- B. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.
- C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

- A. Provide all submittals in accordance with Section 01300.
- B. Qualification Data: For testing agency.
- C. Source quality-control test reports.
- D. Field quality-control test reports.

1.05 O&M SUBMITTALS

- A. Provide all O&M manuals and submittals in accordance with Section 01730.
- B. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

- A. Testing Qualifications: Engage manufacturer with the experience and capability to conduct the testing to NETA standards.
- B. Source Limitations: Obtain each transformer type through one source from a single manufacturer.

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- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.08 COORDINATION

- A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Acme Electric Corporation.
 - 2. Challenger Electrical Equipment Corp.
 - 3. Controlled Power Company.
 - 4. Eaton Electrical Sector; Eaton Corporation; Cutler-Hammer Products.
 - 5. Federal Pacific Transformer Company.
 - 6. General Electric Company.
 - 7. Hammond Co.
 - 8. Magnetek Power Electronics Group.
 - 9. Micron Industries Corp.
 - 10. Myers Power Products, Inc.
 - 11. Siemens Energy & Automation, Inc.
 - 12. Sola/Hevi-Duty.
 - 13. Square D Co./Schneider Electric.

2.02 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Cores: Grain-oriented, non-aging silicon steel.

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- C. Coils: Continuous windings without splices except for taps.
 - 1. Internal Coil Connections: Brazed or pressure type.
 - 2. Coil Material: Copper unless otherwise specified.

2.03 DISTRIBUTION TRANSFORMERS

- A. Comply with NEMA ST 20, and list and label as complying with UL 1561.
- B. Cores: One leg per phase.
- C. Indoor Transformer Enclosure: Ventilated, NEMA 250, Type 2.
 - 1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
- D. Outdoor Transformer Enclosure: Totally enclosed, nonventilated, NEMA 250, Type 4X, stainless steel
 - 1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
- E. Transformer Enclosure Finish: Comply with NEMA 250.
 - 1. Finish Color: ANSI 61 gray.
- F. Taps for Transformers Smaller Than 3 kVA: One 5 percent tap above normal full capacity.
- G. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.
- H. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.
- I. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.
- J. Energy Efficiency for Transformers Rated 15 kVA and Larger:
 - 1. Complying with NEMA TP 1, Class 1 efficiency levels.
 - 2. Tested according to NEMA TP 2.
- K. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.
 - 1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
 - 2. Indicate value of K-factor on transformer nameplate.
- L. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.
 - 1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
 - 2. Include special terminal for grounding the shield.

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3. Shield Effectiveness:
 - a. Capacitance between Primary and Secondary Windings: Not to exceed 33 picofarads over a frequency range of 20 Hz to 1 MHz.
 - b. Common-Mode Noise Attenuation: Minimum of minus 120 dBA at 0.5 to 1.5 kHz; minimum of minus 65 dBA at 1.5 to 100 kHz.
 - c. Normal-Mode Noise Attenuation: Minimum of minus 52 dBA at 1.5 to 10 kHz.
- M. For wall mounted transformers, wall brackets: Manufacturer's standard brackets.
- N. For tropical or sub tropic environments, provide fungus proofing.
- O. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.
- P. Low-Sound-Level Requirements: Maximum sound levels, when factory tested according to IEEE C57.12.91, as follows:
 1. 9 kVA and Less: <40 dBA
 2. 30 to 50 kVA: <45 dBA
 3. 51 to 150 kVA: <50 dBA
 4. 151 to 300 kVA: <55 dBA
 5. 301 to 500 kVA: <60 dBA
 6. 501 to 750 kVA: <62 dBA
 7. 751 to 1000 kVA: <64 dBA

2.04 BUCK-BOOST TRANSFORMERS

- A. Description: Self-cooled, two-winding dry type, rated for continuous duty and with wiring terminals suitable for connection as autotransformer. Transformers shall comply with NEMA ST 1 and shall be listed and labeled as complying with UL 506 or UL 1561.
- B. Enclosure: Ventilated, NEMA 250, Type 3R.
 1. Finish Color: ANSI 61 gray.

2.05 IDENTIFICATION DEVICES

- A. Nameplates: Engraved, laminated-plastic or metal nameplate for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 16075 "Identification for Electrical Systems."

2.06 SOURCE QUALITY CONTROL

- A. Test and inspect transformers according to IEEE C57.12.91.
- B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

SECTION 16461

LOW-VOLTAGE TRANSFORMERS

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place and requirements in Section 16060 "Grounding and Bonding for Electrical Systems" have been met.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.

3.03 CONNECTIONS

- A. Ground equipment according to Section 16060 "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Section 16120 "Low-Voltage Electrical Power Conductors and Cables."

3.04 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- C. Remove and replace units that do not pass tests or inspections and retest as specified above.
- D. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

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LOW-VOLTAGE TRANSFORMERS

3.05 ADJUSTING

- A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
- B. Output Settings Report: Prepare a written report recording output voltages and tap settings.
- C. Adjust all access doors and operating handles for free mechanical operation as described in manufacturer's instructions.

3.06 CLEANING

- A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.
- B. Repaint scratched or marred exterior surfaces to match original finish.

END OF SECTION 16461

SECTION 16495

VARIABLE FREQUENCY MOTOR CONTROLLERS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes separately enclosed, preassembled, combination VFDs, rated 600 V and less, for speed control of three-phase, squirrel-cage induction motors.

1.03 RELATED SECTIONS

- A. Section 16150 – Electric Motors
- B. Section 16910 – Control Panel Construction
- C. Section 16930 – Process Loop Description

1.04 DEFINITIONS

- A. CPT: Control power transformer.
- B. EMI: Electromagnetic interference.
- C. LED: Light-emitting diode.
- D. NC: Normally closed.
- E. NO: Normally open.
- F. OCPD: Overcurrent protective device.
- G. PID: Control action, proportional plus integral plus derivative.
- H. RFI: Radio-frequency interference.
- I. VFC/VFD/AFD: Variable-frequency motor controller.

1.05 ACTION SUBMITTALS

- A. All submittals shall be in accordance with Section 01300.
- B. Product Data: For each type and rating of VFD indicated.
 - 1. Include catalog information and datasheets for each model VFD supplied.
 - 2. Include dimensions and finishes for VFDs.
 - 3. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

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VARIABLE FREQUENCY MOTOR CONTROLLERS

4. Include data and calculations to support the minimum SCCR specified.
- C. Shop Drawings: For each VFD indicated.
 1. Include mounting and attachment details.
 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 3. Include diagrams for power, signal, and control wiring.
 4. Include marking data per NEC 70, Article 409.110.
 5. Where VFDs are installed in 3rd party fabricated control panels, include datasheets and catalog information for all components utilized in the design and construction of the VFD control panel.

1.06 INFORMATIONAL SUBMITTALS

- A. All submittals shall be in accordance with Section 01300.
- B. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout, which the following items are shown and coordinated with each other, using input from installers of the items involved:
 1. Required working clearances and required area above and around VFDs.
 2. Show VFD layout and relationships between electrical components and adjacent structural and mechanical elements.
 3. Show support locations, type of support, and weight on each support.
 4. Indicate field measurements.
- C. Product Certificates: For each VFD from manufacturer.
- D. Harmonic Analysis Study and Report: Comply with IEEE 519 and NETA Acceptance Testing Specification; identify the effects of nonlinear loads and their associated harmonic contributions on the voltages and currents throughout the electrical system. Analyze possible operating scenarios, including recommendations for VFD input filtering and active correction to limit TDD and THD(V) at the defined PCC to specified levels. PCC shall be defined at the primary side of the main service transformer.
- E. Source quality-control reports.
- F. Field quality-control reports.
- G. Sample Warranty: For special warranty.

1.07 O&M SUBMITTALS

- A. Operation and Maintenance Data: For VFDs include in emergency, operation, and maintenance manuals.
 1. In addition to items specified in Section 01730 "Operation and Maintenance Data," include the following:
 - a. Manufacturer's written instructions for testing and adjusting thermal-magnetic circuit breaker and motor-circuit protector trip settings.

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VARIABLE FREQUENCY MOTOR CONTROLLERS

- b. Manufacturer's written instructions for setting field-adjustable overload relays.
- c. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
- d. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.
- e. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate, full-load currents.
- f. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that switch settings for motor-running overload protection suit actual motors to be protected.

1.08 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification. An authorized VFD technician employed by the VFD manufacturer shall perform startup service and basic operational training for the owner or an owner's representative following VFD installation.
- B. Source Limitations: Obtain VFDs Through one source from a single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NFPA 70.

1.09 SPARE PARTS

- A. Furnish spare parts that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 - 2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
 - 3. Indicating Lights: Two of each type and color installed.
 - 4. Relays: Two of each type and style installed.
 - 5. Terminal Blocks: 10 percent spare terminal blocks installed within the equipment. These are installed and not shipped loose.
 - 6. Variable Frequency Drives: Where VFD's provided are non-standard JEA equipment, supply one spare VFD preprogrammed for immediate replacement for each type and size included.

1.10 DELIVERY, STORAGE, AND HANDLING

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VARIABLE FREQUENCY MOTOR CONTROLLERS

- A. If stored in space that is not permanently enclosed and air conditioned, remove loose packing and flammable materials from inside controllers and install temporary electric heating in accordance with manufacturers requirements.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for VFDs, including clearances between VFDs, and adjacent surfaces and other items. Suppliers unable to meet the maximum dimensions shown in the project drawings will be rejected unless specifically approved by the ENGINEER and the OWNER.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace VFDs that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: One year from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - 1. Eaton SVX9000 Enclosed Drives
 - a. SVX20014AAK4KBL1LDLELJP1P7PGB9
 - 1) ProfiNet OPTE9 Card

2.02 SYSTEM DESCRIPTION

- A. General Requirements for VFDs:
 - 1. VFDs and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Comply with NEMA ICS 7, NEMA ICS 61800-2, UL 409 and UL 508A.
 - 3. VFD-401 shall be sized for future pump upgrade to 200 HP
- B. Application: VFDs shall be variable torque unless otherwise indicated on the drawings.
- C. VFD Description: Variable-frequency motor controller, consisting of power converter that employs pulse-width-modulated inverter, factory built and tested in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.
 - 1. Units suitable for operation of inverter-duty rated motors as defined by NEMA MG 1.
 - 2. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.
- D. Design and Rating: Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.

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VARIABLE FREQUENCY MOTOR CONTROLLERS

- E. Output Rating:
 - 1. Variable Torque: Three phase; 10 to 60 Hz, with voltage proportional to frequency throughout voltage range; maximum voltage equals input voltage.
- F. Unit Operating Requirements:
 - 1. Input AC Voltage Tolerance: Plus 10 and minus 10 percent of VFD input voltage rating.
 - 2. Input AC Voltage Unbalance: Not exceeding 5 percent.
 - 3. Input Frequency Tolerance: Plus or minus 3 percent of VFD frequency rating.
 - 4. Minimum Efficiency: 97 percent at 60 Hz, full load.
 - 5. Minimum Displacement Primary-Side Power Factor: 96 percent under any load or speed condition.
 - 6. Minimum Short-Circuit Current (Withstand) Rating: to match the AIC of the servicing over current device.
 - 7. Ambient Temperature Rating: Not less than 32 deg F (0 deg C) and not exceeding 104 deg F (40 deg C).
 - 8. Humidity Rating: Less than 95 percent (noncondensing).
 - 9. Altitude Rating: Not exceeding 3300 feet (1000 m).
 - 10. Vibration Withstand: Comply with NEMA ICS 61800-2.
 - 11. Overload Capability: 1.1 (variable torque) or 1.5 (constant torque) times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.
 - 12. Starting Torque: Minimum 100 percent of rated torque from 3 to 60 Hz.
 - 13. Speed Regulation: Plus or minus 5 percent.
 - 14. Output Carrier Frequency: Selectable; 0.5 to 15 kHz.
 - 15. Stop Modes: Programmable; includes fast, free-wheel, and dc injection braking.
- G. Inverter Logic: Microprocessor based, 16 bit, isolated from all power circuits.
- H. Isolated Control Interface: Allows VFDs to follow remote-control signal over a minimum 40:1 speed range.
 - 1. Signal: Electrical
- I. Internal Adjustability Capabilities:
 - 1. Minimum Speed: 5 to 50 percent of maximum rpm.
 - 2. Maximum Speed: 80 to 100 percent of maximum rpm.
 - 3. Acceleration: 0.1 to 999.9seconds.
 - 4. Deceleration: 0.1 to 999.9 seconds.
 - 5. Current Limit: 30 to minimum of 150 percent of maximum rating.
- J. Self-Protection and Reliability Features:
 - 1. Surge Suppression: Field or Factory mounted surge suppressors UL 1449 SPD, Type 2 (installed when shown on the One Line Diagrams or Elementary Diagrams). Comply with 16289 "Surge Protection for Low Voltage Electric Power."
 - 2. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.
 - 3. Under and overvoltage trips.

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4. Inverter overcurrent trips.
 5. VFD and Motor-Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFDs and motor thermal characteristics, and for providing VFD overtemperature and motor-overload alarm and trip; settings selectable via the keypad.
 6. Critical frequency rejection, with three selectable, adjustable deadbands.
 7. Instantaneous line-to-line and line-to-ground overcurrent trips.
 8. Loss-of-phase protection.
 9. Reverse-phase protection.
 10. Short-circuit protection.
- K. Automatic Reset/Restart: The drive shall be configured such that it automatically resets on return of power after a power loss. In addition, the drive shall be configured for manual reset of faults from the fault reset pushbutton or remotely from the control system.
- L. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.
- M. Bidirectional Autospeed Search: Capable of starting VFD into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.
- N. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.
- O. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
- P. Integral Input Disconnecting Means and OCPD: UL 489, molded-case switch, with power fuse block and current-limiting fuses with pad-lockable, door-mounted handle mechanism.
1. Disconnect Rating: Not less than 125 percent of NFPA 70 motor full-load current rating or VFD input current rating, whichever is larger.
 2. Auxiliary contacts "a" and "b" arranged to activate with circuit-breaker handle.
 3. NC alarm contact that operates only when circuit breaker has tripped.
- Q. Line and load cable terminations: Provide quantity and size of lugs as required to accommodate design cabling as seen in the conduit and conductor schedule.

2.03 CONTROLS AND INDICATION

- A. Status Lights: Door-mounted LED indicators displaying the following conditions (lights to have a push to test function):
1. Run (Red).
 2. Stop (Green)
 3. Fault (Amber)

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4. Control Power Available (White)
- B. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English-language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.
- C. Provide a HAND –OFF – AUTO selector switch for each VFD.
- D. Provide RESET pushbutton for each VFD.
- E. Historical Logging Information and Displays:
 1. Total run time.
 2. Fault log, maintaining last four faults with time and date stamp for each.
- F. Control Signal Interfaces:
 1. Electric Input Signal Interface:
 - a. A minimum of two programmable analog inputs: 4 - 20-mA
 - b. A minimum of six multifunction programmable digital inputs.
 2. Output Signal Interface: A minimum of two programmable analog output signals 4 – 20 mA, which can be configured for any of the following:
 - a. Output frequency (Hz)
 - b. Output speed.
 3. Remote Indication Interface: A minimum of two programmable dry-circuit relay outputs (120-V ac, 1 A) for remote indication of the following:
 - a. Motor running.
 - b. Fault and warning indication (overtemperature, overcurrent, motor thermal overload, or other system fault)
- G. Facility Control System Interface: Factory-installed hardware and software shall interface with Facility Control System to monitor, control, display, and record data for use in processing reports. VFD settings shall be retained within VFD's nonvolatile memory.
 1. Communication Interface: Comply with ProfiNet.
 2. The VFD control board must have the functionality to be energized with 24Vdc External source to maintain active the Communication and VFD control board when three (3) phase power of VFD goes out.
 3. Communications interface connection shall be certified by ProfiBus and ProfiNet International.

2.04 LINE CONDITIONING AND FILTERING

- A. LINE CONDITIONING
 1. Input Line Conditioning: Based on the manufacturer's harmonic analysis study and report, provide input filtering and active harmonic correction, as required, to limit total harmonic distortion at the defined Point of Common Coupling (PCC) to meet IEEE 519 recommendations. Harmonic study shall define the PCC at the primary terminals of the main facility service transformer.
 2. As a minimum all drives shall be provided with a 3 percent input filter reactor. For installations with excessive harmonics a passive input filter reactor

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assembly with associated tuning reactor and capacitive bleeding resistor assembly shall be provided to reduce harmonics.

- B. Output filtering: Provide output filtering per the VFD manufacturer's recommendations based on the motor lead lengths. Output filtering is required on all motor leads greater than 150 ft.

2.05 OPTIONAL FEATURES

- A. Motor Heater Contact and CPT: Provide a motor space heater contact and a CPT sized to provide power for the motor heater when the VFD is offline.
- B. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.
- C. Remote digital operator kit, located on the exterior of the drive enclosure
- D. Communication Port: ProfiNet.

2.06 ENCLOSURES

- A. VFD Enclosures: NEMA 250, to comply with environmental conditions at installed location.
 - 1. Dry and Clean Indoor Locations: Type 1
 - 2. Outdoor Locations: Type 4X stainless steel with integral AC units.
 - 3. Wet Areas: Type 4X stainless steel with integral AC units.
 - 4. Other Wet or Damp Indoor Locations: Type 4X stainless steel with integral AC units
 - 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12.

2.07 ACCESSORIES

- A. General Requirements for Control-Circuit and Pilot Devices: NEMA ICS 5; factory installed in VFD enclosure cover unless otherwise indicated.
 - 1. Push Buttons: Unguarded.
 - 2. Pilot Lights: Push to test, and LED
 - 3. All pilot devices to be 30 mm, heavy duty, oil tight (housing to match VFD enclosure)
 - 4. Selector Switches: Rotary type.
 - 5. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied has arranged so padlock can be used to lock push button in depressed position with control circuit open.
- B. Cooling Fan and Exhaust System: For NEMA 250, NEMA 1 UL 508 component recognized: Supply fan, with intake and exhaust grills and filters 120 -V ac, power from integral CPT. (Provide thermostat control and interlock with drive operation).
- C. Spare control-wiring terminal blocks; wired.

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2.08 SOURCE QUALITY CONTROL

- A. Testing: Test and inspect VFDs according to requirements in NEMA ICS 61800-2.
 - 1. Test each VFD while connected to its specified motor
 - 2. Verification of Performance: Rate VFDs according to operation of functions and features specified.
- B. VFDs will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine areas, surfaces, and substrates to receive VFDs, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of the Work.
- B. Examine VFD before installation. Reject VFDs that are wet, moisture damaged, or mold damaged.
- C. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFD installation.
- D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Wall-Mounting Controllers: Install with tops at uniform height and with disconnect operating handles not higher than 79 inches (2000 mm) above finished floor, unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with Section 16071 "Hangers and Supports."
- B. Floor-Mounting Controllers: Install VFDs on 4-inch (100-mm) nominal thickness concrete base. Comply with requirements for concrete.
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.

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VARIABLE FREQUENCY MOTOR CONTROLLERS

- C. Roof-Mounting Controllers: Install VFD on roofs with tops at uniform height and with disconnect operating handles not higher than 79 inches (2000 mm) above finished roof surface unless otherwise indicated, and by bolting units to curbs or mounting on freestanding, lightweight, structural-steel channels bolted to curbs. Seal roof penetrations after raceways are installed.
 - 1. Structural-steel channels are specified in Section 16071 "Hangers and Supports."
- D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- E. Install fuses in each fusible-switch VFD.
- F. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors are installed.
- G. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.
- H. Comply with NECA 1.

3.03 CONTROL WIRING INSTALLATION

- A. Install wiring between VFDs and remote devices and facility's control system. Comply with requirements in Section 16120 "Low Voltage Electrical Power Conductors" and Section 16710 "Communications Cabling."
- B. Bundle, train, and support wiring in enclosures.
- C. Connect selector switches and other automatic-control devices where applicable.
 - 1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switches are in manual-control position.
 - 2. Connect selector switches with control circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor-overload protectors.

3.04 IDENTIFICATION

- A. Identify VFDs, components, and control wiring. Comply with requirements for identification specified in Section 16075 "Identification for Electrical Systems".
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each VFD with engraved nameplate.
 - 3. Label each enclosure-mounted control and pilot device.
- B. Operating Instructions: Frame printed operating instructions for VFDs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of VFD units.

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3.05 FIELD QUALITY CONTROL

- A. Factory acceptance testing shall be required for suppliers who choose to fabricate the enclosed VFD control panel and install a manufacturers VFD within the control panel to ensure that the provided control panel meets the requirements of the project documents. FAT testing shall be in accordance with the Section 16991.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each VFD element, bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Inspect VFD, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
 - 2. Test insulation resistance for each VFD element, component, connecting motor supply, feeder, and control circuits.
 - 3. Test continuity of each circuit.
 - 4. Verify that voltages at VFD locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify ENGINEER before starting the motor(s).
 - 5. Test each motor for proper phase rotation.
 - 6. Perform tests according to the Inspection and Test Procedures for Adjustable Speed Drives stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- D. VFDs will be considered defective if they do not pass tests and inspections.
- E. Perform Harmonic Distortion Testing at the point of common coupling defined in this specification and verify compliance with IEEE 519 guidelines.
- F. Prepare test and inspection reports, including a certified report that identifies the VFD and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.06 STARTUP SERVICE

- A. Perform startup service - Complete installation and startup checks according to manufacturer's written instructions.
- B. Factory authorized representative shall provide startup services at the request of the CONTRACTOR and / or Control System Integrator.

3.07 ADJUSTING

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- A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.
- B. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
- C. Set field-adjustable circuit-breaker trip ranges as specified in Section 16055 "Overcurrent Protective Device Coordination Study."
- D. VFD internal programming:
 - 1. The VFD's shall limit current delivered to each motor, such that the VFD full load amp (VFD FLA) rating of each motor is never exceeded, regardless of the motor speed called by the PLC or manual operation.
 - 2. Motor starting shall be controlled on a two-slope setting, to enable the motor to come to speed quickly, yet minimize transient surge conditions in the distribution system. Slope 1 (50 HZ and below) = 3.0 HZ/sec (0 to 50 HZ within 17 seconds). Slope 2 = 0.333 HZ/sec (50 to 60 HZ within 30 seconds).
 - 3. Motor stopping shall be controlled on a two-slope setting, to enable the motor to come to stop quickly, yet minimize transient surge conditions in the distribution system. Slope 1 (50 HZ and above) = 0.5 HZ/sec (60 to 50 HZ within 20 seconds). Slope 2, 3.0 HZ/sec (50 to 0 HZ within 17 seconds).

3.08 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until controllers are ready to be energized and placed into service.
- B. Replace VFDs whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.09 DEMONSTRATION

- A. CONTRACTOR shall engage a factory-authorized service representative to train OWNER's maintenance personnel to adjust, operate, and maintain VFD's, overcurrent protective devices, instrumentation, and accessories, and to use and reprogram microprocessor-based trip, monitoring, and communication units.

END OF SECTION 16495

SECTION 16515
INTERIOR LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Interior lighting fixtures, lamps, and ballasts.
 - 2. Emergency lighting units.
 - 3. Exit signs.
 - 4. Lighting fixture supports.
- B. Related Sections:
 - 1. Division 16

1.03 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color-rendering index.
- C. LER: Luminaire efficacy rating.
- D. Lumen: Measured output of lamp and luminaire, or both.
- E. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.04 ACTION SUBMITTALS

- A. All submittals "Action," "Informational," and "Closeout" shall meet the requirements of Sections 01300 and 01730.
- B. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of lighting fixture including dimensions.
 - 2. Emergency lighting units including battery and charger.
 - 3. Driver
 - 4. Energy-efficiency data.
 - 5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
 - 6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and

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accessories identical to those indicated for the lighting fixture as applied in this Project.

- a. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
- C. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.
 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 2. Wiring Diagrams: For power, signal, and control wiring.
- D. Samples: When requested by the ENGINEER, provide a sample light fixture of each type and style including all specified options, mounting brackets, and accessories. Each Sample shall include the following:
 1. Lamps and ballasts, installed.
 2. Cords and plugs.
 3. Pendant support system.
- E. Installation instructions.

1.05 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 1. Lighting fixtures.
 2. Suspended ceiling components.
 3. Partitions and millwork that penetrate the ceiling or extends to within 12 inches (305 mm) of the plane of the luminaires.
 4. Ceiling-mounted projectors.
 5. Structural members to which suspension systems for lighting fixtures will be attached.
 6. Other items in finished ceiling including the following:
 - a. Air outlets and inlets.
 - b. Speakers.
 - c. Sprinklers.
 - d. Smoke and fire detectors.
 - e. Occupancy sensors.
 - f. Access panels.
 7. Perimeter moldings.
- B. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.
- C. Field quality-control reports.

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INTERIOR LIGHTING

D. Warranty: Sample of special warranty.

1.06 O&M SUBMITTALS

- A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.07 SPARE PARTS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
 2. Plastic Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
 3. Fixture-mounted, emergency battery pack: One for every 20 emergency lighting unit.
 4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.08 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NFPA 70.

1.09 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.10 WARRANTY

- A. CONTRACTOR shall warranty all non-emergency lighting for a period of one (1) year after substantial completion. Warranty shall include material and labor for re-lamping.

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INTERIOR LIGHTING

- B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Emergency LED Driver and Self-Powered Exit Sign Batteries: One year from date of Substantial Completion. Full replacement warranty shall apply for first year.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide product indicated on Drawings or approved equal per the notes indicated on the project plans.

2.02 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Internal LED Driver.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit re-lamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during re-lamping and when secured in operating position.
- F. Provide plaster frames for all fixtures installed in drywall or plaster ceilings.
- G. All light fixtures shall be circuited to the nearest power panel unless otherwise indicated on the drawings. Conductors shall be 3#12 in a ¾-inchc.
- H. All fixtures shall be provided with lamps.
- I. Diffusers and Globes:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125-inch (3.175 mm) minimum unless otherwise indicated.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass unless otherwise indicated.

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- J. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 - 1. Label shall include the following lamp and ballast characteristics:
 - a. "USE ONLY" and include specific lamp type.
 - b. Lamp diameter, shape, size, wattage, and coating.
 - c. CCT and CRI for all luminaires.

2.03 EMERGENCY POWER UNIT

- A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.
 - 1. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - 2. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - 3. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 - 4. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.04 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
 - 1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
 - 2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - f. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

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INTERIOR LIGHTING

- C. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.
 - 1. Battery: Sealed, maintenance-free, lead-acid type.
 - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - 4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - 5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - 6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
 - 7. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.
 - 8. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.05 LED LAMPS

- A. Color temp and CRI to match adjacent spaces.

2.06 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Section 16071 "Hangers and Supports for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).
- E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).
- F. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
- G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

SECTION 16515

INTERIOR LIGHTING

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Lighting fixtures:
 - 1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
 - 2. Install lamps in each luminaire.
- B. Temporary Lighting: If it is necessary, and approved by ENGINEER, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.
- C. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.
- D. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.
 - 1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches (150 mm) from lighting fixture corners.
 - 2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
 - 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
 - 4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.
- E. Suspended Lighting Fixture Support:
 - 1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 - 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
 - 4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.
- F. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.
- G. Connect wiring according to Section 16120 "Low-Voltage Electrical Power Conductors and Cables."

SECTION 16515

INTERIOR LIGHTING

3.02 IDENTIFICATION

- A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 16010 "Identification for Electrical Systems."

3.03 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.04 STARTUP SERVICE

- A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by OWNER.

3.05 ADJUSTING

- A. Occupancy Adjustments: Within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.

END OF SECTION 16515

SECTION 16670

LIGHTNING PROTECTION FOR STRUCTURES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General and Supplementary Conditions and Division 1 specification sections, apply to this Section.

1.02 SUMMARY

- A. Section includes lightning protection requirements for the facility as indicated on the project drawings.

1.03 ACTION SUBMITTALS

- A. Submittals shall be in accordance with Section 01300.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: For air terminals and mounting accessories.
 - 1. Layout of the lightning protection system, along with details of the components to be used in the installation.
 - 2. Include indications for use of raceway, data on how concealment requirements will be met, and calculations required by NFPA 780 for bonding of grounded and isolated metal bodies.
- D. Plans showing dimensioned as-built locations of grounding features, including the following:
 - 1. Ground rods.
 - 2. Ground loop conductor.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer and manufacturer. Include data on listing or certification by UL.
- B. Provide a certification, from the manufacturer of all roofing systems that the mounting method is approved by manufacturer of roofing material.
- C. Field quality-control reports.
- D. Comply with recommendations in NFPA 780, Annex D, "Inspection and Maintenance of Lightning Protection Systems," for maintenance of the lightning protection system.

1.05 O&M SUBMITTALS

- A. Provide operation and maintenance data in accordance with Section 01730.

SECTION 16670

LIGHTNING PROTECTION FOR STRUCTURES

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Certified by UL or LPI as a Master Installer/Designer, trained and approved for installation of units required for this Project.
- B. System Certificate:
 - 1. UL Master Label.
 - 2. LPI System Certificate.
 - 3. Provide a Recertification for any existing lightning protections system that the proposed system connects to.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 780, "Definitions" Article.

1.07 COORDINATION

- A. Coordinate installation of lightning protection with installation of other building / structural systems and components, including electrical wiring, supporting structures and building materials, metal bodies requiring bonding to lightning protection components, and building finishes.
- B. Coordinate installation of air terminals attached to roof systems with roofing manufacturer and Installer.
- C. Flashings of through-roof assemblies shall comply with roofing manufacturers' specifications.

1.07 WARRANTY

- A. The CONTRACTOR shall provide a concurrent manufacturer's and installation warranty covering the full replacement of all equipment specified within this section. All equipment supplied under this section shall be warranted for a period of one (1) year by the MANUFACTURER and the CONTRACTOR from date of substantial completion.

PART 2 – PRODUCTS

2.01 LIGHTNING PROTECTION SYSTEM COMPONENTS

- A. Comply with UL 96 and NFPA 780.
- B. Roof-Mounted Air Terminals: NFPA 780, Class I or Class II depending on building height, aluminum unless otherwise indicated.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, or comparable product by one of the following:
 - a. East Coast Lightning Equipment Inc.
 - b. ERICO International Corporation.

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LIGHTNING PROTECTION FOR STRUCTURES

- c. Harger.
 - d. Heary Bros. Lightning Protection Co. Inc.
 - e. Independent Protection Co.
 - f. Preferred Lightning Protection.
 - g. Robbins Lightning, Inc.
 - h. Thompson Lightning Protection, Inc.
 - i. or Approved Equal
 - 2. Air Terminals More than 24 Inches (600 mm) Long: With brace attached to the terminal at not less than half the height of the terminal.
 - 3. Single-Membrane, Roof-Mounted Air Terminals: Designed specifically for single-membrane roof system materials. Comply with requirements in roofing Sections.
- C. Main and Bonding Conductors: Aluminum.
- D. Ground Loop Conductor: The same size and type as the main conductor except tinned.
- E. Ground Rods: Copper-clad steel, sectional type; $\frac{3}{4}$ -inch (19 mm) in diameter by 10 feet (3 m) long.
- F. Heavy-Duty, Stack-Mounted, Lightning Protection Components: Stainless steel.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install lightning protection components and systems according to UL 96A and NFPA 780.
- B. Install conductors with direct paths from air terminals to ground connections. Avoid sharp bends.
- C. Conceal aluminum lightning protection system down conductors in 1 inch Schedule 40 PVC conduit along the exterior surface of structures. Conduit shall be painted to match the structure. Conceal down conductor conduits with building gutter systems where applicable.
- D. Cable Connections: Use crimped or bolted connections for all conductor splices and connections between conductors and other components above grade. Use dissimilar metal connectors (i.e. copper to aluminum) as applicable.
- E. Cable Connections: Use exothermic-welded connections in underground portions of the system.
- F. Air Terminals on Single-Ply Membrane Roofing: Comply with roofing membrane and adhesive manufacturer's written instructions.
- G. Bond lightning protection components with intermediate-level interconnection loop conductors to grounded metal bodies of building at 60-foot (18-m) intervals.

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LIGHTNING PROTECTION FOR STRUCTURES

- H. Install a bond jumper between the building ground and the lightning protection ground goop. The bond jumper shall be a #4/0 awg.

3.02 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 16131 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.03 CORROSION PROTECTION

- A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials. Utilize manufacturer provided connectors for dissimilar metals.
- B. Use factory fabricated bi-metallic cable connectors for dissimilar metals such as aluminum / copper connector similar to Erico part number LPA598.
- C. Use conductors with protective coatings where conditions cause deterioration or corrosion of conductors.

3.04 FIELD QUALITY CONTROL

- A. Notify ENGINEER at least 48 hours in advance of inspection before concealing lightning protection components.
- B. Obtain one of the following labels:
 - 1. UL Inspection: Meet requirements to obtain a UL Master Label for system.
 - 2. LPI System Inspection: Meet requirements to obtain an LPI System Certificate.

END OF SECTION 16670

SECTION 16710
COMMUNICATIONS CABLING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Specifications for instrumentation cables
- B. Specifications for ProfiNet cables
- C. Specifications for ethernet cables
- D. Specification for optical fiber cables.

1.02 CITED STANDARDS

- A. National Fire Protection Association (NFPA):
 - 1. 70, National Electrical Code (NEC)
 - 2. 70E Standard for Electrical Safety in the Workplace 2012
- B. The Institute of Electrical and Electronics Engineers (IEEE)
- C. International Society of Automation (ISA)
- D. Telecommunications Industry Association (TIA)
- E. Underwriters Laboratory (UL)
- F. Insulated Cable Engineers Association (ICEA)
- G. ProfiNet / ProfiBus Users Organizations

1.03 QUALITY CONTROL

- A. The CONTRACTOR shall inspect all materials in the field for compliance with Contract requirements prior to compliance testing with the ENGINEER.
- B. The CONTRACTOR shall demonstrate, to the satisfaction of the Owner's ENGINEER, that materials meet the intent of the Contract Documents.
- C. The Integrator shall remove or replace any materials or programming that do not comply with the Contract Documents.
- D. All test equipment shall be calibrated in accordance with the manufacturer's written documentation. The CONTRACTOR shall provide acceptable proof of calibration with all test reports.

1.04 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.

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COMMUNICATIONS CABLING

- B. EMI: Electromagnetic interference.
- C. IDC: Insulation displacement connector.
- D. LAN: Local area network.
- E. RCDD: Registered Communications Distribution Designer.

1.05 ACTION SUBMITTALS

- A. Submit in accordance with Section 01300:
 - 1. Product data for each type of product.

1.06 INFORMATIONAL SUBMITTALS

- A. Submit in accordance with Section 01300.
- B. Qualification Data: For testing agency.
- C. Field quality-control reports.
- D. Standard Test Record Sheets.

1.07 O&M SUBMITTALS

- A. Provide submittals in accordance with Section 01730

PART 2 - PRODUCTS

2.01 GENERAL

- A. Furnish network media products as indicated in the contract drawings and specifications.
- B. All products shall meet all requirements stated in this specification.

2.02 INSTRUMENTATION CABLE

- A. Manufacturers:
 - 1. Belden
 - 2. Or approved equal
- B. Flame Rating: LSZH
- C. Analog Control Cable
 - 1. Analog signal cable (4-20 mA) shall be 18-gauge twisted shielded single pair tinned copper stranded conductors or as noted on the Drawings.
 - 2. The pair shall have a minimum lay of 2 inches per twist.

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COMMUNICATIONS CABLING

3. The shield shall be aluminum-polyester with a 20 AWG stranded tinned copper drain wire and an overall Teflon jacket rated at 300 volts.
4. Multiple pair cables shall have an individual pair and overall shield.
5. Color code shall be red and black.
6. Cable shall be suitable for plenum, conduit and submerged service.
7. Shields shall be properly grounded at each end.

D. Discrete Signal Wire

1. Soft drawn copper conforming to ASTM Standard B-3.
2. All wire shall be single conductor type for sizes #14 AWG and smaller.
3. All wire shall be stranded in accordance with ASTM Standard B-8.
4. Instrumentation discrete signal wire shall be a minimum of #14 AWG.
5. Wiring within control panels shall be a minimum of #16 AWG.

2.03 PROFINET COMMUNICATION

A. Manufacturers:

- a. Belden
- b. Siemens
- c. Or approved equal

B. Cable shall be rated for PROFINET, Type A cable.

1. Core Diameter: 22AWG

C. ProfiNet listed network isolators are required to be installed on all ProfiNet networks where they originate from field devices outside of the main pump building.

2.04 ETHERNET COMMUNICATION

A. Manufacturers:

- a. Belden
- b. Or approved equal

B. Description: CAT 6, 22awg, UTP (unshielded twisted pair) manufactured in accordance ANSI/TIA/EIA-568-B.2 and ANSI/ICEA S-80-576

C. Ethernet network isolators are required on all ethernet networks where they originate from field devices outside of the main pump building.

2.05 OPTICAL FIBER CABLE

A. Manufacturers:

1. Belden
2. Corning
3. Approved Equal

B. Description: Multimode, 62.5/125 micrometer, 6 count minimum, nonconductive, tight buffer, optical fiber cable or as noted on the Drawings.

1. Comply with ICEA S-83-596 for mechanical properties.

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COMMUNICATIONS CABLING

2. Comply with TIA/EIA-568-B.3 for performance specifications.
 3. Comply with TIA-492AAAA-A for detailed specifications.
 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
 - a. General Purpose, Nonconductive: Type OFN or OFNG
 - b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
 - c. Riser Rated, Nonconductive: Type OFNR or OFNP, complying with UL 1666.
 5. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
 6. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
- C. Jacket:
1. Jacket Color:
 - a. Orange for 62.5/125-micrometer cable.
 2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-C.
 3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).
- D. Fiber optic connectors shall be ST type unless otherwise noted.

PART 3 - EXECUTION

3.01 GENERAL

- A. Provide all labor, materials, field-test instruments and equipment required to complete the installation, testing and commissioning of the required Network Media in accordance with the contract documents.
- B. In order to conform to the overall project schedule, the CONTRACTOR shall survey the work area and coordinate cable testing with the other applicable trades.

END OF SECTION 16710

SECTION 16900

CONTROL SYSTEM INTEGRATION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

- A. Requirements for the CONTRACTOR to provide a Control System Integrator (CSI) who shall be responsible for integrating the existing and proposed equipment, material, and software into a fully operational control system.
- B. Requirements specific to the CSI and specific integration work associated with the contract plans and specifications.
- C. CSI shall be responsible for the coordination, supply, and testing of the following:
 - 1. Section 16910 "Control Panel Construction"
 - 2. Section 16930 "Functional Description"
 - 3. Section 16950 "Field Instruments"
- D. OWNER is responsible for development of all system programming.
 - 1. OWNER shall attend preliminary and final coordination meetings as scheduled by the CSI.
 - 2. OWNER shall work closely with CSI to ensure PLC firmware versions are consistent with current JEA standards for programming development.
 - 3. OWNER shall deliver final programming to CSI a minimum of 2 weeks prior to CSI scheduled factory acceptance testing of the control panels and functional programming.
- E. CSI shall plan and lead two coordination meetings including the following entities; electrician, instrumentation supplier, control system integrator, control panel fabricator, ENGINEER, and the OWNER. The purpose of the meetings is to fully understand the scope of work, sequencing of construction activities, and functional programming requirements of each facility.
 - 1. A preliminary coordination meeting shall be scheduled during development of the construction schedule and prior to shop drawing submittals.
 - 2. A final coordination meeting shall be scheduled a minimum of 2 weeks after final approved pump factory acceptance test curves have been supplied to the ENGINEER. Meeting shall also take place prior to final control panel and programming factory acceptance testing, to allow time for final revisions to the function programming.

1.02 CITED STANDARDS

SECTION 16900

CONTROL SYSTEM INTEGRATION

- A. National Fire Protection Association (NFPA):
 - 1. 70, National Electrical Code (NEC)
 - 2. 70E Standard for Electrical Safety in the Workplace
- B. The Institute of Electrical and Electronics Engineers (IEEE)
- C. International Society of Automation (ISA)

1.03 INTRODUCTION

- A. The Control System Integrator may also be referred in this contract as the Integrator or the CSI.
- B. The CSI shall be responsible for coordinating the control systems equipment and communication capability detailed in contract documents. Equipment shall include instrumentation, PLC, OIT, control panels, panel wiring, interconnections between panels, panel devices and communications equipment. The CSI shall facilitate all coordination between contractors, subs, owner, and engineer to ensure complete operational functionality of the project. Additionally, the CSI shall provide detailed designs, testing, validation, quality assurance/quality control, calibrations, settings, control systems maintenance, and training as associated and required within the scope of work.

1.04 OVERVIEW OF INTEGRATOR'S SCOPE

- A. The intent of the work shall be in accordance with the contract drawings, specifications, terms of reference, applicable codes, existing documents, and any applicable listings.
- B. The control system shall include but not be limited to: monitoring, control, data acquisition, communications, and networking.
- C. The Integrator's scope of work is to include but not necessarily be limited to:
 - 1. Perform discovery work as required for implementing further detailed design to meet the requirements detailed herein.
 - 2. Supply and testing of materials and equipment.
 - 3. Provide detailed design as described.
 - 4. Coordinate activities with other divisions to ensure complete and fully operational systems are provided.
 - 5. Coordinate with manufacturers as applicable to interface with manufacturer's equipment.
 - 6. Coordinate new control panels in accordance with Contract Drawings and Specifications.
 - 7. Ensure all devices and components are set, tested, and calibrated for proper operation.

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CONTROL SYSTEM INTEGRATION

8. Coordinate with OWNER to ensure programming and graphical displays are developed and integrated into a fully functional system.
 9. Provide drawings and submittal documents as listed in this Section.
 10. Perform factory acceptance testing (FAT), commissioning assistance, and site acceptance testing (SAT) for control systems.
 11. Schedule and provide operator training.
- E. The Integrator shall include an additional 40 manhours in their price for programming assistance as directed by the OWNER or ENGINEER during the FAT or in the field. This will only be used as directed by the ENGINEER.
- F. The Integrator shall coordinate installation and configuration of all communication equipment.
- G. The Integrator shall be required to meet minimum qualification levels as defined herein.
- H. The Integrator shall assume responsibility and maintain equipment identified for upgrade or replacement in the Contract Plans and Specifications during the project period.
- I. The Integrator shall adhere to national and local code requirements for installation and commissioning.
- J. The CONTRACTOR and CSI are required to install all wiring, piping, conduits and necessary mounting hardware and accessory equipment to provide a complete and fully operational control system as indicated in the Contract Plans and Specifications.

1.05 SPECIAL PROJECT PROCEDURES

- A. The Integrator is to consider the following special conditions that apply in addition to conventional project procedures as follows:
1. The Integrator must ensure protection of the existing operating controls during construction until such time as they are to be replaced by new systems.
 2. Access is limited to typical business hours (8 AM to 5 PM) and access beyond normal business hours must be coordinated with the OWNER.
 3. The Integrator shall protect all supplied equipment against damages and replace any failures during the entire project period.

1.06 QUALITY CONTROL

- A. The CSI, working under the direction of the CONTRACTOR, shall implement quality assurance and control measures to include the following:
1. Factory Acceptance Test (FAT) procedures.

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CONTROL SYSTEM INTEGRATION

- a. The Factory Acceptance Test (FAT) shall allow the Integrator to demonstrate simulated operation and functionality of the control system to the OWNER and ENGINEER prior to delivery and installation. Notify OWNER and ENGINEER two weeks in advance to allow for attendance during FAT testing in accordance with Section 16991.
 - b. The Integrator shall provide all hardware and software for simulation.
 2. Installation and Commissioning Procedures
 - a. The Integrator shall follow installation and commissioning procedures to reduce risk and to safeguard personnel and equipment during installation.
 - b. These procedures shall be conducted in accordance with Section 16992.
 3. Site Acceptance Test (SAT) procedures.
 - a. The SAT shall allow the Integrator to demonstrate and document proper operational readiness and functionality of the control system, to the OWNER and ENGINEER after installation and on-site I/O checkout.
 - b. Include site system integration into OWNER'S overall control system and verify functionality within OWNER'S remote operations system.
 - c. The SAT shall be conducted in accordance with Section 16993.
- B. To ensure quality, all components shall be UL listed or certified by an approved NRTL.

1.07 ACTION SUBMITTALS

- A. Submit in accordance with Section 01300.
1. As part of the requirements of this section of the specifications, the CONTRACTOR shall provide shop drawings and descriptive literature of the control system package for the ENGINEER's review. No fabrication, programming, or installation of any control system equipment shall take place without such review. No partial shop drawing submittals will be accepted.
 2. Shop drawings for the control system shall be submitted in accordance with the requirements of the general requirements of these specifications and shall include, as a minimum, the following:
 - a. Elementary wiring diagrams and panel elevations for control panels.
 - b. Control schematics for equipment.
 - c. Interconnection wiring diagrams detailing wiring or cabling to the field devices, sensors, or instruments as well as network or other communication cables necessary for integration.

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CONTROL SYSTEM INTEGRATION

- d. Manufacturer's Data Sheets with complete model numbers and any applicable manufacturer's recommended practices for the equipment.
- e. Software data sheets. Complete software descriptions and version numbers shall be provided for review and approval.
- f. Diagram of the control system communication architecture. The diagram shall show all hardware and communication components.

1.09 O&M SUBMITTALS

- A. Submit operation and maintenance data in accordance with Section 01730.
- B. Final Documentation
 - 1. Revisions to the equipment, programming, graphical displays, or other made during installation, testing, or final checkout shall be incorporated into the project documents. Shop drawings affected by these revisions shall be resubmitted to the ENGINEER for review and final approval.

PART 2 – PRODUCTS

2.01 TRAINING

- A. The CONTRACTOR shall provide a total of 16 hours for training of field operations personnel at project site as well as operations personnel at the Ridenour facility prior to the 5 day performance test. The CONTRACTOR shall coordinate with OWNER for availability of operators to schedule training. Training may be broken up over multiple days in 4 hour blocks so that different shift operators can be present for the training at the request of the OWNER. CONTRACTOR shall submit a training plan for review and approval at least 21 days in advance of planned training activities.
- B. CONTRACTOR shall submit a training plan for review and approval at least 21 days in advance of planned training activities.
- C. The training shall consist of the following:
 - 1. New equipment training.
 - 2. Control system functionality and operational training.
 - 2. OIT training.
 - 3. Trouble-shooting procedures.

2.02 WARRANTY FOR INTEGRATION SUPPORT

- A. The warranty shall be one year from the date of substantial completion.
- B. The warranty period shall provide the following:
 - 1. Replacement of any newly installed equipment for 1 year.

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CONTROL SYSTEM INTEGRATION

PART 3 – EXECUTION

3.01 CONTROL SYSTEMS INTEGRATOR (CSI)

- A. The Integrator shall:
 - 1. Be responsible for integrating the existing and proposed equipment, material, and software into a fully operational control system.
 - 2. Work directly for the CONTRACTOR involved with the installations.
 - 3. Provide integration and supply of controls related hardware and software shown on the design drawings to include, but not limited to:
 - a. PLC equipment
 - b. Control panel equipment
 - c. Cable and wiring for a complete functional control system
 - d. Communication equipment for wireless cellular communication
 - e. Overseeing terminations and testing of wiring to PLC, I/O, sensors, control and monitoring panels, control elements, other systems interface, OIT and communications system.
 - f. Terminal boxes as required.
 - g. Miscellaneous items required for a fully operational control system.
 - 4. Configuration of wireless cellular communication equipment.
 - 5. Provide record documentation as specified in this Section.
 - 6. Provide training as specified in this Section.
 - 7. Work closely with JEA on the coordination efforts of the program provided by JEA with implementation of a fully functioning system for the project.

3.02 CONTROL SYSTEM INTEGRATOR QUALIFICATIONS

- A. The Integrator shall be one of the following JEA approved Siemens Solutions Providers:
 - 1. DSI Innovations, LLC.
 - 2. ITG Technologies
- B. The Integrator's staff shall meet the following requirements:
 - 1. Programmers:
 - a. Lead Programmers shall be graduate engineers or computer science majors with a 4-year college degree.
 - b. Team programmers shall have a minimum of a 2-year associate degree in a field related to computers or electrical maintenance.
 - c. As a minimum, all programmers shall have a minimum of 5 years of experience in industrial PLC and HMI programming.
 - 2. Field Service Technicians:
 - a. All service technicians shall have a minimum of a 2-year associates degree in a field related to computers or electrical maintenance.

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- b. All service technicians shall have a minimum of five years of experience in PLC systems and HMIs.
- c. All service technicians shall be capable of programming minor edits in the project PLC's and uploading or downloading PLC applications.
- d. All service technicians shall have experience troubleshooting: motor starters, PLC's, computers, HMI systems, and basic electrical controls.
- e. Service technicians shall show proficiency in using the following equipment: volt meters, PLC programming software, HMI configuration tools.

END OF SECTION 16900

SECTION 16910

CONTROL PANEL CONSTRUCTION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

- A. Requirements for the CONTRACTOR to furnish and install control panels referenced on the Contract Drawings and specified herein.
- B. Control panel fabrication shall be performed by a JEA approved control panel fabricator under the direct supervision of the CSI.
- C. Control panels shown or described in the Contract documents are diagrammatic in nature and may not depict all required components necessary. This in no way limits the CONTRACTOR'S and CSI's responsibility to provide a complete and fully functional system as required to operate the facility according to Section 16930 of these specifications.
- D. Control panels to be furnished and installed are as follows:
 - 1. Main Station Control Panel (SCP-1)
 - 2. Hypochlorite Distributed I/O Control Panel (DIO-1)
 - 3. Generator Distributed I/O Control Panel (GIO-1) (described further in Section 16231)
 - 4. GST Area Distributed I/O Control Panel (RIO-1)
 - 5. Hypochlorite Truck Fill Control Panel (CP-501)

1.03 REFERENCED SECTIONS

- A. Section 16120 – Low Voltage Electrical Power Conductors
- B. Section 16231 – Diesel Engine Driven Generator
- C. Section 16710 – Communications Cabling
- D. Section 16930 – Process Loop Description

1.04 REFERENCE STANDARDS

- A. National Fire Protection Association (NFPA)

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- B. Occupational Safety & Health Administration (OSHA)
- C. The Institute of Electrical and Electronics Engineers (IEEE)
- D. International Society of Automation (ISA)
- E. Building Industry Consulting Service International
- F. Telecommunications Industry Association (TIA)
- G. Underwriters' Laboratories, Inc. (UL)
- H. National Electric Manufacturers Association (NEMA)
- I. American National Standards Institute (ANSI)

1.05 NOTED RESTRICTIONS

- A. The "Delegate" ENGINEER of Record for the Control System shall be responsible for the detailed design of all custom built control panels based on the information contained in the drawings. In addition, the "Delegate" ENGINEER of Record for the Control System shall be responsible for all interconnection and loop drawings associated with the custom built control panels.

1.06 QUALITY CONTROL

- A. The control panel components shall be of the most current and proven design. Specifications and Drawings call attention to certain features but do not purport to cover all details entering into the design of the control panels. The components provided by the Control Panel Builder shall be compatible with the functions required and shall form a complete working system.
- B. The entire control system shall bear a UL 508A serialized label "Enclosed Industrial Control Panel". The use of the label "Industrial Control Panel Enclosure" without the UL508A serialized label is not acceptable.

1.07 ACTION SUBMITTALS

- A. Shop drawings shall be submitted in accordance with Section 01300 and shall include at a minimum the following:
 - 1. Catalog information and descriptive literature of all components, wiring diagrams, and panel layout drawings showing dimensions to all devices.
 - 2. Loop diagram and field wiring diagrams for each control panel.

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3. Network installation drawings/schematics related to the panel.
4. Material test certifications and manufacturer's material certifications.
5. Heat load calculations for equipment containing active electronic components.
6. Power supply load calculations
7. CONTRACTOR's installation methods, equipment, materials, and product data.
8. Material Safety Data Sheets (MSDSs) for all materials to be used to meet the requirements of this section.

1.08 O&M SUBMITTALS

- A. Operation and maintenance manuals shall be submitted in accordance with Section 01730.

1.09 ARC FLASH HAZARD MITIGATION AND REDUNDANCY

- A. The control panel shall be constructed so as to allow the panel to remain in service and to limit the exposure to voltages above 50VAC while in the process of maintaining devices within the panel.

1.10 SPARE PARTS

- A. Spare parts shall be furnished for each pump station including but not limited to the following:
 1. One (1) spare PLC for each type provided
 2. One (1) spare HMI for each type provided
 3. One (1) spare remote I/O controller with active bus module for each type provided
 4. One (1) spare SD memory card for each type provided
 5. One (1) spare power supply, UPS, and selectivity module for each type provided
 6. One (1) spare ethernet switch for each type provided
 7. One (1) spare I/O modules for each type provided
 8. 10% spare fuses of each type provided but not less than two of each type.
 9. 20 percent spare I/O within installed I/O modules by the panel fabricator
 10. 10 percent spare terminal blocks (preinstalled by the control panel fabricator)
 11. One (1) spare indicator light for each type provided
 12. Spare parts shall be packaged individually in boxes that are clearly labeled with part name and manufacturer's part/stock number.
 13. Where indicated or requested by the OWNER, provide a lockable steel cabinet sized based on the spare parts provided plus 20 percent spare capacity for owner's use. Indoor conditioned space cabinets shall be NEMA 1. Indoor unconditioned space cabinets shall be NEMA 12.

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1.09 WARRANTY

- A. The CONTRACTOR shall provide a manufacturer's warranty covering the full replacement of all equipment specified within this section. All equipment supplied under this section shall be warranted for a period of one (1) year by the MANUFACTURER from substantial completion.

PART 2 - PRODUCTS

2.01 CONTROL PANEL

- A. The completed control panel assembly shall be manufactured by a JEA approved control panel fabricator under the direct supervision of the CSI. Approved control panel fabricators include: ECS, EG Controls, Suncoast, Sun State Systems, ITG Technologies, and DSI Innovations LLC.
- B. The control panel enclosure shall be designed and sized in accordance with the requirements of the Drawings and as specified herein. The control panel enclosure shall be manufactured by Hoffman or ENGINEER approved equal.
- C. Control panel enclosures located in conditioned spaces shall be NEMA 12, minimum 14 USS gauge.
 - 1. Panels with any dimension greater than 36-inch shall be 12 USS gauge minimum.
 - 2. Piano type hinged, overlapping doors with neoprene gasket. Doors shall be equipped with a heavy-duty 3-point latching mechanism operated by a padlocking handle.
 - 3. Following fabrication, the control panel shall be degreased and cleaned.
 - 4. All panels shall have continuously welded seams.
- D. Control panel enclosures located in unconditioned spaces or outside shall be NEMA, 4X, 0.125 inch marine grade aluminum or 316L SS panels and shall be equipped with the following:
 - a. Piano type hinged, overlapping doors with neoprene gasket. Doors shall be equipped with a heavy-duty 3-point latching mechanism operated by a padlocking handle.
 - b. Following fabrication, the control panel shall be degreased and cleaned. Stainless steel panels shall also be treated with a phosphatizing process.
 - c. All panels shall have continuously welded seams.
 - d. Panel enclosures shall be equipped with aluminum sun shields of the same grade and thickness material as the panel. Sun-shields shall be mounted with 1.5 inch of separation from the panel, in a manner that maintains the NEMA rating of the panel.

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- e. Panels shall be constructed with thermostatically controlled anti-condensation space heaters.
- f. The maximum size of an aluminum enclosure shall be no taller than 60-inch wide or 60-inch high with 12-inch floor stands for a total height of 60-inch. Any enclosure that requires a larger size shall be 316 SS.
- g. Aluminum enclosures with free standing bases shall have the bases manufactured out of 316 SS, to give extra strength.

E. Panel Finishes

- 1. Marine Grade Aluminum: Factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting polyester powder topcoat. The inside of the panel shall be white and the exterior shall be white.
- 2. Carbon Steel: Factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting powder topcoat. The inside of the panel shall be white and the exterior shall be white.
- 3. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.

F. Hardware / Fasteners:

- 1. All Hardware and Fasteners shall be 316 stainless steel.
- 2. All mounting screws shall be drilled and tapped, no self-tapping screws are allowed.

G. Provide a plastic data pocket in the control panel. Data pocket shall be attached to the lower portion of the enclosure door or the lower right door of two (2) door models.

H. Instrumentation Wire

- 1. Cable for 4-20mA analog instrumentation circuits shall be multi-conductor twisted, tinned, 18 AWG, with a FOIL and BRAIDED shield.
- 2. Insulation is to be stripped back 6-inch from the terminal connection to allow clamp on measurement of 20ma loop.

I. Discrete Signal Wire

- 1. Cable for 24VDC to 120VAC discrete signal control circuits shall be minimum #16 awg stranded ASTM Standard B-8.
- 2. Insulation is to be stripped back 6-inch from the terminal connection.

2.02 PANEL MOUNTED DEVICES

A. Enclosure Door Switches

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1. Provide door switches on the enclosure doors for remote indication that the door is open.
 2. The door switch shall be comprised of a microswitch with a swing-arm activation mechanism.
 3. Enclosure door switches shall be manufactured by Eaton, Siemens, Hoffman, or ENGINEER approved equal.
- B. Enclosure Lighting
1. Panel shall have adequate lighting.
 2. Smaller panels shall have an LED panel light with integral switch.
 3. Larger panels shall have an LED panel light with a remote switch.
- C. Control Circuit Breakers
1. Control circuit breakers shall be of energy-limiting design and field-mountable for selective applications.
 2. Circuit breakers shall mount on a DIN rail.
 3. Control Circuit breakers fed by an integral Control Power Transformer shall have a UL/CSA Rated Interrupt Capacity of 10,000 A.
- D. Surge Protection Devices (SPDs)
1. The Control Panel will have a minimum Type 2 SPD with a surge capacity of 40 kA at 8 x 20 us or above.
 2. All surge protection devices, including SPDs located remote from station control panel, shall be fault monitored by a discrete input to the PLC.
 3. The surge suppression listed in TABLE 1-1 are all approved for the application listed. No other device will be accepted.
- TABLE 1-1: CITEL Surge Arrestors
- | Part Number | Application |
|-------------|---------------|
| DLAW-24D3 | Analog |
| DLA-12DBC | Profibus |
| DS220S-24DC | 24VDC |
| DS41S-120 | 120 VAC Surge |
| DS42S-230 | 240 VAC |
- E. 24 Volt DC Power Supplies and UPS
1. The 24 volt DC power supplies and UPS equipment shall be manufactured by:
 - a. Siemens
 - b. Puls
 - c. Orion
 2. Provide a 24VDC power supply for all devices such as PLC, HMI and other such devices, separate from field power.

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3. Provide a 24VDC power supply for communications, control loops, and field power.
 4. Provide a redundancy module for the power supplies.
 5. Provide dedicated single channel signaling selectivity modules for equipment such as PLC, HMI, switches, etc. Modules shall be monitored by discrete inputs to the PLC.
 6. UPS – Station Control Panel SCP-1 Only
 - a. Provide a 24VDC UPS for all control devices such as PLC, HMI and other such devices.
 - b. Provide a 24VDC UPS for power to control devices, communications components, automatic transfer switch, switchboard power analyzers, and other devices as indicated in the Drawings.
 7. The power supplies and UPS equipment shall be sized as required plus 25% spare capacity. Load calculations shall be provided with the control panel shop drawing submittal.
 8. Power supplies and UPS equipment shall be monitored by discrete inputs to the OWNERS PLC.
 9. Grounds common and power for each electrical device shall have its own wire connected to one central distribution. Daisy chained shall not be accepted.
- F. Selector Switches (Where specified on drawings)
1. Selector switches shall be 30.5 mm, heavy-duty, and non-illuminated.
 2. Switches shall have double-break silver contacts and shall be maintained contact type unless otherwise indicated on the Drawings. Auxiliary contact blocks shall be provided on switches where indicated on the Drawings or in the Description of Operation.
 3. Selector switches shall carry the same NEMA rating as the panel on which installed.
 4. Provide a white legend plate for each switch with black engraving as indicated on the Drawings.
 5. Selector switches shall be manufactured by:
 - a. Rockwell (Allen-Bradley)
 - b. Square D
 - c. General Electric
 - d. Siemens
 - e. ENGINEER approved equal
- G. Push Buttons (Where specified on drawings)
1. Push buttons shall be 30.5 mm, heavy-duty, non-illuminated.
 2. Push buttons shall have double-break silver contacts, momentary contact type and shall be color-coded as indicated on the Drawings. Push Buttons without a color indication shall be black.
 3. Push buttons shall carry the same NEMA rating as the panel on which installed.

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4. All push buttons shall have flush heads unless otherwise indicated on the Drawings.
 5. Provide a white legend plate for each push button with black engraving as indicated on the Drawings.
 6. Selector switches shall be manufactured by:
 - a. Rockwell (Allen-Bradley)
 - b. Square D
 - c. General Electric
 - d. Siemens
 - e. ENGINEER approved equal
- H. Pilot Lights (Where specified on drawings)
1. Pilot lights shall be 30.5 mm, heavy-duty, **push-to-test**, with universal LED lamps. Lens color shall be as indicated on the drawings.
 2. Pilot lights shall carry the same NEMA rating as the panel on which installed.
 3. Provide a white legend plate for each pilot light with black engraving as indicated on the Drawings.
 4. Selector switches shall be manufactured by:
 - a. Rockwell (Allen-Bradley)
 - b. Square D
 - c. General Electric
 - d. Siemens
 - e. ENGINEER approved equal
- I. Relays, General Purpose
1. General purpose relays as shown on the drawings shall be UL labeled, industrial grade as manufactured by:
 - a. IDEC: RU Series
 - b. Or Approved Equivalent
 2. Relays shall have LED indication of energized/de-energized state.
 3. Relays shall have latching Levers.
- J. Interposing Relays – Used with PLC I/O
1. Interposing relays shall be utilized on all digital outputs in lieu of PLC output cards.
 2. Interposing relays shall be miniature industrial type with 120 VAC coils or pluggable miniature type for 24 VDC coils.
 3. Relays shall have LED indication of energized/de-energized state.
 4. Relays shall be SPDT or DPDT type with AgNi contacts rated for 6A resistive minimum.
 5. Interposing relays shall be manufactured by:
 - a. Finder

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- K. Fuses (Where specified in the drawings)
1. All fuses shall be sized as required for the circuit they are protecting.
 2. Fuses shall be rated at 600 VAC/170 VDC (1/2-20 A) and 480 VAC/300 VDC (25 – 60 A).
 3. Fuses shall be listed UL Std. 248.
 4. Fuses shall be supplied with manufacturer recommended fuse blocks.
 5. Fuses shall be manufactured by:
 - a. Cooper Bussman, Inc.
 - b. Ferraz Shawmut, Inc.
 - c. Littlefuse, Inc.
 - d. Edison Fuse, Inc.
 - e. or ENGINEER approved equal
- L. Terminal Blocks
1. Terminal Blocks shall be by:
 - a. Phoenix Contact
 - b. Or approved equivalent
 2. The minimum size shall be 4mm.
 3. Terminals colors are to match UL508A voltage color code
 4. All field wiring shall land on din-rail mounted terminal blocks near the bottom of the control panel prior to distribution within the control panel.
 5. All spare I/O shall be brought out to terminal blocks for future use.
 6. Like devices, equipment, or signals shall be grouped together on terminal blocks. Terminal block layout shall provide for future expansion without the need for renumbering.
 7. All terminal blocks shall be rated for 600 volts AC and shall be identified with a permanent machine printed marking.
 8. A maximum of two (2) wires shall be provided per terminal block.
 9. Field signal terminal blocks:
 - a. 24Vdc Fuse modular terminal block - UKK 5-HESILED 24 (5X20) - 3026654
 - b. 120Vac Fuse modular terminal block - UKK 5-HESILA 250 (5X20) - 0711629
 10. For multiplex signal terminal blocks:
 - a. 120v Four-conductor universal terminal block - UT 4-QUATTRO RD - 3074460
 - b. 24v Feed-through terminal block - UT 4-QUATTRO BU - 3044584
 11. Feed through terminal blocks:
 - a. UT 4-QUATTRO - 3044571
 12. For Isolation or disconnect terminal blocks:
 - a. Single level knife disconnect terminal blocks - UT 4-QUATTRO-MT-3064043
 - b. Double level knife disconnect terminal blocks - UTTB 4-MT - 3044775

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13. Analog signal (Input and Output) terminal blocks:
 - a. Fuse modular terminal block - UT 4-PE/L/HESILED 24 (5X20) - 3214321
- M. Convenience Outlet – General Enclosures
 1. GFCI convenience outlets shall be UL labeled, industrial grade, and DIN rail mounted. GFCI outlets shall be rated for 120 VAC, 15 A.
 2. GFCI convenience outlets shall be labeled with the tag number indicated in the Contract Drawings and shall clearly indicate the maximum current available.
- N. Convenience Outlet – SCP-1
 1. UPS Duplex Receptacle – Outlets shall be UL labeled, industrial grade, and DIN rail mounted. Outlets shall be rated for 120 VAC, 30 A and mounted in lower left corner dedicated for the Orion UPS.
 2. GFCI Convenience Quadraplex Receptacle – Outlets shall be UL labeled, industrial grade, and DIN rail mounted. GFCI outlets shall be rated for 120 VAC, 15 A.
- O. Wiring
 1. Type and Identification
 - a. All Wire Colors in the panel are to follow the UL508A standards.
 - b. Control Wiring shall be numbered / lettered at each end. Wire numbers / letters shall be Flattened Polyolefin Heat Shrink Markers for Permanent Wire and Cable Identification (Panduit) or JEA approved equal.
 2. All interior control panel control wiring shall be stranded copper #18 AWG, 600V, Type RHW2.
 3. All interior control panel analog signal wiring shall be 18 gauge, twisted-shielded pairs with foil shield and drain wire. Analog signal wire shall be manufactured with 600V, 75° insulation.
 4. All wiring and terminal strips shall be isolated by voltage levels to the greatest possible extent.
 5. Wiring shall be continuous with no splices.
 6. Exterior panel wiring shall be as indicated on the Drawings.
- P. Wiring Duct
 1. Wiring Duct shall be as follows
 - a. Panduit Wide Slot with a Hinged Cover. Non hinged covers will not be accepted. An example part number is H1.5X2LG6 / HC1.5LG6 but not limited to this size.
 2. Wiring Duct is to have a maximum fill limit of 40%.
 3. The outside edge of the Panduit can be placed no closer than 2 inches to the nearest terminal edge or component. This is to allow adequate space to wire the terminals.

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4. Wire Duct installed on the outside edges of the back panel must be a minimum of 2 inches from the edge of the back panel.

Q. Grounding Bus

1. Provide a copper isolated grounding bus inside the control panel for terminating all ground wires.
2. Grounding busses shall be 2-inch x 1/4-inch x 12-inch long and manufactured of copper. Grounding busses used for isolated grounds shall be provided with a standard hardware kit that includes fixtures for isolation from the panel. The installation kit shall include at least one (1) #2 compression lug.
3. Grounding busses shall be manufactured by:
 - a. Cooper Industries (SBTGBK)
 - b. Panduit
 - c. Eritech
 - d. or ENGINEER approved equal

R. Nameplates

1. Nameplates are to be provided for all individual panels, instruments and panel mounted devices.
2. Use plastic laminate nameplates having engraved black letters on a white background.
3. Letters must be a minimum of 24 Font.
4. Nameplate must be visible when devices are wired

S. Programmable Logic Controllers

1. PLC system shall be S7-400.
2. Provide a complete PLC system with processors, communication modules, local and remote I/O modules and other system components as shown on the Drawings. All PLC hardware components shall be configured to perform the functions shown on the Drawings and within these specifications.
3. The PLC shall be suitable for use under the following environmental conditions:
 1. Operating temperature: 0°C to 60°C for horizontal configuration
0°C to 40°C for vertical configuration
 2. Relative humidity: 95% at 25°C, non-condensing
5. The PLC or Distributed I/O shall be provided with approximately 20% spare I/O points.
 - a. All spares are to be wired to terminals
6. The CONTRACTOR shall provide all Ethernet switches, adapters, connectors, and interconnection cables necessary to connect the PLCs to the network. Network isolators shall be required on all ethernet based networks originating from field devices outside of the main pump building.
7. Analog Input modules shall be isolated from the backplane and each channel shall be individually isolated from each other.

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8. Each Input module shall have two fuses to divide the inputs
9. Maximum I/O per card shall be as follows:
 - a. Discrete Input - 16
 - b. Discrete Output - 16
 - c. Analog Input - 8
 - d. Analog Output -8

T. Hypochlorite Control Panel DIO-1

1. The Bill of Material below is the list of the devices to be provided and installed as part of the Hypochlorite distributed I/O panel. The list provides the main components and equipment to be furnished, but it is not all inclusive. The control panel fabricator shall furnish additional components or equipment as required to meet the control intent of the contract documents.
2. The hypochlorite distributed I/O panel shall be located in the hypochlorite storage area.
3. The hypochlorite distributed I/O panel shall be powered from a 120VAC source from the main station control panel SCP-1.
4. Hypochlorite distributed I/O panel shall have a thermostatically controlled space heater / anti condensation heater installed.
5. Approved Panel Bill of Materials (modify as required to meet specific facility design intention).

Manufacturer	Part Number	Description
Siemens	6AG1124-0GC13-2AX0	TP700 Comfort Outdoor w/ Conformal Coating
Siemens	6AV2181-8XP00-0AX0	SIMATIC HMI SD memory card, 2 GB
Siemens	6ES5710-8MA11	DIN rail 35 mm, length: 483 mm, for 19" cabinets
Siemens	6ES7153-4BA00-0XB0	IM 153-4 High Feature for ET 200M, PROFINET
Siemens	6ES7193-6AR00-0AA0	Bus Adapter 2xRJ45
Siemens	6ES7195-1GA00-0XA0	DIN rail for active bus modules, 482 mm (19")
Siemens	6ES7195-7HA00-0XA0	Active bus module for power supply and interface module 153
Siemens	6ES7195-7HB00-0XA0	Active bus module for 2 modules 40 mm wide
Siemens	6ES7321-1BH02-0AA0	Digital input, 16 DI, 24V DC; isolated
Siemens	6ES7321-1FH00-0AA0	Digital input 16 DI, 120/230 V AC; isolated
Siemens	6ES7322-1FH00-0AA0	Digital output 16DO, 120/230V AC, 0.5A; isolated
Siemens	6ES7331-7KF02-0AB0	Analog input 8AI; 14-bit; 20ms; isolated
Siemens	6ES7332-5HD01-0AB0	Analog output 4 AO; 12-bit; isolated
Siemens	6ES7392-1AJ00-0AA0	Front connector, 20-pin, with screw contacts
Siemens	6ES7392-1AM00-0AA0	Front connector, 40-pin, with screw contacts
Siemens	6ES7307-1KA02-0AA0	PS; AC 120/230V, DC 24V, 10A
Siemens	6GK5205-3BB00-2AB2	SCALANCE XB205-3 (PN pre-config. + EIP, MM ST)
Corning	SPH-12OTS-12H3H	Integrated 12MMF ST Wall Mount Patch Panel
Square D	PK5GTA	Equipment Ground Bar Kit
Siemens	6XV1 840-2AH10	PROFINET Cable, Fast Connect
Siemens	6AG1901-1BB10-7AA0	PROFINET Connector, Siplus

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U. Station Control Panel SCP-1

1. The Bill of Material below is the list of the devices to be provided and installed as part of the main station control panel. The list provides the main components and equipment to be furnished, but it is not all inclusive. The control panel fabricator shall furnish additional components or equipment as required to meet the control intent of the contract documents.
2. Main station control panel shall be located in the electrical room of the pump building.
3. The main station control panel shall be powered from the ORION UPS to supply power if AC main is out of service.
4. The main station control panel SCP-1 shall feed 120VAC UPS power and 24VDC power to the station automatic transfer switch ATS-1.
5. SCP-1 shall also feed 120VAC power to the GST area remote I/O panel, the hypochlorite area remote I/O panel, and the generator area remote I/O panel.
6. Approved Panel Bill of Materials (modify as required to meet specific facility design intention).

Manufacturer	Part Number	Description
Siemens	6AV2124-0QC02-0AX1	TP1500 Comfort
Siemens	6AV2181-8XP00-0AX0	SIMATIC HMI SD memory card, 2 GB
Orion	OPS-Relay	Orion UPS Relay Card
Orion	RT1 Unity 3k	3000VA/2850 Online UPS w/ Unity Power Factor
Siemens	6ES7407-0RA02-0AA0	Power supply PS407 20A; 120/230V AC -> 5V/24V DC
Siemens	6ES7414-2XL07-0AB0	CPU 414-2; 2x256KB RAM; 1 MPI/DP, 1 DP
Siemens	6ES7421-1FH20-0AA0	Digital input 16 DI; 120/230V UC
Siemens	6ES7421-7DH00-0AB0	Digital input 16 DI; 24-60V UC; alarm; diagnostics
Siemens	6ES7422-1FH00-0AA0	Digital output 16 DO; 120/230V AC; 2A
Siemens	6ES7431-1KF10-0AB0	Analog input 8AI, 14-bit, with linearization
Siemens	6ES7432-1HF00-0AB0	Analog output 8AO, 13-bit, isolated
Siemens	6ES7492-1AL00-0AA0	Front connector for signal modules; screw contacts
Siemens	6ES7952-1KK00-0AA0	Flash memory card, long; 1 MB
Siemens	6ES7971-0BA00	Buffer battery 3.6 V/1.9 Ah for PS 405/PS 407
Siemens	6ES7400-1TA01-0AA0	UR1, central controller/expansion device; 18 slots, K bus
Siemens	6GK5213-3BB00-2AB2	SCALANCE XB213-3 (PN pre-config. + EIP, MM ST)
Siemens	6GK7443-1GX30-0XE0	CP 443-1 Advanced, Communication Processor, S7-400
Corning	SPH-12OTS-12H3H	Integrated 12MMF ST Wall Mount Patch Panel
Square D	PK5GTA	Equipment Ground Bar Kit
Siemens	6XV1 840-2AH10	PROFINET Cable, Fast Connect
Siemens	6AG1901-1BB10-7AA0	PROFINET Connector, Siplus

V. Generator Remote I/O Panel GIO-1

SECTION 16910

CONTROL PANEL CONSTRUCTION

1. The Bill of Material below is the list of the devices to be provided and installed as part of the generator remote I/O panel. The list provides the main components and equipment to be furnished, but it is not all inclusive. The control panel fabricator shall furnish additional components or equipment as required to meet the control intent of the contract documents. Refer to Section 16231 for additional requirements.
2. Generator remote I/O panel shall be located adjacent to the generator.
3. The generator remote I/O panel shall be powered from a 120VAC source from the main station control panel SCP-1.
4. Generator remote I/O panel shall have a thermostatically controlled space heater / anti condensation heater installed.
5. Approved Panel Bill of Materials (modify as required to meet specific facility design intention).

Manufacturer	Part Number	Description
Siemens	6ES5710-8MA11	DIN rail 35 mm, length: 483 mm, for 19" cabinets
Siemens	6ES7153-4BA00-0XB0	IM 153-4 High Feature for ET 200M, PROFINET
Siemens	6ES7193-6AR00-0AA0	Bus Adapter 2xRJ45
Siemens	6ES7195-1GA00-0XA0	DIN rail for active bus modules, 482 mm (19")
Siemens	6ES7195-7HA00-0XA0	Active bus module for power supply and interface module 153
Siemens	6ES7195-7HB00-0XA0	Active bus module for 2 modules 40 mm wide
Siemens	6ES7321-1FH00-0AA0	Digital input 16 DI, 120/230 V AC; isolated
Siemens	6ES7331-7KF02-0AB0	Analog input 8AI; 14-bit; 20ms; isolated
Siemens	6ES7392-1AJ00-0AA0	Front connector, 20-pin, with screw contacts
Siemens	6ES7392-1AM00-0AA0	Front connector, 40-pin, with screw contacts
Siemens	6ES7400-1TA01-0AA0	UR1, central controller/expansion device; 18 slots, K bus
Siemens	6ES7307-1BA01-0AA0	PS 307; AC 120/230V, DC 24V, 2A
Siemens	6ES7952-1KK00-0AA0	Flash memory card, long; 1 MB

W. GST Area Remote I/O Panel RIO-1

1. The Bill of Material below is the list of the devices to be provided and installed as part of the GST area remote I/O panel. The list provides the main components and equipment to be furnished, but it is not all inclusive. The control panel fabricator shall furnish additional components or equipment as required to meet the control intent of the contract documents.
2. GST area remote I/O panel shall be located adjacent to the ground storage tanks.
3. GST area remote I/O panel shall have a thermostatically controlled space heater / anti condensation heater installed.
4. The GST area remote I/O panel shall be powered from a 120VAC source from the main station control panel SCP-1.
5. Approved Panel Bill of Materials (modify as required to meet specific facility design intention).

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CONTROL PANEL CONSTRUCTION

Manufacturer	Part Number	Description
Siemens	6ES5710-8MA11	DIN rail 35 mm, length: 483 mm, for 19" cabinets
Siemens	6ES7153-4BA00-0XB0	IM 153-4 High Feature for ET 200M, PROFINET
Siemens	6ES7193-6AR00-0AA0	Bus Adapter 2xRJ45
Siemens	6ES7195-1GA00-0XA0	DIN rail for active bus modules, 482 mm (19")
Siemens	6ES7195-7HA00-0XA0	Active bus module for power supply and interface module 153
Siemens	6ES7195-7HB00-0XA0	Active bus module for 2 modules 40 mm wide
Siemens	6ES7321-1FH00-0AA0	Digital input 16 DI, 120/230 V AC; isolated
Siemens	6ES7331-7KF02-0AB0	Analog input 8AI; 14-bit; 20ms; isolated
Siemens	6ES7392-1AJ00-0AA0	Front connector, 20-pin, with screw contacts
Siemens	6ES7392-1AM00-0AA0	Front connector, 40-pin, with screw contacts
Siemens	6ES7400-1TA01-0AA0	UR1, central controller/expansion device; 18 slots, K bus
Siemens	6ES7307-1BA01-0AA0	PS 307; AC 120/230V, DC 24V, 2A
Siemens	6ES7952-1KK00-0AA0	Flash memory card, long; 1 MB

X. Communication Networks

1. All Profibus installation must comply with the PROFIBUS User Organization. More information can be found at "WWW.Profibus.com".
 - a. Reference "PROFIBUS Installation Guideline for Planning" order number 8.0012.
 - b. Reference "PROFIBUS Assembly Guideline" order number 8.0022.
 - c. ALL recommendations from the Profibus User Organization must be followed, such as using Fiber Optic instead of copper when leaving a building.
 - d. Profibus connectors shall be made of metal housing and have Power, Transmit, Termination and Error indicating LED's. Connectors shall be Brad Harrison MA9D00-42 and MA9D01-42 type or equal.
 - e. Only diagnostic repeaters shall be used where repeaters are required. Standard repeaters shall not be accepted. Repeater shall be Siemens diagnostic repeater 6ES7 972-0AB01-0XA0 or equal.
 - f. For fiber optic communications use the Siemens OLM G12 Part # 6GK1503-3CB00.
 - g. All ends of the copper Profibus network must have an active termination resistor installed. The active termination resistor shall be a Procentec part # 101-00211A.
2. All Ethernet installation must comply with the PROFINET User Organization. More information can be found at "WWW.Profinet.com".
 - a. Reference "PROFINET Installation Guideline for Cabling and Assembly" order number 8.072.
 - b. ALL recommendations from the ProfiNet User Organization must be followed such as using Fiber Optic when leaving a building as well as network isolators.

SECTION 16910

CONTROL PANEL CONSTRUCTION

- c. Ethernet connector connectors shall be made of metal housing. Connectors shall be Siemens 6GK1901-1BB10-2AA0 type or equal.
- d. All switches shall have the capability to be managed. Switches shall be of type Siemens SCALANCE X200 Series.
- e. Network topology shall be a redundant ring between managed switches and star between managed switches and end user devices.
- f. ProfiNet network isolators are required on all industrial ethernet circuits that originate from devices located in the field and not within the pump building electrical room.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Factory acceptance testing shall be in accordance with Section 16991. Testing shall occur at the panel fabricators facility or a facility chosen by the CSI. CSI shall coordinate all testing requirements, 2 week advance notifications to OWNER and ENGINEER, and reporting results. CSI or panel fabricator shall prepare a FAT testing protocol document and submit to the OWNER and ENGINEER for review and approval at least 3 weeks in advance of planned FAT testing.
- B. Start-up and Testing
 - 1. Check the panel for conformity with the approved shop drawings for the panel being supplied.
 - 2. Provide a minimum of sixteen (16) hours for onsite support to be used at the direction of the OWNER or ENGINEER for field required modifications to the control panels.
 - 3. Test the operation of the control panel and all controls.
 - 4. Test the operation of all communication equipment.
 - 5. All start-up and testing shall be performed in the presence of JEA and the ENGINEER.
 - 6. Any field revisions to the control panels shall be documented and incorporated into final O&M manuals. Additionally, shop drawings shall be updated and resubmitted to the ENGINEER for record keeping purposes.
- C. Training
 - 1. Provide up to sixteen (16) hours of training for the OWNER's personnel on the operation of the control panel.
 - 2. Training shall be provided on at least two separate days and two separate shifts, as necessary, to accommodate personnel on all work schedules and shifts.
 - 3. Training shall include operation of the controls and troubleshooting procedures.

END OF SECTION 16910

SECTION 16930

FUNCTIONAL DESCRIPTION (TWIN CREEKS)

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. This specification section describes required work associated with the Twin Creeks Reclaimed Water Re-Pump Station.
- B. This section describes the general function of each primary process loop to be modified or included. The OWNER shall provide additional functions as needed to adhere to good control and engineering practices.
- C. Functional process control and system setpoints have been established using preliminary information provided by pump suppliers during the detailed design process. The OWNER shall expect a revision to the functional process control and system setpoints after the CONTRACTOR has selected a pump supplier and the pump supplier has issued approved factory test curves. Finalization and approval of the functional process control and system setpoints will not be acceptable prior to approval of pump factory test curves.
- D. OWNER is responsible for development of all system programming as well as development of the HMI graphics and screens required.
 - 1. OWNER shall attend preliminary and final coordination meetings as scheduled by the CSI.
 - 2. OWNER shall work closely with CSI to ensure PLC firmware versions are consistent with current JEA standards for programming development.
 - 3. OWNER shall deliver final programming to CSI a minimum of 2 weeks prior to CSI scheduled factory acceptance testing (FAT) of the control panels and functional programming. CSI shall coordinate with OWNER as required to load the program and perform a preliminary checkout at least three days prior to scheduled FAT. The time needed for the CSI and the CONTRACTOR to be able to adhere to the requirements of the project and begin startup and testing needs to be outlined clearly in the CONTRACTOR's schedule and submitted at least six months prior to FAT or within 90 days of Notice to Proceed, whichever is earlier, so that the OWNER can meet these deadlines.
- E. Refer to the following specifications for additional requirements and coordination:
 - 1. 16900 – Control System Integrator
 - 2. 16910 – Control Panel Construction
 - 3. 16950 – Field Instruments
 - 4. 16991 – Factory Acceptance Testing
 - 5. 16992 – Commissioning
 - 6. 16993 – Site Acceptance Testing

SECTION 16930

FUNCTIONAL DESCRIPTION (TWIN CREEKS)

1.03 GENERAL

- A. Overall requirements of the pumping station operating and control system are as described in the loop descriptions in these specifications as well as the process and instrumentation diagrams included on the Drawings.
- B. In general, all process functional control and annunciation available locally at the facility HMI shall also be available remotely through the JEA SCADA system at the Ridenour WTP Control Station.
- C. General functionality of the motor driven equipment includes Hand-Off-Auto selector switches at the local control panels. In the "Auto" position, the motors shall be controlled from the main pumping station control system, based on the descriptions provided in these specifications. In the "Hand" position, the motors shall be controlled from local HMI's or control devices on the local panels.
- D. The OWNER shall develop HMI graphics and screens in accordance with the latest JEA approved standards which shall include such screens as:
 - 1. Title screen
 - 2. Overall facility status screen with all major components
 - 3. Facility instrumentation status screen
 - 4. Ground storage tanks status screen
 - 5. Pump status screen
 - 6. Pump setpoint screen
 - 7. Hypochlorite status screen
 - 8. Hypochlorite setpoint screen
 - 9. Power system status screen
 - 10. Alarms screen
- E. Hypochlorite Remote I/O Panel DIO-1 will have a TP700 Comfort Outdoor Panel. Include screens for this panel such as:
 - 1. Title screen
 - 2. Overall facility status screen with all major components
 - 3. Facility Instrumentation status screen
 - 4. Hypochlorite status screen
 - 5. Hypochlorite setpoint screen
 - 6. Alarms screen

1.04 ALARM CONDITIONS

- A. All alarm conditions for the proposed equipment shall adhere to the following:
 - 1. Be displayed on the HMI (Human Machine Interface) located on the Main Station Control Panel SCP-1 located in the electrical room of the pump building as well as local HMI's located in remote I/O control panels located in the field.
 - 2. Be recorded in the HMI alarm database
 - 3. Trigger alarm conditions within the OWNER's SCADA system as indicated within the Drawings.
 - 4. Adjustable operator setpoints shall define alarm levels.

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FUNCTIONAL DESCRIPTION (TWIN CREEKS)

1.05 PASSWORD PROTECTION

- A. Programming functions shall be password protected within the HMI to prevent accidental manipulation of pump PID control loop settings.
- B. System shall have login functions for Admin (Full read/write control), Engineer (Full read/write control), and Operator (Limited visibility and setpoint adjustment)

1.06 DATA ARCHIVAL AND TRENDING

- A. The HMI shall be configured to trend all points connected to the station control system within the HMIs available memory as indicated in the I/O lists shown on the Drawings and consistent with industry standards.

PART 2 – TWIN CREEKS SYSTEM DESCRIPTION

2.01 SYSTEM DESCRIPTION

- A. This project includes work at the Twin Creeks Reclaimed Water Re-Pumping Station including the following proposed auxiliary systems:
 - 1. Tank fill, station discharge, and bypass reclaimed water control stations.
 - 2. Ground storage tanks for total storage of approximately 3.0 million gallons of reclaimed water.
 - 3. Reclaimed water pumping systems.
 - 4. Sodium hypochlorite storage and feed system for control of residual chlorine.
 - 5. Standby emergency generator for backup power generation.

2.02 PUMP STATION PROCESS CONTROL NARRATIVE

- A. There is a total of four pumps and one future pump powered by variable frequency drives (VFDs); Jockey pump (P-401) Re-pumps (P-402, P-403, P-404) Future Re-pump (P-405). P-401 will be installed as a jockey pump as part of the work included in these contract documents. and will later be replaced by others in the future with a larger re-pump, along with adding a new re-pump P-405. The re-pumps are fed directly from the onsite ground storage tanks (GSTs). The GSTs are fed directly from the reclaimed water main from the Greenland WRF. When RW demand is low and influent pressure to the Twin Creeks Reclaimed RW RPS is high enough to supply the station demand based on the operator selected discharge pressure setpoint, the station will automatically shut down in a stepped shutdown approach allowing the bypass check valve to open.
- B. The station is designed to provide a stable pressure of 84 psi during the max month peak hour demand scenario and will achieve any operator setpoint within a 20-psi operator selectable range (64 to 84 psi), to the Twin Creeks Service area.
- C. Modes of Operation. There shall be three operator selectable modes of operation which are:
 - 1. Manual. In the Manual Mode, the operator shall set the speed of pumps and select the step manually from the HMI.

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FUNCTIONAL DESCRIPTION (TWIN CREEKS)

2. Automatic. In the Automatic Mode, which is the default mode, the operator shall set the desired station discharge pressure and the control system shall automatically determine the step and pump speed required to achieve and maintain the operator selected setpoint within an acceptable band, (+3 psi, – 2 psi of set pressure), within a 20-psi allowable operator selectable range.
 3. Bypass. In the Bypass Mode, (which is also Step 0 in Automatic Mode with additional constraints) the control system will allow the Twin Creeks service area to be served by other pumps stations (i.e. Bartram and Greenland) and not re-engage pumps until an operator selected Bypass low pressure set point is achieved. When selected by the operator via the local HMI or remotely via the SCADA system, the station will shut down in a stepped approach to allow the bypass check valve to open. The Bypass low pressure setting selected by the operator shall also control in the Automatic Mode if the RPS achieves Step 0, re-engaging pumps only when the Bypass low pressure setpoint is achieved.
 4. The mode of operation shall be displayed on the HMI.
- D. The control system shall operate the pumps in a stepped approach based on the plant discharge pressure as measured through PIT-700 or PIT-701. Each step is activated by a low pressure, has a pressure to maintain, and a “high pressure” that when maintained or exceeded for an adjustable time (120 seconds initial for high pressure and 30 seconds initial for low pressure) will be used to return to the next step (higher or lower). If high pressure is achieved for the specified time while in step one, then the pump in operation will shut down (Step 0 = the station will shut down) until the Bypass Mode - low-pressure setpoint is achieved; at which time the control system will initiate step one operation. While in each step the control system shall vary the speed of all running pumps equally to maintain the specified pressure of that step. When more than one pump is in operation, all pumps shall always operate at the same speed.
- E. The pump control loops shall be as follows:

Step	Pumps Running	Low Pressure (PSI)	Maintain Pressure (PSI)	High Pressure (PSI)	Minimum Pump Speed (Smin)	Maximum Pump Speed (Smax)
0	None	Bypass Low Pressure Set Point	N/A	N/A	N/A	N/A
1	1 Jockey	-2	Setpoint	+3	By PLC	By PLC
2	1 Repump	-2	Setpoint	+3	By PLC	By PLC
3	2 Repumps	-2	Setpoint	+3	By PLC	By PLC
4	3 Repumps	-2	Setpoint	+3	By PLC	By PLC
5	Future	Future	Future	Future	Future	Future

The PLC will automatically control the speed of the pumps to maintain the station discharge pressure monitored via an operator selectable discharge pressure transmitter, PIT-700 or PIT-701. When multiple pumps are required to operate

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FUNCTIONAL DESCRIPTION (TWIN CREEKS)

simultaneously, all pumps shall be called to operate at the same speed. In normal operation, the pump will operate to provide pressure and supply demand as described below.

1. When the capacity of called step is exceeded by demand (resulting in discharge pressure falling below setpoint range), the next step will be called, which typically another pump (if available) will be called to join pump operation and maintain discharge pressure set point via variation of pump(s) speed with VFD. However, prior to replacement of the jockey pump with a repump, Step 2 shuts down the jockey pump and starts a full pump. In Steps 3 and 4, another full pump is called into service as applicable. When the jockey pump is replaced in the future, Step 2 will call another pump in the same manner as Steps 3 and 4.
 2. When the capacity of called step falls below minimum value (as demonstrated by discharge pressure rising above setpoint range), a pump will be dropped from operation and remaining pumps (if any) will maintain discharge pressure set point via variation of pump(s) speed with VFD. However, prior to replacement of the jockey pump with a repump, falling pressure which would initiate Step 1 will shut down the full pump and start the jockey pump. In Steps 2 and 3, a full pump is removed from service as applicable. When the jockey pump is replaced in the future, Step 1 will shut down a full pump in the same manner as Steps 2 and 3.
- F. Pump Speed Determination for pumps. The control system shall continuously determine the pump speed and span based upon the minimum allowable and maximum allowable pump speeds (Smin and Smax). The PI Controller shall constantly determine the allowable percent speed/frequency span based upon the Smin and Smax limits determined based upon discharge pressure (PIT-700 or PIT-701) as described in the equations below. The PI Controller shall assign minimum and maximum output values of 0 to 100 percent of allowable span when directing pump speed to maintain operator discharge setpoint based on the following equations:
1. Smin - Minimum allowable pump operating speed shall be calculated continuously by the control system.
 - a.
$$Smin \% = \{ [((PIT\ 700/701) - (LIT\ 100/200 - 3)] - 137) \times 0.277 \} + 76.0$$

} Values are in Ft of head, not psi.
 - b. If Smin % is greater than 100.0, then Smin shall be 100 percent. Speeds in excess of 100 percent are prohibited.
 2. Smax - Maximum allowable pump operating speed shall be calculated continuously by the control system
 - a.
$$Smax \% = \{ [((PIT\ 700/701) - (LIT\ 100/200 - 3)] - 106) \times 0.360 \} + 82.0$$

} Values are in Ft of head, not psi.
 - b. If Smax % is greater than 100, then Smax shall be 100 percent. Speeds in excess of 100 percent are prohibited.
 3. Smin and Smax pump speed determination equations may change once pump is factory tested and results accepted by ENGINEER. Speed limit determination may be in alternate form of equation, expressed as a function of any or all of the following (discharge flow, discharge pressure, tank level).
- G. Pump speed span limits and midpoint
- a. 0% of allowable span = Calculated Smin (e.g. 72%)

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- b. 100% of allowable span = Calculated Smax (e.g. 94%)
 - c. Span Range = Smax – Smin (e.g. 94% - 72% = 22%)
 - d. Mid span for PID loop = Avg. (Smax and Smin), (e.g. Avg. (94% and 72% = 83%))
- H. Pump Speed Determination for Jockey Pump. The control system shall continuously determine the pump speed and span based upon the Minimum allowable and Maximum allowable pump speeds (Smin and Smax). The PI Controller shall constantly determine the allowable percent speed/frequency span based upon the Smin and Smax limits determined based upon discharge pressure (PIT-700 or PIT-701) as described in the equations below. The PI Controller shall assign minimum and maximum output values of 0% to 100% of allowable span when directing pump speed to maintain operator discharge setpoint based on the following equations:
 - 1. Smin - Minimum allowable pump operating speed shall be calculated continuously by the control system.
 - a. $Smin \% = \{ [((PIT\ 700/701) - (LIT\ 100/200 - 3)] - 137) \times 0.277 \} + 76.0$
} Values are in Ft of head, not psi.
 - b. If Smin % is greater than 100.0, then Smin shall be 100%. Speeds in excess of 100% are prohibited.
 - 2. Smax – Maximum allowable pump operating speed shall be calculated continuously by the control system
 - a. $Smax \% = \{ [((PIT\ 700/701) - (LIT\ 100/200 - 3)] - 106) \times 0.360 \} + 82.0$
} Values are in Ft of head, not psi.
 - b. If Smax % is greater than 100, then Smax shall be 100%. Speeds in excess of 100% are prohibited.
 - 3. Smin and Smax pump speed determination equations may change once pump is factory tested and results accepted by ENGINEER. Speed limit determination may be in alternate form of equation, expressed as a function of any or all of the following (discharge flow, discharge pressure, tank level).
- I. Station Flow Limitation. Control system shall prohibit flow in excess of limit value, by reducing called pump speed as required, to maintain flow equal to or less than flow limit. In Step 1 with Jockey Pump only, if total flow (FIT-700) exceeds 1,900 gpm PID loop shall reduce pump speed as required to limit flow below threshold value. For Repumps Steps 2 through 4, and Step 1 after Jockey pump is replaced, if total flow (FIT-700) divided by the number of pumps in operation exceeds 4,300 gpm, PID loop shall reduce pump(s) speed as required to limit flow below threshold value. Control system shall limit pump(s) speed, even if PI loop calls for greater speed to maintain pressure set point. If low pressure limit is achieved as a result of pump speed reduction due to flow limitation, then another Step/pump (if available) shall automatically be called into service to maintain pressure. (e.g. control system calls pumps to increase speed to achieve operator discharge pressure setpoint and FIT-700 reports flow of 8,650 gpm with two pumps in service, then control system shall cease increasing pumps speed and shall reduce speed if required until flow is equal to or less than 8,600 (4,300 gpm x 2 pumps)) This value may be revised based upon actual pump selection and pump factory acceptance testing results.
- J. The pumps shall operate in the step called by the control system, according to the hierarchy and daily operation of pumps determined by JEA as set within the Setpoint

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Sequencer Matrix. Matrix is modifiable by operator on the HMI, to balance pump runtimes and accommodate pumps that may be out of service.

- K. Status of Pump Operation: Each pump shall have HMI selectable settings for out-of-service or Automatic Mode of operation.
- L. PLC Control Functionality Requirements
 - 1. The actual speed of each pump shall be displayed on the HMI.
 - 2. The control system shall monitor the status of each pump.
 - a. If a fault status is tripped while a pump is running, the control system shall shutdown and alarm the HMI and automatically advance to the next configuration of the sequencer until an acceptable configuration that does not include the failed pump is found.
 - b. If a pump is out of service, the control system shall automatically advance to the next configuration of the sequencer until an acceptable configuration that does not include the out of service pump is found
 - 3. The control system shall limit the number of starts per hour for the pumps based on the motor manufacturer's recommendations, or to a maximum of 10 starts, whichever is more restrictive.
 - 4. Adjust PI gain in pump called speed determination to minimize pressure fluctuations as second and subsequent pumps come into service.
 - 5. Use actual instrumentation values for all calculations.
 - 6. Bypass low pressure limit is selected by the operator and must be less than the operator selected setpoint for RPS discharge pressure in Automatic operation. (e.g. if operator selected discharge pressure is 80, bypass low pressure limit must be less than 80).

2.03 GROUND STORAGE TANK CONTROL LOOPS

- A. Ground Storage Tank No. 1 GST-100
 - 1. HMI shall display GST status as selected by operator on the HMI – in service / out of service
 - 2. GST-100 Level
 - a. LIT-100 analog reporting in feet of depth, displayed on the HMI
 - b. The HMI shall display the following alarms:
 - i. High Water Level (HWL) Alarm
 - ii. Low Water Level (LWL) Alarm
 - iii. Low Low Water Level (LLWL) Alarm and pump shut down
 - 3. GST-100 Level Setpoints
 - a. The following levels shall govern operation of the pumps.
 - i. The pumps may only be started when the water level is more than one foot above the LW Alarm set point.
 - ii. If the LLW set point is achieved during pump operation, then the all pumps shall be stopped and locked out of service. Pumps shall remain locked out of service until the pump start permissive to start lead pump is achieved.
 - iii. If pump(s) are in operation and GST level falls below pump start permissive level, pumps will remain in operation, but additional pumps may not be called into service.

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GST-100 Level Set Points	Feet (depth/elevation)
HHW Alarm	71.63
HW Alarm	71.48
Stop Fill (Operator Variable)	71.38
Pump Start Permissive Minimum (Operator Variable)	56.93
LW Alarm	54.93
LLW Alarm	53.93

4. GST-100 Back up signals
 - a. The GST shall have two backup discrete signals (floats) LSLL-100 and LSH-100, that shall be set to match the LLW alarm level and the HW alarm Level respectively.
 - b. If LLW or LSLL-100 is achieved, it shall alarm the HMI and SCADA system and perform the stepped pump shutoff of pumps.
 - c. If HW or LSH-100 is achieved, it shall alarm the HMI and SCADA and close valve PSV-101.

B. Ground Storage Tank No. 2 GST-200

1. HMI shall display GST status as selected by operator on the HMI – in service / out of service
2. GST-200 Level
 - a. LIT-200 analog reporting in feet of depth, displayed on the HMI
 - b. The HMI shall display the following alarms:
 - i. High Water Level (HWL) Alarm
 - ii. Low Water Level (LWL) Alarm
 - iii. Low Low Water Level (LLWL) Alarm and pump shut down
3. GST-200 Level Setpoints
 - a. The following levels shall govern operation of the pumps.
 - i. The pumps may only be started when the water level is more than one foot above the LW Alarm set point.
 - ii. If the LLW set point is achieved during pump operation, then the all pumps shall be stopped and locked out of service. Pumps shall remain locked out of service until the pump start permissive to start lead pump is achieved.
 - iii. If pump(s) are in operation and GST level falls below pump start permissive level, pumps will remain in operation, but additional pumps may not be called into service.

GST-200 Level Set Points	Feet (depth/elevation)
HHW Alarm	71.63
HW Alarm	71.48
Stop Fill (Operator Variable)	71.38

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FUNCTIONAL DESCRIPTION (TWIN CREEKS)

Pump Start Permissive Minimum* (Operator Variable)	56.93
LW Alarm	54.93
LLW Alarm	53.93

4. GST-200 Back up signals
 - a. The GST shall have two backup discrete signals (floats) LSLL-200 and LSH-200, that shall be set to match the LLW alarm level and the HW alarm Level respectively.
 - b. If LLW or LSLL-200 is achieved, it shall alarm the HMI and SCADA system and perform the stepped pump shutoff of pumps.
 - c. If HW or LSH-200 is achieved, it shall alarm the HMI and SCADA and close valve PSV-101.

2.04 STATION INSTRUMENTATION CONTROL LOOPS

- A. Station Discharge
 1. PIT-700 / PIT-701 redundant discharge pressure transmitters, analog reporting in psi, sampled every 0.25 seconds and averaged over the previous 1 seconds, displayed on the HMI in trend screen.
 - a. High pressure alarm, Operator adjustable value, initial = 90 psi
 - b. Low pressure alarm, Operator adjustable value, initial = 60 psi
 - c. Operator shall select on the HMI which PIT control system shall use for control.
 2. FIT-700 discharge flow transmitter analog reporting in gpm, sampled every 0.25 seconds and averaged over the previous 1 seconds, displayed on the HMI in trend screen.
- B. Station Tank Fill
 1. PIT-101 tank fill pressure transmitter analog reporting in psi, sampled every 0.25 seconds and averaged over the previous 1 seconds, displayed on the HMI in trend screen.
 2. FIT-101 station tank fill flow transmitter analog reporting in gpm, sampled every 0.25 seconds and averaged over the previous 1 seconds, displayed on the HMI in trend screen.
- C. Pump Suction
 1. PIT-401 pump suction pressure transmitter analog reporting in psi, sampled every 0.25 seconds and averaged over the previous 1 seconds, displayed on the HMI in trend screen.
 - a. Suction pressure shall be provided for annunciation only and no control functionality shall be based on this pressure.
- D. Station Bypass
 1. FIT-111 bypass flow transmitter analog reporting in gpm, sampled every 0.25 seconds and averaged over the previous 1 seconds, displayed on the HMI in trend screen.
- E. Residual Chlorine and PH Analyzer AIT-401

SECTION 16930

FUNCTIONAL DESCRIPTION (TWIN CREEKS)

1. The control system shall monitor the residual chlorine level and pH level of the water leaving the pump station. The operator shall have the ability to input the residual chlorine level setpoint between 0 mg/L and 3 mg/L over the SCADA network.
2. The control system HMI shall be configured to display the following:
 - a. Instantaneous residual CL level
 - b. Instantaneous pH level
 - c. In the trending area of the HMI, the control system shall allow the operator to trend residual chlorine and pH for a period of time of up to 12 months.
3. Residual chlorine alarms:
 - a. High chlorine alarm, Operator adjustable value, initial = 4.0 ppm
 - b. Low chlorine alarm, Operator adjustable value, initial = 1.0 ppm
4. pH level alarms:
 - a. High pH alarm, Operator adjustable value, initial = 8.5
 - b. Low pH alarm, Operator adjustable value, initial = 6.5

2.05 VFD CONTROL LOOPS

A. General

1. Programming of VFDs shall be by CSI. SCADA screen and alarm display development shall be by Owner. CSI shall coordinate and implement as required to accomplish the described functionality.
2. Primary VFD control shall be by ProfiNet communications with the following safety interlocks:
 - a. Motor temperature switch input to VFD shall shutdown VFD when deenergized.
 - b. Remote stop input to VFD shall shutdown VFD when deenergized.
 - c. Pump check valve limit switches shall input to the main station control system. If the check valve does not open within operator variable setpoint, initial set at 30 seconds of pump start, the main station control system shall issue a stop command to the VFD.
3. VFD Speed Reporting
 - a. ProfiNet / Analog in both % speed and Hz. for each VFD/Pump, displayed on the HMI.
 - b. Warning notification when VFD is limiting current to pumps to FLA programmed limit.
4. Pump Run Time Reporting
 - a. Totalized run time, reported in whole hours for each pump, displayed on the HMI. A run-time reset button shall be provided on the HMI for each pump, with passcode protection to enact.

2.06 PRESSURE SUSTAINING AND TANK FILL VALVE CONTROL NARRATIVE

A. Electronic Control Valve PSV-101

1. The GST is designed to be filled during the max month (late May, no rain) off-peak hour scenario, maintaining a system residual pressure of 35 psi. Pressures greater than this level will not allow the tank to completely fill during the design scenario. Operators may change this setting during other seasonal times of the year, based on actual demand and preference.

SECTION 16930

FUNCTIONAL DESCRIPTION (TWIN CREEKS)

2. Valve status as a percentage of travel shall be displayed on the HMI (open/filling, closed).
3. The pressure sustaining and tank fill valve shall be prohibited from opening during retail service time (regardless of tank level) as set by the operator, initially set to begin at 4:30 am and end at 8:30 pm. The PLC shall automatically calculate and adjust the time for standard and daylight savings times.
4. When the GST depth is below the operator set point, which initially shall be set to 2 ft less than the stop fill set point, the control valve opens to fill the tank. The control system shall automatically fill the GST at the maximum rate possible while maintaining the operator pressure sustaining set point, initially set at 35 psi. When the GST depth achieves the LSH OR HW setpoint, the control system initiates the control valve to close to stop filling the tank.
5. Operator adjustable setpoint for ground storage tank stop fill level to allow operators to define tank stop fill level.
6. Start fill shall be hardcoded at 2 feet below operator stop fill setpoint, but not less than pump start permissive level.
7. PSV-101 shall fail closed on power loss and shall actuate open and close as follows:

Close Valve	Open SV-101A, Close SV-101B
Open Valve	Close SV-101A, Open SV 101B
Hold Valve position	Close SV-101A, Close SV-101B
Maintain Pressure (control loop once valve is opened)	Maintain LP setting as described. Hold Valve position until called to change.

- i. SV-101A is a 3-way universal - Normally Open – Energize to Close
- ii. SV-101B is a 3-way universal - Normally Closed – Energize to Open
- iii. Once open to fill, valve shall act in pressure sustaining mode until called to close. Valve shall pulse (repeatedly if required) to open and to close to maintain pressure setpoint. Pulse duration and frequency/rest duration shall be per valve manufacturer recommendation.
- iv. Operator variable set point (allowable range 35 to 55 psi) shall be displayed on the HMI.

B. GST Fill Procedure

1. Hand/Off/Auto selector on the HMI
 - a. Hand selector shall be manual fill / open.
 - b. Off selector shall be manual stop / close selector on the HMI.
 - c. Auto selector shall open/start fill or close/stop fill according to the GST level setpoints identified in the table above or operator adjustable setpoint.

2.07 SODIUM HYPOCHLORITE SYSTEM CONTROL LOOPS

A. General

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FUNCTIONAL DESCRIPTION (TWIN CREEKS)

1. The control system shall monitor that status of the hypochlorite system including pumping system, tank level, system pressure, and fault status.
 2. The control system HMI shall be configured to display the following:
 3. Hypochlorite pump speed in percent format shall be displayed on the HMI
 4. Adjustable setpoints, system status, pump in service/out of service
 5. Reset pushbutton to reset PID control loop
- B. Hypochlorite Tank Level
1. LIT-501 analog reporting in feet, sampled every 0.25 seconds and averaged over the previous 1 second, displayed on the HMI and trended.
 2. High level alarm, Operator adjustable value, initial = 14.5 feet
 3. Low level alarm, Operator adjustable value, initial = 3.0 feet
- C. Hypochlorite System Pressure
1. PIT-591 analog reporting in pressure, sampled every 0.25 seconds and averaged over the previous 1 second, displayed on the HMI and trended.
 2. High pressure alarm, Operator adjustable value, initial = 20.0 psi
 - a. High pressure shall shutdown hypochlorite pumps.
 3. Low pressure alarm, Operator adjustable value, initial = 2.0 psi
 - a. Only applicable when hypochlorite pumps are being called to run.
- D. Hypochlorite Pumping System
1. The control system shall control and monitor the hypochlorite feed pumps (P-511, P-512).
 2. The control system shall control the speed of the pumps based on the effluent flow rate, trimmed based on the residual chlorine using a PID Loop. The dosing rate shall be automatically adjusted based on residual chlorine level feedback and the adjustable residual chlorine level setpoint.
 3. The operator shall be capable of selecting the active feed pumps.
 4. Hypochlorite feed pumps shall be capable of being tagged out-of-service by the operator.
- E. Hypochlorite Control Panels
1. DIO-1 control panel shall have a Hand/Off/Auto selector switch capable of operating the hypochlorite feed pumps as follows:
 - a. In Hand – local control via hardwired digital and analog signals, local selector switches, and speed potentiometers located on the DIO-1 control panel or via controls interface on each hypochlorite feed pump.
 - b. In Auto – control shall be by operator setpoints and discharge feedback as a function of station discharge flow.
 - c. In Off - Hypochlorite feed pumps shall be off until placed in Hand or Auto position.
 2. Truck Fill Panel CP-501
 - a. CP-501 shall annunciate hypochlorite tank level status during filling operations to prevent overfilling conditions. The panel shall have a digital display to annunciate level in feet and an audio / visual combination horn / strobe activated upon tank high level.

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FUNCTIONAL DESCRIPTION (TWIN CREEKS)

2.08 SAFETY SHOWERS

- A. The facility has two safety showers, one located in the hypochlorite storage area and one located in the existing wastewater pump station area. Safety showers have a flow switch to indicate activation of the safety shower. The control system shall monitor the safety shower flow switch and alarm the control system upon activation. The HMI shall display the alarm.

2.09 GRINDER PUMP STATION

- A. The duplex grinder pump station accepts sanitary and sump drains from the facility and discharges to an off-site force main. The system operates in a lead / lag pump sequence configuration with pump control via an integral manufacturer provided level annunciation system.
- B. The grinder pump station shall output system status to the main facility control system. The control system HMI shall be configured to display the following:
 - 1. Grinder pump running / stopped status
 - 2. Grinder wet well high level
 - 3. Grinder system fault

2.10 OVERHEAD DOOR

- A. The pump building overhead maintenance door shall receive a command to open from the control system initiated by a high level float LSHH-611 located in the building reclaimed water discharge header trench. HMI shall display the high level float LSHH-611 alarm and indicate when the overhead door is being commanded open.

2.11 SCADA

- A. The pumping station control system shall output digital and analog information to the SCADA system as required by JEA. The signals will be same information displayed on the HMI in a digital or analog format.
- B. Full functional control shall be available remotely through the SCADA system.
- C. SCADA annunciation and control shall be accomplished via JEA's private fiber optic network.

2.12 BACKUP DIESEL GENERATOR

- A. The backup diesel generator shall be capable of carrying the plant auxiliary loads and one re-pump during emergency conditions through the use of an Automatic Transfer Switch (ATS) located in the electrical equipment room of the pump building.
- B. All diesel generator annunciation and control functions shall transmit to the OWNER's SCADA system through the generator remote I/O panel GIO-1 as indicated on the Drawings.

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FUNCTIONAL DESCRIPTION (TWIN CREEKS)

- C. Quantity of re-pumps running shall be limited to one when station is operating on backup diesel generator.

2.13 AUTOMATIC TRANSFER SWITCH ATS-1

- A. The ATS shall have voltage sensing for the normal source and backup source input into the ATS at all times.
- B. Transfer switch in “Emergency” position shall be used to prevent station from operating more than one pump at any given time. This functionality shall be hard coded into the PLC program.
- C. All transfer switch annunciation and control shall be as indicated on the Drawings and operable from the HMI or remotely from the SCADA system.
- D. Sequence of Operation – Automatic Mode
 1. Under normal conditions, the ATS is connected to the normal incoming utility power source.
 2. Upon phase loss or loss of phase-to-phase voltage of the utility source to between 80% and 100% of nominal, and after a time delay, adjustable from 1 to 60 seconds to override momentary dips and outages the transfer switch shall disconnect from the normal source, start the generator, sense generator power available, and close to the emergency generator power source.
 3. When the normal source has been restored and after a time delay, adjustable from 10 to 600 seconds (to ensure the integrity of the source), the transfer switch shall transfer back to the normal power source in an open transition. Transfer switch contacts shall open enabling shutdown of the generator.
 4. If the generator should fail while carrying the load, the transfer switch shall instantaneously switch to the normal power source upon satisfactory conditions.
 5. If both sources should fail simultaneously, no action shall be taken.
- E. Sequence of Operation – Bypass to Normal Mode
 1. While in “Bypass to Normal” mode, the transfer switch shall be completely isolated, and the Normal source shall be connected.
- F. Sequence of Operation – Bypass to Emergency Mode
 1. While in “Bypass to Emergency” mode, the transfer switch shall be completely isolated, and the Emergency Source shall be connected.
- G. Sequence of Operation – Open / Test Mode
 1. While in “Open / Test” mode, the transfer switch shall be completely isolated from the all source and all load conductors allowing for repair and testing of the transfer switch without service interruption.

END OF SECTION 16930

SECTION 16950

FIELD INSTRUMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Water Analyzer
 - 2. Liquid Level Transmitters
 - 3. Liquid Level Floats
 - 4. Pressure Transmitters
 - 5. Flow Meters
 - 6. Temperature Transmitters
 - 7. Surge Arrestor Enclosures
 - 8. Float Switch Junction Box

- B. Related Sections: Division 16.

1.03 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base air ratings on sea-level conditions.
- B. Operating Temperature: 0 degrees F to 100 degrees F.
- C. Environment: Reclaimed Water.

1.04 ACTION SUBMITTALS

- A. Submit shop drawings in accordance with Section 01300.
- B. Shop Drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connections
- C. Shop Drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connections.
- D. Shop Drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connections.
- E. Coordination Drawings, including plumbing/connection plans and sections drawn accurately to scale. Submit with Shop Drawings. Show layout and relationships between components and adjacent structural and mechanical elements. Show

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support locations, type of support, and weight on each support. Indicate and certify field measurements.

- F. Wiring diagrams detailing wiring for power and control systems and differentiating clearly between manufacturer-installed and field-installed wiring.

1.05 INFORMATIONAL SUBMITTALS

- A. Submit manufacturer's catalog and standard datasheets for all equipment delivered under this section.

1.06 O&M SUBMITTALS

- A. Submit operation and maintenance data in accordance with Section 01730.

1.07 QUALITY ASSURANCE

- A. Electrical Component Standard: Provide components that comply with NFPA 70 and that are listed and labeled by UL where available.
- B. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver units as factory-assembled units, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Lift and support units with the manufacturer's designated lifting and covering.

1.07 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions by field measurements. Verify clearances for installation.

1.08 COORDINATION AND SCHEDULING

- A. Coordinate with the ENGINEER for the mounting locations of each instrument prior to installation.

1.09 SPARE PARTS

- A. Furnish any spare parts that are expected to be replaced within a 1-year period in sufficient quantity to keep monitoring equipment operating for a minimum period of one year.

1.10 WARRANTY

- A. All equipment supplied under this section shall be warranted for a period of one (1) year by the MANUFACTURER from substantial completion.

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FIELD INSTRUMENTS

- 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 OWNER.
- C. The MANUFACTURER'S warranty period shall run concurrently with the CONTRACTOR'S warranty period. No exception to this provision shall be allowed.

PART 2 - PRODUCTS

2.01 CHLORINE RESIDUAL ANALYZER (AIT-401)

- A. Manufacturer: Wallace & Tiernan
- B. Model: Depolox 400
- C. Sensor Type: Variasens C Flow Cell
- D. Sensor Type: Depolox 5C Flow Cell
- E. Free Chlorine Range: 0 – 20 mg/l
- F. pH Measuring Range: 0 - 14
- G. Flow Control: Stop valve
- H. Signal Output: Four 4-20mA, Two discrete
- I. Housing: NEMA 4X
- J. Ambient Temperature: 0 to 50 degrees Celsius
- K. Power Requirements: 120 VAC

2.02 GROUND STORAGE TANK LIQUID LEVEL TRANSMITTER (LIT-100, LIT-200)

- A. Manufacturer: Rosemount
- B. Catalog Section: 3051L2AB0BL21AEM4Q4
- C. Principle: Pressure Transducer
- D. Analog Output: 4-20mA
- E. Alternate: Engineer Approved Equal

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FIELD INSTRUMENTS

2.03 HYPOCHLORITE TANK LEVEL TRANSMITTER (LT-501)

- A. Manufacturer: Kenco
- B. Model: KTC-83439-R1
- C. Principle: Magneto Strictive
- D. Analog Output: 4-20mA
- E. Alternate: Engineer Approved Equal
- F. Mounting: Mounted to Kenco Magna-Site Level Gauge
Kenco KMLG-83439-R1
- G. Sizing: Field Coordinate w/ Vendor Equipment

2.04 LIQUID LEVEL FLOATS (LSH-100, LSH-200, LSL-100, LSL-200, LSHH-611)

- A. Manufacturer: B/W Controls
- B. Catalog Section: 7010
- C. Description: Weighted Float Switch
- D. Options: 30-foot Min. Cable Length

2.05 PRESSURE TRANSMITTER (PIT-101, PIT-401, PIT-700, PIT-701, PIT-591)

- A. Manufacturer: Rosemount
- B. Model No: 3051TG2A2B21AB4Y2Q4M4DW
- C. Pressure Range: Refer to drawings
- D. Alternate: Engineer Approved Equal

2.06 FLOW METER (FIT-101, FIT-111, FIT-700)

- A. Manufacturer: Endress & Hauser
- B. Model No: Promag W500, 5W5B6H-BSBDRABIAGBAA
3DUA1KGBA1+AAEAEBECI8L2PB71
- C. Principal: Electromagnetic
- D. Communication: ProfiNet
- E. Analog Output: 4-20mA

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F. Flow Rate: Refer to drawings

G. Sizes Refer to drawings

2.07 TEMPERATURE TRANSMITTER (TIT-101)

A. Manufacturer: Dwyer

B. Model No: Series BTT-N-00-6-FC

C. Principal: Pt 1000 RTD

D. Power Input: 24VDC

E. Analog Output: 4-20mA

F. Temperature Range: 0° C – 100° C

2.08 SURGE ARRESTER ENCLOSURES

A. Furnish surge arrester junction boxes for all existing and proposed field mounted instrument transmitters such as pressure transmitters, flow transmitters, and level transmitters.

B. Surge arrester junction boxes shall include the following:

1. Minimum 10-inch x 8-inch x 4-inch stainless steel hinged cover junction box with white 14 ga carbon steel backplane.
2. Citel DLA-24D32, 24VDC surge arrester
3. Wago terminal blocks 2004-1201
4. Wago end clamps 249-117
5. Wago grounding terminal 2004-1207
6. Blackburn ground lug ADR11-21
7. Phenolic nameplate

2.09 FLOAT SWITCH JUNCTION BOX

A. Furnish junction boxes for new float switch cable terminations at the dome probe curb for each proposed ground storage tank.

B. Junction boxes shall include the following:

1. Minimum 6-inch x 6-inch x 4-inch stainless steel hinged cover junction box with white 14 ga carbon steel backplane.
2. Wago terminal blocks 2004-1201
3. Wago end clamps 249-117
4. Wago grounding terminal 2004-1207
5. Blackburn ground lug ADR11-21
6. Phenolic nameplate

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FIELD INSTRUMENTS

PART 3 - EXECUTION

3.01 TRAINING

- A. Train OWNER's maintenance personnel on operation and maintenance procedures for all equipment supplied as part of this specification and schedules related to startup and shutdown, troubleshooting, servicing, and preventative maintenance. Allow for one 8 hour day for training of OWNER's personnel at the project location.

3.02 INSTALLATION

- A. Install according to manufacturer's written instructions.
- B. Install units with clearances for service and maintenance.
- C. All instruments and devices shall be provided with a stainless steel identification tag minimum 1-inch x 2-inch with two lines of text corresponding to identification as seen on P&IDs and conduit / cable list.
- D. All in-line pressure transmitters shall be installed using a stainless-steel isolation valve, stainless steel and 'T' fitting to drain, and stainless steel pipe nipple. Alternately, in-line pressure transmitters may be furnished coupled with a 2 way block and bleed valve similar to Rosemount 306 manifold.
- E. All field mounted transmitters with indicating displays shall be provided with sun/rain hoods. Instruments with displays shall be mounted such that the display is facing in the northern direction where possible.
- F. Field instruments shall be factory calibrated and delivered to project site with certificates. CONTRACTOR shall coordinate process ranges in the field and document as-built I/O list with calibrated process ranges for turnover to the Owner.

3.03 CONNECTIONS

- A. Electrical: Conform to applicable requirements in Division 16 Sections.
- B. Grounding: Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values or use those specified in UL 486A and UL 486B.

3.04 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Provide services of a factory-authorized service representative to supervise the field assembly of components and installation and electrical connections. Field service representative shall furnish a complete manufacturers installation checklist for ENGINEER's review and approval for all instruments installed as part of this specification prior to commissioning.

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- B. CONTRACTOR shall install all equipment and related accessories before having the manufacturer's field service. If additional trips are required due to incorrect installation, CONTRACTOR shall pay for the costs for the field services.

END OF SECTION 16950

SECTION 16991

FACTORY ACCEPTANCE TESTING (FAT)

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. A FAT shall be performed after the system is manufactured and configured prior to shipment to the site. The CSI shall provide labor, tools, material, and equipment for performing the factory acceptance tests on the system.
- B. The CONTRACTOR shall be responsible for coordinating the FAT of the proposed control system with all involved parties including OWNER, ENGINEER, control panel supplier, control system integrator, and other equipment vendors as applicable.
- C. CSI shall receive all programming and OIT graphical displays 2 weeks prior to scheduled FAT. Programming and graphics shall be loaded into the control system and tested by the CSI prior to performing the FAT.
- D. The control system integrator (CSI) shall provide detailed FAT protocol documents prior to the commencement of FAT. FAT protocol documents shall include test plan, schedule, and document to record punch list items.
- E. Protocol documents for testing equipment and functionality shall include but not be limited to:
 - 1. All pumping system control equipment
 - 2. All sodium hypochlorite system control equipment
 - 3. PLC control logic for booster system control equipment
 - 4. PLC interface with other systems
 - 5. Communication equipment configuration and operation.
 - 6. OIT graphic displays
 - 7. All generator control system equipment
- F. FAT testing shall include all equipment and control panels fabricated in accordance with the project requirements.

1.03 CITED STANDARDS

- A. National Fire Protection Association (NFPA):
 - 1. 70, National Electrical Code (NEC)
 - 2. 70E Standard for Electrical Safety in the Workplace 2012

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FACTORY ACCEPTANCE TESTING (FAT)

- B. The Institute of Electrical and Electronics Engineers (IEEE)
- C. International Society of Automation (ISA)

1.04 NOTED RESTRICTIONS

- A. The factory test shall not begin until all related control system and shop drawings have been submitted and approved.
- B. All systems, panels, and equipment required for factory acceptance testing are specified in this section.

1.05 QUALITY CONTROL

- A. The Integrator shall generate the FAT protocol document.
- B. The FAT protocol shall be submitted and approved by the ENGINEER.
- C. The Integrator shall certify to the ENGINEER that the entire control system is ready for testing prior to the initiation of the FAT.
- D. The factory test shall be declared a failure and a retest shall be required if any of the following were to occur:
 - 1. Failure to meet the requirements of the operational testing of the system as specified in this Section.
 - 2. Failure to meet the acceptance criteria as established in the approved Factory Acceptance Test Procedures.

1.06 SUBMITTALS

- A. All submittals shall be provided in accordance with Section 01300.
- B. The Integrator shall submit information on the factory testing facility and procedures to verify that testing shall fulfill the requirements as specified herein. Submittal shall be made at least 21 calendar days in advance of any scheduled testing and shall include dates of scheduled tests.
- C. The control system integrator shall submit Factory Acceptance Test (FAT) Protocols for each item listed in paragraph 1.01E of this document.
- D. The approved testing protocols shall be used for recording the test results during the FAT.
- E. Factory Acceptance Test protocol documents shall include but not necessarily be limited to the following:
 - 1. Detailed description of system to be tested

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FACTORY ACCEPTANCE TESTING (FAT)

2. Overall scope of testing and acceptance criteria for:
 - a. Control Panels
 - 1) Visual inspection, dimension, access for maintenance
 - 2) Bill of material verification
 - 3) Manufacturer's documentation
 - 4) Recommended spare parts list and spares
 - 5) Tagging of components
 - 6) Warning labels, if applicable
 - b. Wiring
 - 1) Visual inspection for cable entry, routing, support
 - 2) Termination,
 - 3) Segregation by voltages/type
 - 4) Review of vendor's reports of tests and checks, if applicable
 - c. Software Licenses and Version including firmware
 - d. Control Logic – Functional capability, demonstrated to the satisfaction of the ENGINEER.
 - e. Discrete I/O
 - f. Analog I/O
 - g. Hard-wired Interlocks
 - h. PLC logic Interlocks
 - i. Alarms
 - j. Graphics – Operator interface capability
 - k. Tag numbers and database
 - l. Communication equipment and configuration
 - m. Communication performance
 - n. Control system Interface with other systems
 - o. Non-standard operating conditions
 - 1) Loss of power for each component
 - 2) Communications failure
 - 3) Removal of each PLC card
 - 4) PLC failure
3. FAT Schedule
 - a. The CSI and OWNER shall mutually agree upon the test schedule based on project schedule and when the system should be delivered to the site.
 - b. The ENGINEER and OWNER shall be present for the FAT. A minimum of 2 weeks' notice shall be provided to allow them to attend.
 - c. The CSI shall include a minimum of five working days in the schedule for FAT,
4. FAT Punch List
 - a. Any incomplete work or non-conformances detected during FAT shall be recorded on FAT punch list. Punch list items shall be categorized as follows:

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FACTORY ACCEPTANCE TESTING (FAT)

- 1) Immediate: FAT shall be paused for rectification and FAT shall continue after rectification.
 - 2) On-going: Rectification during FAT and will be completely rectified at the end of FAT. This category is used typically for multiple instances of the same issue which will be rectified during FAT as the issues are encountered.
 - 3) Repeat: FAT should be repeated after rectification and before completion of FAT.
 - 4) Before Ship: Issue to be rectified after FAT but before item is shipped to site. Re-test, if required should be documented and conducted during SAT.
 - 5) At Site: Remaining work to be rectified after shipment. Re-test. If required to be conducted during SAT.
 - 6) Future: Issues that are beyond the scope of the project but something that should be addressed in the future.
5. FAT punch list at a minimum shall include:
 - a. Reference to applicable FAT test plan requirement
 - b. Description of the issue
 - c. Person responsible for resolution
 - d. Description of the resolution and date completed
6. Corrections and retest
 - a. Any changes made during FAT that may affect previously completed tests require that those tests be re-performed and documented.
7. Correction after FAT
 - a. All problem corrections and subsequent recheck should be executed during the FAT. If this is not possible then rectification can be undertaken after the FAT, if mutually agreed to by the OWNER and CONTRACTOR. Problem correction after the FAT should include the following:
 - 1) Identification of re-work needed
 - 2) Action plan/time schedule
 - 3) Person responsible for completing task
 - 4) Execution of re-work
 - 5) Re-test of anything affected by the re-work. Need for OWNER witness of re-test to be agreed upon with CONTRACTOR
 - 6) Notification of completion
 - 7) Acceptance of re-check
8. Documentation of FAT
 - a. FAT report including:
 - 1) Attendees
 - 2) Tests performed
 - 3) Open issues and agreements for their resolution
 - 4) OWNER approval to ship or other disposition of the system
 - b. FAT documentation including:

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FACTORY ACCEPTANCE TESTING (FAT)

- 1) Signed copies of test function plans
- 2) Date and sign all documents generated during FAT
- 3) FAT punch list with status of each item
- 4) Document the actual hardware and software (including versions) tested
- 5) Document all configurable parameters used for testing
- 6) Backup copies of the final complete system and software
- 7) Color copies of all applicable graphic displays
- 8) Update of all system related documentation to reflect the FAT complete status of the system

- F. The CSI shall submit completed and signed FAT report and documentation to the ENGINEER within 5 days of completion of the FAT. The protocols, reports and documentation shall be submitted electronically in PDF format.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 CONTROL SYSTEM

- A. The proposed control system at the FAT shall use simulated equipment, simulation code, and emulators where necessary for successfully testing functional capabilities of the system.
- B. The CSI shall verify throughout the FAT procedure that the functionalities of the entire system is in accordance with the operational requirements as established in the contract documents and the approved detailed design.
- C. FAT Completion
1. FAT shall be considered complete when all the required functions have been demonstrated and verified to be in accordance with the FAT plan and specifications. Upon successful completion of the FAT procedure, the CSI shall sign the test results/report. FAT report and documentation shall be delivered to the ENGINEER. The CSI shall be granted permission to ship the system and equipment to the field site after the completion of FAT.
- D. The location for the FAT shall be facilitated by the CSI for as long as it is needed to successfully complete the entire FAT and resolve all encountered deficiencies to the satisfaction of the ENGINEER and the OWNER.
- E. All interconnections shall be on the same type of media as proposed for the final installation. Shorter runs are acceptable.
- F. All tag numbers, description of tags, I/O addresses for PLC and for SCADA shall be fully configured prior to FAT and tested during FAT.

SECTION 16991

FACTORY ACCEPTANCE TESTING (FAT)

- G. Safety
 - 1. All testing shall be done in accordance with NFPA 70E.

3.02 MINIMUM STAFFING

- A. The CSI shall provide the following minimum staffing available during the FAT:
 - 1. Control Systems Integrator – Project Manager or Lead Engineer/Programmer
 - 2. 1 - PLC/HMI Programmer

END OF SECTION 16991

SECTION 16992

COMMISSIONING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

- A. Requirements for the CONTRACTOR to provide commissioning and installation services.
- B. Requirements for the CONTRACTOR to provide labor, materials, tools, and testing equipment to commission controls, networking, and communications related equipment and systems.
- C. Requirements for the CONTRACTOR to perform associated testing of electrical systems, wiring, equipment, and grounding.

1.03 CITED STANDARDS

- A. National Fire Protection Association (NFPA):
 - 1. 70, National Electrical Code (NEC)
 - 2. 70E Standard for Electrical Safety in the Workplace 2012
- B. The Institute of Electrical and Electronics Engineers (IEEE)
- C. International Society of Automation (ISA)

1.04 NOTED RESTRICTIONS

- A. Commissioning of any system shall not begin until permission is granted by the ENGINEER and OWNER.
- B. Comply with NFPA 70E.
- C. The OWNER and ENGINEER shall have the option to witness and participate in the entire commissioning process.

1.05 QUALITY CONTROL

- A. The CONTRACTOR shall submit commissioning progress reports to the ENGINEER. The report formats shall be developed by the CONTRACTOR.
- B. Test Equipment Traceability:

SECTION 16992

COMMISSIONING

1. The CONTRACTOR shall have a calibration program which maintains applicable test instrumentation and equipment within rated accuracy and within their calibration time limits.
2. Equipment and instruments used to evaluate electrical performance shall be calibrated to a secondary standard traceable to the National Institute of Standards and Technology (NIST).
3. Test equipment operating instructions and procedures shall be with the test equipment.
4. A copy of test equipment calibration certificate or calibration sticker must be with equipment at all times to be available for inspection.

1.06 SUBMITTALS

- A. Provide all submittals in accordance with Section 01300.
- B. The following submittals shall be made during commissioning:
 1. Progress reports
- C. A commissioning report shall be submitted upon the completion of commissioning activities to notify the OWNER and ENGINEER of the milestone and the readiness for Site Acceptance Testing (SAT). The commissioning report shall include, but not be limited to, the following:
 1. Completed commissioning checklists
 2. Completed punch lists
 3. Calibration data sheets
 4. Drawings and manuals
 5. Training
 6. Commissioning Schedule

PART 2 – PRODUCTS

2.01 GENERAL

- A. Where equipment is to be retained but rewired, that equipment and associated wiring shall be subjected to testing requirements of new equipment and wiring procedures.
- B. The start-up service personnel must follow job site electrical safety requirements, installation standards and electrical testing standards. Adhere to OSHA safety practices for the entirety of commissioning.
- C. In addition to the requirements of this section, the installation and commissioning will comply with all applicable requirements of these Specifications.

2.02 PRODUCT NAME

SECTION 16992

COMMISSIONING

- A. A partial list of systems and equipment to be commissioned shall include such things as:
 - 1. Control Panels
 - 2. VFDs or Motor Controllers
 - 3. PLC systems and HMI Displays
 - 4. Motors and Pumping Systems
 - 5. Instrumentation System
 - 6. Communications and Network Equipment
 - 7. Power Distribution Equipment
 - 8. Crane Systems
 - 9. Hypochlorite Systems
 - 10. Standby Diesel Generator Systems

PART 3 – EXECUTION

3.01 GENERAL

- A. The commissioning and installation shall be considered complete by the ENGINEER upon successful installation of equipment / control systems and execution of the commissioning requirements listed herein.
- B. During or directly following CONTRACTOR completion of commissioning and installation, Manufacturer representatives shall thoroughly inspect and document the equipment and systems ready for SAT testing.
- C. CONTRACTOR shall be responsible for any damage to equipment or material due to improper testing or commissioning and shall replace or restore to original condition any damaged equipment or material.
- D. All systems, equipment, and rooms shall be commissioned in a complete manner as possible to ensure a complete working control system, network and communication system.
- E. The intent of commissioning is to start-up equipment or systems and prepare them for performance and SAT testing. Care should be taken to ensure continuous and reliable operation of the pumping station systems at all times.
- F. Commissioning of all systems listed to include such things as:
 - 1. All wire, cable, equipment, and systems installed or connected shall be tested to assure proper installation, setting, connection, and functioning in accordance with the drawings, specifications, and the manufacturer's recommendations. The intent herein is that field testing be extensive and complete as specified, to provide assurance of correct installation and operation of equipment.
 - 2. All tests and inspections recommended by the equipment manufacturer shall be included, whether required by these specifications or not, unless

SECTION 16992

COMMISSIONING

specifically waived in writing by the ENGINEER. Manufacturer certificates of installation shall be submitted for review and approval.

3.02 COMMISSIONING

- A. Commissioning shall be performed with all inter-related systems operating. In general, integrated system commissioning shall be operated through all modes of operation (normal, emergency, interruption to the incoming services, manual operations). Verification of each mode in the sequences of operation is required.
- B. If a problem is detected while conducting commissioning, the problem will be identified and reported to the CONTRACTOR for diagnosis and correction. The failed portion shall be repeated after the repairs are completed.
- C. A combination punch list/checklist shall be maintained by the CONTRACTOR in spreadsheet format to monitor and track equipment commissioning and installation. The spreadsheet shall be an integral part of the weekly report documentation and must be included with final report.
- D. CONTRACTOR shall enlist the services of the CSI on an as needed basis for integration of related systems during the commissioning phase.

3.03 CERTIFICATION

- A. Notification of Completion of Work
 - 1. Prior to acceptance of Work, the OWNER shall request from the CONTRACTOR a written notification certifying that:
 - a. Work has been completed in accordance with Contract Documents.
 - b. Work has been inspected for compliance with Contract Documents.
 - c. Work is ready for final inspection and site acceptance testing.
- B. Final Walk-Thru
 - 1. After receipt of the notification of completion of work, the ENGINEER or Project Manager will conduct a final walk-thru with the participation of the OWNER, CONTRACTOR, ENGINEER and other appropriate project team members to verify the status of the completion.
- C. Final Punch List
 - 1. Should the ENGINEER consider that the Work is incomplete or defective:
 - a. The OWNER will notify the CONTRACTOR in writing, by form of a final punch list, listing the incomplete or defective Work.
 - b. The CONTRACTOR will take immediate steps to remedy the stated deficiencies and send a second or subsequent written certification to the ENGINEER stating that the Work is complete.
 - c. The ENGINEER or Project Manager will re-inspect the Work.

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COMMISSIONING

2. Upon satisfaction that all the work is complete and all items in the Final Punch List addressed to the satisfaction of the ENGINEER, the OWNER and CONTRACTOR will sign-off on the final punch list indicating concurrence that the work is complete.

D. Manuals and Records

1. After final walk-thru and sign-off on the final punch list have been achieved the CONTRACTOR releases to the OWNER the following manuals and records kept, updated and/or developed during the project:
2. All final documentation.
3. Training session forms.
4. Copies of all punch lists.

3.04 TRAINING

- A. After the completion of commissioning and installation, designated OWNER personnel shall be trained in the operation and maintenance of all equipment and systems related to the project.
- B. Training shall consist of a formal eight (8) hour session wherein all procedures necessary to operate and maintain equipment and systems on a continuing basis are explained in full detail. Hands-on operations and maintenance tasks shall be executed to ensure that all aspects of the training are fully understood. The session may be broken into two smaller sessions so that various operators can attend.
- C. Training shall be conducted on-site by the CONTRACTOR and the CSI and shall be offered to accommodate up to twelve (12) persons.
- D. Training times shall be determined and coordinated by the OWNER.

END OF SECTION 16992

SECTION 16993

SITE ACCEPTANCE TESTING (SAT)

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including JEA General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Site Acceptance Testing (SAT) shall be performed after the system is delivered, installed and commissioned at the site. SAT shall demonstrate proper installation and functionality of the system after CONTRACTOR commissioning activities.
- B. The Control System Integrator (CSI) shall coordinate SAT with all involved parties including OWNER, ENGINEER, and CONTRACTOR for all labor, tools, material, and testing equipment to perform and document SAT.
- C. OWNER shall be present at all times during SAT and capable of making program revisions as necessary to ensure correct operational functionality of the control system and related equipment.
- D. The CSI shall submit SAT protocol documents prior to the commencement of SAT. SAT protocol documents shall include:
 - 1. SAT plan
 - 2. SAT test schedule
 - 3. Document for recording punch list items
- E. SAT plan shall include testing of such systems as:
 - 1. All pumping system control equipment
 - 2. All sodium hypochlorite system control equipment
 - 3. PLC control logic for pumping equipment
 - 4. PLC interface with other systems
 - 5. Communication equipment configuration and operation.
 - 6. OIT graphic displays
 - 7. All generator system control equipment

1.03 CITED STANDARDS

- A. National Fire Protection Association (NFPA):
 - 1. 70, National Electrical Code (NEC)
 - 2. 70E Standard for Electrical Safety in the Workplace 2012
- B. The Institute of Electrical and Electronics ENGINEERs (IEEE)

SECTION 16993

SITE ACCEPTANCE TESTING (SAT)

- C. International Society of Automation (ISA)

1.04 NOTED RESTRICTIONS

- A. SAT shall not begin until permission is granted by the ENGINEER and OWNER.
- B. Comply with NFPA 70E.
- C. The OWNER and ENGINEER shall have the option to witness and participate in the entire SAT process.

1.05 QUALITY CONTROL

- A. The SAT protocol shall be based on a revised FAT protocol document to ensure consistency and efficiency.
- B. The SAT plan shall be submitted and approved by the OWNER and ENGINEER prior to the commencement of SAT.
- C. The CSI shall certify to the OWNER and ENGINEER that all facility systems are ready for the SAT prior to the initiation of the SAT.
- D. The SAT shall be declared a failure and a retest shall be required if any of the following occur:
 - 1. Failure to meet the requirements of system hardware operational testing as specified in this Section.
 - 2. Failure to meet the acceptance criteria as established in the approved Site Acceptance Test Procedures.
- E. Prove-In Period
 - 1. The SAT shall be concluded with a 30 day “prove-in” period to allow time for any errors, omissions, or deficiencies in the proposed works to be revealed.
 - 2. The CONTRACTOR shall correct any items revealed in the “prove-in” period at no cost to the OWNER and as part of the warranty requirements specified in Section 01740.
- F. Minimum Staffing
 - 1. The CSI shall provide the following minimum staffing during the SAT:
 - a. CSI Project Manager or Lead ENGINEER / Programmer
 - b. 1 – PLC / HMI Programmer

1.06 SUBMITTALS

- A. Provide all submittals in accordance with Section 01300.

SECTION 16993

SITE ACCEPTANCE TESTING (SAT)

- B. The CSI shall submit the detailed SAT plan to the ENGINEER, to include testing for such things as:
1. Control Panels
 - a. Visual inspection, dimension, access for maintenance
 - b. Bill of material verification
 - c. Manufacturer's documentation: Data sheets, User's Manual, etc.,
 - d. Recommended spare parts list
 - e. Spare parts received
 - f. Labelling of components
 - g. Warning labels, if applicable
 - h. Wiring
 - 1) Visual inspection for cable entry, routing, support
 - 2) Termination,
 - 3) Segregation by voltages/type
 - 4) Review of vendor's reports of tests and checks, if applicable
 2. Software licenses and version including firmware received and installed
 - a. System Energization
 - 1) Initialization of controller(s)
 - 2) Software download
 - 3) Diagnostic checks
 3. Hardware Redundancy and Diagnostics, if applicable
 - a. OIT
 - 1) Check latest version of graphics are installed (By OWNER)
 4. Control Logic
 - 1) Check latest revision is installed (By OWNER)
 5. Discrete I/O
 6. Analog I/O
 7. Hard-wired Interlocks
 8. PLC logic Interlocks
 9. Alarms
 10. Graphics – Operator interface capability (By OWNER)
 11. Tag numbers and database
 12. Communication equipment and configuration
 - a. Communication performance
 13. Control system interface to other systems
 14. Non-standard operating conditions shall be tested
 - a. Loss of power for each component
 - b. Communications failure
 - c. Removal of each PLC card
 - d. PLC failure
- B. SAT Schedule
1. The CSI shall develop a schedule for performing SAT based on project schedule.

SECTION 16993

SITE ACCEPTANCE TESTING (SAT)

C. SAT Punch List

1. Any incomplete work or non-conformances detected during SAT shall be recorded on SAT Punch List. Punch list items shall be categorized as follows:
 - a. Immediate: SAT shall be paused for rectification and SAT shall continue after rectification.
 - b. On-going: Rectification during SAT and will be completely rectified at the end of SAT. This category is used typically for multiple instances of the same issue which will be rectified during SAT as the issues are encountered.
 - c. Repeat: SAT should be repeated after rectification and before completion of SAT.
 - d. Future: Issues that are beyond the scope of the project but something that should be addressed in the future.
2. Corrections
 - a. Any changes made during SAT during rectification of punch list items, shall be documented. Any changes that may affect previously completed tests require that those tests be re-performed and documented.
3. Correction after SAT
 - a. All problem corrections and subsequent re-check should be executed during SAT. If this is not possible then rectification can be undertaken after the SAT, if mutually agreed to by the OWNER and CONTRACTOR. Problem correction after the SAT should include the following:
 - 1) Identification of re-work needed
 - 2) Action plan/time schedule
 - 3) Person responsible for completing task
 - 4) Execution of re-work
 - 5) Re-test of anything affected by the re-work. Need for OWNER witness of re-test to be agreed upon with CONTRACTOR
 - 6) Notification of completion
 - 7) Acceptance of re-test
4. Documentation of the SAT
 - a. SAT Report including:
 - 1) Attendees
 - 2) Tests performed
 - 3) Open issues and agreements for their resolution
 - 4) OWNER acceptance of the system
 - b. SAT Documentation including:
 - 1) Signed copies of test function plans
 - 2) Date and sign all documents generated during SAT
 - 3) SAT punch list with latest status of each item
 - 4) Document the hardware and software (including versions) tested

SECTION 16993

SITE ACCEPTANCE TESTING (SAT)

- 5) Document all configurable parameters used for testing
 - 6) Backup copies of the final complete system and software
 - 7) Document system loading observed during the test and spare capacity
 - 8) Provide an index and color graphics of any displays modified or added during SAT
 - 9) Update of all system-related documentation to reflect the SAT complete status
5. SAT Completion
- a. SAT shall be considered complete when all of the required functions have been demonstrated and verified to be in accordance with the SAT plan and specifications. Upon successful completion of the SAT procedure, the CSI shall sign the test results/report. SAT report and documentation shall be delivered to the OWNER/ENGINEER.
- D. The SAT protocols shall be submitted a minimum of 14 days prior to anticipated testing start date.
- E. SAT procedures document shall include all the tests included in the FAT test protocol requirements defined in Section 16991.
- F. Only approved protocols shall be used for recording the test results during the SAT. The test protocols shall include pass/fail criteria and spaces for the ENGINEER and CONTRACTOR/Integrator sign-off.
- G. The CSI shall submit completed and signed SAT report and documents to the ENGINEER/OWNER within 5 days of completion of the SAT. The report and documents shall be submitted electronically in PDF format.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 16993

Appendix A

Geotechnical Report

Final Report of Geotechnical Exploration

For

**JEA Twin Creeks Water Storage Tanks and Re-Pump Station
St. Johns County, Florida**

MAE Project No. 0103-0017

November 13, 2019

Prepared for:



Prepared by:



8936 Western Way, Suite 12
Jacksonville, Florida 32256
Phone (904) 519-6990
Fax (904) 519-6992

November 13, 2019

Ms. Leslie S. Samel, P.E., BCEE
Mott MacDonald Florida, LLC
10245 Centurion Parkway, Suite 320
Jacksonville, Florida 32256



Reference: Final Report of Geotechnical Exploration
JEA Twin Creeks Reclaimed Water Storage Tanks and Re-Pump Station
St. Johns County, Florida
MAE Project No. 0103-0017

Dear Ms. Samel:

Meskel & Associates Engineering, PLLC (MAE) has completed a geotechnical exploration for the subject project. Our work was performed in general accordance with the Subcontract Agreement signed by MAE on April 23, 2019, which includes our proposal of October 8, 2018, and as amended in Amendment No. 1 dated November 4, 2019. The geotechnical exploration was performed to evaluate the general subsurface conditions within the area of the planned Twin Creeks Reclaimed Water Storage and Re-Pump facility expansion, and to provide recommendations for foundation design and site preparation for the proposed construction. This report has been updated from our Draft report dated October 11, 2019 to include Mott MacDonald's review comments and the results of our supplemental test pit exploration (Amendment No. 1).

As further discussed in this report, the borings typically encountered a topsoil layer up to 6 inches thick across the site, underlain by very loose to very dense fine sands and fine sands with silt and/or clay (SP, SP-SM, A-3) up to a depth of 80 feet below the existing ground surface. The encountered sands often contained trace to few amounts of root fragments and organic fines. Sands containing shell fragments were encountered at an approximate depth of 73.5 feet and continued to the boring termination depths. Groundwater was encountered at depths varying from 1-foot 7 inches to 5 feet 10 inches below the existing ground surface.

We note that sands containing a significant amount of large root fragments were encountered at boring location B-7 (i.e., at the center of the planned GST No. 2) between depths of 6 and 8 feet. However, a supplemental test pit exploration did not encounter soils with a significant amount of organic material as encountered at boring B-7 location. Therefore, additional site preparation measures to remove organic soils have not been recommended.

Based on our evaluation of the encountered subsurface conditions, it is our opinion that the proposed structures may be supported on conventional shallow foundation systems, provided the site preparation recommendations provided in this report are followed.

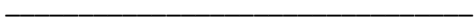
We appreciate this opportunity to be of service as your geotechnical consultant on this phase of the project. If you have any questions, or if we may be of any further service, please contact us.

Sincerely,

MESKEL & ASSOCIATES ENGINEERING, PLLC
MAE FL Certificate of Authorization No. 28142

P. Rodney Mank, State of Florida, Professional Engineer, License No. 41986. This item has been electronically signed and sealed by P. Rodney Mank, P.E. on 11/13/2019 using a Digital Signature. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.


W. Josh Mele, E.I.
Staff Engineer


P. Rodney Mank, P.E.
Principal Engineer
Licensed, Florida No. 41986

Distribution: Ms. Leslie S. Samel, P.E., BCEE – Mott MacDonald Florida, LLC.

1 pdf



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FIGURES

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- Figure 2. Boring Location Plan
- Figures 3-9. Generalized Soil Profiles

APPENDICES

- Appendix A. Soil Boring Logs
 - Field Exploration Procedures
 - Key to Boring Logs
 - Key to Soil Classification
- Appendix B. Summary of Laboratory Test Results
 - Laboratory Test Procedures
- Appendix C. Report of Supplemental Test Pit Exploration

1.0 PROJECT INFORMATION

1.1 General

Project information was provided to us by Ms. Leslie Samel, P.E., Mr. Daniel Keck and Ms. Lindsey Tracy, E.I. with Mott MacDonald Florida, LLC (Mott MacDonald). We were provided with the JEA Solicitation Number 069-18 which outlined our scope for this project. In addition, for our review and reference, we were provided with a site plan titled *Project Control & Overall Site Layout*, prepared by Mott MacDonald, dated September 2019. This plan denotes the layout and dimensions of the planned structures and access roadway and pavement areas, as well as Northing and Easting coordinates for the requested soil boring locations and their required minimum depths.

1.2 Project Description

The site for the subject project is located on County Road 210 in St. Johns County, Florida. The general site location is shown on Figure 1.

Based on the information contained in the JEA Solicitation Number 069-18 for this project and information received from Mott MacDonald, we understand that the existing facility will be expanded. The new construction will include two, 1.5 million-gallon (MG) Ground Storage Tanks (GST). We understand each GST will be a prestressed concrete tank with a diameter of 120 feet. Also included is a Reclaimed Water Re-Pump Building, a Sodium Hypochlorite Building, Generator and Transformer pads, and an access road and utility pipelines. We received the Grading and Drainage Plan (Sheet C-5) and the Plan and Profile sheets for the Access Road (Sheets C-6 and C-7) from Mott MacDonald's 30% Submittal Plans dated September 2019. We also received the entire 30 Percent Submittal Plans. Based on our review of the provided drawings, we understand that the site currently slopes from north to south, ranging in elevation from about elevation EL. 54 feet to about EL. 50 feet. Final tank subgrade elevations range from about EL. 54 feet (GST No. 2) to about EL. 53 feet (GST No. 1). Final pavement grades on the plant site appear to be near or within 12 inches below the existing ground surface within the northern part of the pavement area, to near existing grade to 6 inches above within the southern portion. The final pavement grade of the Access Road generally follows the existing grade.

If the final design details vary from those described above, then the recommendations provided in this report may need to be re-evaluated. Any changes in the design details should be provided so the need for re-evaluation of our recommendations can be assessed.

2.0 FIELD EXPLORATION

A field exploration was performed during the period of September 18 through 23, 2019. The Plan sheet and Northing and Easting coordinates provided to us were used by the field crew to locate the borings at the site. Once the borings were located and marked, a utility locate request was submitted to the Sunshine State One-Call Center. Once the utilities were located and marked, our field crew mobilized to the site. A copy of the provided plan, which shows the final boring locations, is included as the *Boring Location Plan*, Figure 2. The locations as shown on Figure 2 should be considered approximate.

2.1 Standard Penetration Test Borings

To explore the subsurface conditions within the area of the proposed structures and access roadway, 24 Standard Penetration Test (SPT) borings were drilled to depths of approximately 10, 20, 50, and 80 feet

below the existing ground surface, in general accordance with the methodology outlined in ASTM D 1586. Split-spoon soil samples recovered during the borings were visually described in the field, and representative portions of the samples were transported to our laboratory for classification and testing. A summary of the *Field Exploration Procedures* is included in Appendix A.

3.0 LABORATORY TESTING

Representative soil samples obtained from the borings for the proposed structures were visually classified by a geotechnical engineer using the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488. Representative soil samples, obtained from the boring for the proposed access roadway alignment, pavement areas, and utility pipelines were visually classified using the AASHTO Soil Classification System in general accordance with ASTM D 3282. Keys to both soil classification systems are included in Appendix A.

Quantitative laboratory testing was performed on selected samples of the soils encountered during the field exploration to better define the composition of the soils, and to provide data for correlation to their anticipated strength and compressibility characteristics. The laboratory testing determined the natural moisture content, the percent passing a U.S. No. 200 sieve (percent fines), and the organic content of selected soil samples. A summary of the laboratory test procedures is included in Appendix B. The results of the laboratory testing are shown in the *Summary of Laboratory Test Results* included in Appendix B. Also, these results are shown on the *Generalized Soil Profiles* sheets (Figures 3 through 9) and on the *Log of Boring* records at the respective depths from which the tested samples were recovered.

4.0 GENERAL SUBSURFACE CONDITIONS

4.1 General Soil Profile

Graphical presentation of the generalized subsurface conditions is presented on Figures 3 through 9. Detailed boring records are included in Appendix A. When reviewing these records, it should be understood that the soil conditions will vary between the boring locations. The vertical soil profile across this site was generally uniform in nature and is summarized in the following table:

GENERAL SOIL PROFILE			
TYPICAL DEPTH (ft)		SOIL DESCRIPTION	USCS ⁽¹⁾ / AASHTO ⁽²⁾
FROM	TO		
0	0.5	Topsoil Layer	---
0.5	22	Very loose to very dense fine sands and fine sands with silt, often containing trace organic fines and root fragments.	SP, SP-SM / A-3
22	44	Medium dense to very dense fine sands and fine sands with silt.	SP, SP-SM
44	62	Medium dense to dense fine sands and fines sands with silt and/or clay.	SP, SP-SM, SP-SC
62	72	Medium dense to very dense fine sands and fine sands with silt.	SP, SP-SM
72	80	Medium dense to very dense fine sands, fine sands with clay, and clayey fine sands, often with few to some amounts of shell fragments.	SP, SP-SC, SC

(1) Unified Soil Classification System

(2) American Association of State Highway and Transportation Officials

We note that sands containing significant amounts of large root fragments were encountered at boring B-7, located near the center of the planned GST No. 2, between depths of 6 and 8 feet. A test pit exploration was recommended in Section 5.8 of our Draft report to better delineate the vertical and horizontal extents of this deleterious material. The results of this program are summarized in Section 5.8 of this report. The test pit exploration report is included as Appendix C.

4.2 Groundwater Level

The groundwater level was encountered at each of the boring locations and recorded at the time of drilling at depths varying from 1 foot 7 inches to 5 feet 10 inches below the existing ground surface. However, it should be anticipated that the groundwater levels will fluctuate seasonally and with changes in climate. As such, we recommend that the water table be remeasured prior to construction. Measured groundwater levels are shown the boring profiles and boring logs.

4.3 Review of the USDA Web Soil Survey Map

The results of a review of the USDA Soil Survey Conservation Service (SSCS) Web Soil Survey of St Johns County are shown in the table below. There are four predominant soil map units at the project site: Immokalee, Smyrna-Smyrna, St. Johns, and Pomello fine sands. The soil drainage class, hydrological group, and estimated seasonal high groundwater levels reported in the Soil Survey are as follows:

Map Unit Symbol	Map Unit Name	Drainage Class	Hydrologic Group	Depth to the Water Table ⁽¹⁾ (inches)
7	Immokalee fine sand	Poorly Drained	A/D	0 to 12
11	Smyrna-Smyrna, wet, fine sand, 0 to 2 percent slopes	Poorly Drained	A/D	0 to 6
13	St. Johns fine sand	Poorly Drained	B/D	0 to 6
15	Pomello fine sand, 0 to 5 percent slopes	Moderately Well Drained	A	24 to 42

⁽¹⁾ The "Water table" above refers to a saturated zone in the soil which occurs during specified months, typically the summer wet season. Estimates of the upper limit shown in the Web Soil Survey are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

4.4 Seasonal High Groundwater Level

In estimating seasonal high groundwater level, a number of factors are taken into consideration including antecedent rainfall, soil redoximorphic features (i.e., soil mottling), stratigraphy (including presence of hydraulically restrictive layers), vegetative indicators, effects of development, and relief points such as drainage ditches, low-lying areas, etc.

To estimate seasonal low groundwater levels, in addition to review of the soil characteristics used for determining seasonal high water levels as described above, we also reviewed information obtained from

the St. Johns River Water Management District (SJRWMD) web site for historical water level fluctuations at established monitoring stations. Specifically, data was obtained over the last 10 years from the Durbin Fire Tower monitoring stations, which was judged to be the closest to the site that had most recent data. Over the last 10 years, except for an apparent drought period from approximately mid-2010 to mid-2012, the typical groundwater fluctuation between seasonal highs and seasonal lows appears to have been between 2 and 3 feet. Therefore, we used a median value of 2.5 feet as the fluctuation between seasonal high and seasonal low levels for both sites.

Based on our interpretation of the current site conditions, including the boring logs and review of published data, we estimate the seasonal high groundwater levels at the site to be generally 12 to 18 inches above the water levels measured at the time of our field work. However, it is likely that with the development of the plant site, the seasonal high groundwater levels have been altered from their pre-development levels. Therefore, we recommend that the drainage engineer be consulted to determine post-construction seasonal levels.

It is possible that groundwater levels may temporarily exceed the estimated seasonal high groundwater level as a result of intense or prolonged rainfall events. Therefore, we recommend that design drawings and specifications account for the possibility of groundwater level fluctuations, and construction planning should be based on the assumption that such fluctuations will occur.

5.0 DESIGN RECOMMENDATIONS AND CONSIDERATIONS

5.1 General

The following evaluation and recommendations are based on the provided project information as presented in this report, results of the field exploration and laboratory testing performed, and the construction techniques recommended in Section 6.0 below. If the described project conditions are incorrect or changed after this report, or subsurface conditions encountered during construction are different from those reported, MAE should be notified so these recommendations can be re-evaluated and revised, if necessary. We recommend that MAE review the foundation plans and earthwork specifications to verify that the recommendations in this report have been properly interpreted and implemented.

5.2 Re-Pump and Sodium Hypochlorite Building

Based on the results of our exploration, we consider the subsurface conditions at the site adaptable for support of the proposed structures when constructed on a properly designed shallow foundation systems. Provided the site preparation and earthwork construction recommendations outlined in Section 6.0 of this report are performed, the following parameters may be used for foundation design.

5.2.1 Bearing Pressure

The maximum allowable net soil bearing pressure for use in shallow foundation design should not exceed 2,500 psf. Net bearing pressure is defined as the soil bearing pressure at the foundation bearing level in excess of the natural overburden pressure at that level. The foundations should be designed based on the maximum load that could be imposed by all loading conditions.

5.2.2 Foundation Size

The minimum widths recommended for any isolated column footings and continuous wall footings are 24 inches and 18 inches, respectively. Even though the maximum allowable soil bearing pressure may not

be achieved, these width recommendations should control the size of the foundations.

5.2.3 Bearing Depth

The exterior foundations should bear at a depth of at least 18 inches below the exterior final grades, and the interior foundations should bear at a depth of at least 12 inches below the finished floor elevation to provide confinement to the bearing level soils. It is recommended that surface grades adjacent to the building exterior foundations be graded to divert surface water away from the building exterior to reduce the possibility of erosion beneath the footings.

5.2.4 Bearing Material

The foundations may bear in either the compacted suitable natural soils or compacted structural fill. The bearing level soils, after compaction, should exhibit densities equivalent to 98 percent of the modified Proctor maximum dry density (ASTM D 1557), to a depth of at least one foot below the foundation bearing levels.

5.2.5 Settlement Estimates

Post-construction settlement of the structure will be influenced by several interrelated factors, such as (1) subsurface stratification and strength/compressibility characteristics; (2) footing size, bearing level, applied loads, and resulting bearing pressures beneath the foundations; and (3) site preparation and earthwork construction techniques used by the contractor. Our settlement estimates for the structure are based on the use of site preparation/earthwork construction techniques recommended in Section 6.0 of this report. Any deviation from these recommendations could result in an increase in the estimated post-construction settlement of the structure.

Due to the sandy nature of the encountered soils, we expect the majority of settlement to occur in an elastic manner and fairly rapidly during construction. Using the recommended maximum bearing pressure, an assumption of the maximum structural loads, and the field and laboratory test data that we have correlated to geotechnical strength and compressibility characteristics of the subsurface soils, we estimate that total settlements of the structure could be on the order of one inch or less.

Differential settlements result from differences in applied bearing pressures and variations in the compressibility characteristics of the subsurface soils. Because of the general uniformity of the subsurface conditions and the recommended site preparation and earthwork construction techniques outlined in Section 6.0, we anticipate that differential settlements of the structure should be less than a half-inch.

5.2.6 Floor Slabs

The floor slabs for the buildings may be constructed as slabs-on-ground, provided any unsuitable material is removed and replaced with compacted structural fill as outlined in Section 6.0. It is recommended that the bearing soils for floor slabs within enclosed or climate-controlled areas be covered with an impervious membrane to reduce moisture entry and floor dampness. Care should be exercised not to tear large sections of the membrane during placement of reinforcing steel and concrete. In addition, we recommend that a minimum separation of 2 feet be maintained between the finished floor levels and the estimated seasonal high groundwater level.

5.3 Generator and Transformer Pads

The Pads may be constructed as a slab-on-ground, provided any unsuitable material is removed and replaced with compacted structural fill as outlined in Section 6.0. Any fill needed to raise the Pads to final

grade should consist of structural fill that is placed and compacted as discussed in Section 6.5. We recommend that a minimum separation of 2 feet be maintained between the final Pad elevation and the estimated seasonal high groundwater level.

5.4 Reclaimed Water Ground Storage Tanks

Based on the results of our exploration, we consider the subsurface conditions at the site adaptable for support of the proposed GST structures when constructed on a properly designed shallow foundation system. We expect that the prestressed concrete tank will be supported on a 4-inch-thick concrete slab-on-grade. The slab will be thickened at the tank edge to support the tank walls and dome. Provided the site preparation and earthwork construction recommendations outlined in Section 6.0 of this report are performed, the following parameters may be used for foundation design.

5.4.1 Bearing Pressure

Based on the 1.5-million-gallon storage capacity and the tank diameter of 120 feet, we calculated a water storage height of approximately 20 feet. Therefore, we estimate the load applied uniformly across the tank bottom area to the subsurface soils below the tank floor to be on the order of 1,500 pounds per square foot (psf).

The maximum allowable net soil bearing pressure for use in design of the GST foundations should not exceed 1,500 psf based on the results of our analysis. Net bearing pressure is defined as the soil bearing pressure at the foundation bearing level in excess of the natural overburden pressure at that level. The foundations should be designed based on the maximum load that could be imposed by all loading conditions.

5.4.2 Foundation Size

The minimum width of the perimeter footing supporting the tank walls should be 18 inches. Even though the maximum allowable soil bearing pressure may not be achieved, this width recommendation should control the size of the foundation.

5.4.3 Bearing Depth

The minimum embedment depth for the upturned, thickened edge footing portion of the slab is 12 inches below the adjacent outside finished grades. It is recommended that stormwater be diverted away from the tank exterior and all adjacent foundations to reduce the possibility of erosion beneath the tank foundation. It is recommended that surface grades adjacent to the tank structure be graded to divert surface water away from the tank to reduce the possibility of erosion beneath the thickened edge slab.

5.4.4 Bearing Material

The tank slab including the thickened-edge portion may bear in either the compacted suitable existing site soils or compacted structural fill. The bearing level soils, after compaction, should exhibit densities equivalent to 98 percent of the modified Proctor maximum dry density (ASTM D 1557), to a depth of at least two feet below the foundation bearing levels.

5.4.5 Settlement Estimates

Post-construction settlements of the tank structure will be influenced by several interrelated factors, such as (1) subsurface stratification and strength/compressibility characteristics; (2) the size of the tank foundation and the bearing level, applied loads, and resulting bearing pressures beneath the foundation;

and (3) site preparation and earthwork construction techniques used by the contractor. The settlement estimates presented below are based on the results of our field exploration at the site, laboratory test results, and the use of the site preparation/earthwork construction techniques as recommended in this report. Any deviation from these recommendations could result in an increase in the estimated post-construction settlements of the storage tank structure.

Using the calculated load applied to the foundation soils by the full-water tank, and the field and laboratory test data that we have correlated to geotechnical strength and compressibility characteristics of the subsurface soils, we estimate the total settlement of the tank structures at the center to be less than 1 inch. Differential settlements result from differences in applied bearing pressures and variations in the compressibility characteristics of the subsurface soils. Because of the general uniformity of the subsurface conditions, and assuming the recommended site preparation and earthwork construction techniques outlined in Section 6.0 are followed, we estimate the differential settlement between the center and perimeter of each tank to be less than 0.5-inch. We recommend that piping, tank nozzles, and other attachments be designed with adequate consideration for the anticipated settlement.

The soil borings encountered predominately sandy soils within the expected stress zone of influence for the tank structure. Therefore, we expect the majority of the estimated total and differential settlement to occur in an elastic manner during construction and initial filling of the tank. The remainder of the estimated settlement will likely occur within approximately 2 to 4 weeks once the tank is constructed and filled to its design water level, as pore water pressures within the foundation's soils recede. No long-term settlement concerns due to plastic or cohesive soils are anticipated as no such soils were encountered in our explorations.

5.5 Pavement Considerations

Based on the results of our exploration, we consider the subsurface conditions at the site favorable for support of a flexible pavement section, when constructed on properly prepared subgrade soils as outlined in Section 6.0 of this report. We understand the asphalt pavement section as shown on Sheet CD-2 of the 30 Percent Submittal plans is as shown in the following table.

TYPICAL PAVEMENT SECTION	
Pavement Layer	Thickness
Type SP-12.5 Superpave Asphaltic Concrete Wearing Surface	2"
Graded Aggregate Base (GAB) or Reclaimed Concrete Aggregate (RCA) Base ⁽¹⁾	8"
Stabilized Subgrade ⁽¹⁾	12"
⁽¹⁾ Groundwater should be maintained at least 1.5 feet below the pavement surface.	

5.5.1 Wearing Surface

The wearing surface should consist of Florida Department of Transportation (FDOT) Type S asphaltic concrete having a minimum Marshall Stability of 1,500 lbs. Specific requirements for Type SP asphaltic concrete wearing surface are outlined in the latest edition of the *Florida Department of Transportation, Standard Specifications for Road and Bridge Construction*.

5.5.2 Base and Subgrade

Because of the proximity of the base layer to the estimated Seasonal High Groundwater Level, we recommend that the base consist of a Graded Aggregate Base (GAB), or Recycled Concrete Aggregate (RCA) base as an alternate, both as specified by the FDOT. The GAB material should have a minimum Limerock Bearing Ratio (LBR) of 100. The RCA material should have a minimum LBR value of 150. Both materials should be compacted to 100 percent of the modified Proctor maximum dry density (AASHTO T-180). The subgrade material should be stabilized with approved material, typically gravel, to maintain its drainage characteristics and result in a minimum LBR of 40. The stabilized subgrade material should be compacted to 98 percent of the modified Proctor maximum dry density (AASHTO T-180) value.

5.5.3 Underdrains

Satisfactory pavement life is dependent on dry/strong pavement support provided by the base and subgrade courses. Accordingly, a minimum clearance of 1.5 feet must be maintained between the estimated seasonal high groundwater table and the bottom of the base layer, or 2 feet below the pavement surface. Based on the final pavement elevations as shown on the provided plans, we recommend that underdrains be installed to maintain dry base materials. We can discuss the location of the underdrains if desired.

5.6 Below Grade Utility Support Recommendations

Based on the results of the subsurface explorations, laboratory testing, and provided information, as included in this report, we consider the subsurface conditions at the site adaptable for supporting the proposed below-grade pipeline and associated manhole structures when constructed upon properly prepared subgrade soils.

Provided the site preparation and earthwork construction recommendations outlined in Section 6.0 of this report are performed, the following parameters may be used for design of below-grade utilities.

5.6.1 Lateral Pressure Design Parameters

Below-grade walls that are backfilled on one side and restrained against rotation at the top, should be designed to resist lateral pressures from soil and groundwater based on the following equivalent fluid unit weights:

- Above Water Table - Equivalent Fluid Density 60 lb/ft³
- Below Water Table - Equivalent Fluid Density 90 lb/ft³

For the design of lateral loads on below-grade walls, we recommend that the groundwater level be assumed to be at the ground surface. Lateral pressure distributions in accordance with the above do not take into account forces from construction equipment, wheel loads or other surcharge loads. To account for this loading, a pressure equal to 0.5 times the anticipated surface surcharge should be applied over the full height of all walls.

5.6.2 Hydrostatic Uplift Resistance

It is anticipated that the buried structures will exert little or no net downward pressure on the soils, rather, the structures may be subject to hydrostatic uplift pressure when empty. Below grade structures should be designed to resist hydrostatic uplift pressures appropriate for their depth below existing grade and the normal seasonal high groundwater table. Hydrostatic uplift forces can be resisted in several ways including:

- Addition of dead weight to the structure.
- Mobilizing the dead weight of the soil surrounding the structure through extension of footings outside the perimeter of the structure.

A moist compacted soil unit weight of 110 lb/ft³ may be used in designing structures to resist buoyancy.

5.7 Borrow Suitability

Based on the boring results and classification of the soil samples, the fine sands and fine sands with silt (SP, SP-SM, A-3) as encountered at the boring locations, are considered suitable for use as fill soil. The soils containing surficial organic material (topsoil) and soils containing significant root content are considered unsuitable for use as structural fill. The organic soils could be used in landscape berms.

5.8 Organic Soil Delineation

Due to the presence of soils containing significant amounts of organic fines at boring B-7 between depths of approximately 6 and 8 feet below existing grade, a test pit exploration was recommended in our draft report to further explore the limits of these soils. In summary, 4 to 5 test pits were located within the footprint of each tank. They were excavated to a depth of about 6 feet below existing grade. Observation of the excavated soils showed the roots were widespread and were generally one-inch or less in diameter. Large-diameter roots or thick deposits of roots were not observed in any of the test pits. Therefore, additional site preparation to excavate and remove excessive organic materials is not recommended. The report of this supplemental exploration is included as Appendix C of this final report.

6.0 SITE PREPARATION AND EARTHWORK RECOMMENDATIONS

Site preparation as outlined in this section should be performed to provide more uniform foundation bearing conditions, to reduce the potential for post-construction settlements of the planned structures and to maintain the integrity of a flexible pavement section.

6.1 Clearing and Stripping

Prior to construction, the location of existing underground utility lines within the construction area should be established. Provisions should then be made to relocate interfering utilities to appropriate locations. It should be noted that, if underground pipes are not properly removed or plugged, they may serve as conduits for subsurface erosion, which may subsequently lead to excessive settlement of overlying structures.

The "footprint" of the proposed structures plus a minimum additional margin of 5 feet, and of the hardscape areas (parking/driveway) plus a minimum additional margin of 3 feet, should be stripped of all surface vegetation, stumps, debris, organic topsoil, or other deleterious materials. During grubbing operations, roots with a diameter greater than 0.5-inch, stumps, or small roots in a concentrated state, should be grubbed and completely removed.

Based on the results of our field exploration, it should be anticipated that up to 6 inches of topsoil and soils containing significant amounts of organic materials may be encountered across the site. The actual depths of unsuitable soils and materials should be determined by MAE using visual observation and judgment during earthwork operations. Any topsoils removed from the building and parking/drive areas can be stockpiled and used subsequently in areas to be grassed.

6.2 Temporary Groundwater Control

Because of the need for densification of the soils within the upper 2 feet below the stripped surface, temporary groundwater control measures may be required if the groundwater level is within 2 feet below the stripped and grubbed surface at the time of construction. Should groundwater control measures become necessary, dewatering methods should be determined by the contractor. We recommend the groundwater control measures, if necessary, remain in place until compaction of the existing soils is completed. The dewatering method should be maintained until backfilling has reached a height of 2 feet above the groundwater level at the time of construction. The site should be graded to direct surface water runoff from the construction area.

Note that discharge of produced groundwater to surface waters of the state from dewatering operations or other site activities is regulated and requires a permit from the State of Florida Department of Environmental Protection (FDEP). This permit is termed a *Generic Permit for the Discharge of Produced Groundwater From Any Non-Contaminated Site Activity*. If discharge of produced groundwater is anticipated, we recommend sampling and testing of the groundwater early in the site design phase to prevent project delays during construction. MAE can provide the sampling, testing, and professional consulting required to evaluate compliance with the regulations.

6.3 Preparation of Pipe Bedding Soils – Utility Pipelines

As discussed earlier in the report, a surficial topsoil layer up to 6 inches thick was encountered at the boring locations across the site. Below the topsoil layer were very loose to medium dense fine sands with silt (A-3) to the boring termination depth of 10 feet below existing grade. Trace amounts of root fragments and organic fines were encountered through the borings.

The topsoil layer should be stripped within the area of the proposed pipe trench and discarded or used in areas to be grassed. Where the pipeline will bear in sand soils (A-3), these soils should be excavated to the proposed bearing elevation and the exposed excavation surface should be compacted as outlined in Section 6.4 below. The A-3 soils, as encountered in the borings, without roots may be reused as pipe backfill. It should be expected that the moisture content of the soils excavated below the groundwater table at the time of construction will be above the optimum moisture content for compaction. These soils should be stockpiled to drain excess moisture prior to placement and compaction.

Dewatering of the utility pipeline trench excavations should be anticipated. Temporary groundwater control measures as discussed in Section 6.2 should be followed during excavation of the trench, compaction of the pipe bedding soils, and during placement and compaction of the pipe backfill soils.

6.4 Compaction

After completing the clearing and stripping operations and installing the temporary groundwater control measures (if required), the exposed surface area should be compacted with a vibratory drum roller having a minimum static, at-drum weight, on the order of 10 tons. Typically, the material should exhibit moisture contents within ± 2 percent of the modified Proctor optimum moisture content (ASTM D 1557) during the compaction operations. Compaction should continue until densities of at least 98 percent of the modified Proctor maximum dry density (ASTM D 1557) have been achieved within the upper 2 feet of the compacted natural soils at the site.

Once pipe excavation has achieved the pipe culvert elevation, the pipe bedding soils should be compacted to at least 95 percent of the soil's modified Proctor maximum dry density (ASTM D1557). Compaction should be achieved within the upper 12 inches below the pipe culvert elevation.

For the planned access roadway and parking/driveway areas, densities of at least 98 percent of the modified Proctor maximum dry density (ASTM D1557) should be obtained within the upper one foot of the materials immediately below the proposed base course.

Should the bearing level soils experience pumping and soil strength loss during the compaction operations, compaction work should be immediately terminated. The wet soils should be removed and backfilled with dry structural fill soils, which are then compacted, or the excess moisture content within the wet soils should be allowed to dissipate before recompacting.

Care should be exercised to avoid damaging any nearby structures while the compaction operation is underway. Prior to commencing compaction, occupants of adjacent structures should be notified, and the existing conditions of the structures should be documented with photographs and survey (if deemed necessary). Compaction should cease if deemed detrimental to adjacent structures, and MAE should be contacted immediately. It is recommended that the vibratory roller remain a minimum of 50 feet from existing structures. Within this zone, use of a track-mounted bulldozer or a vibratory roller, operating in the static mode, is recommended.

6.5 Structural Backfill, Pipe Backfill and Fill Soils

Any structural backfill or fill required for site development should be placed in loose lifts not exceeding 12 inches in thickness and compacted by the use of the above described vibratory drum roller. The lift thickness should be reduced to 8 inches if the roller operates in the static mode or if track-mounted compaction equipment is used. If hand-held compaction equipment is used, the lift thickness should be further reduced to 6 inches.

All pipe backfill should be placed in thin (6 inches or less) lifts with each lift compacted with hand-held equipment. Thin lifts should be placed until the backfill is greater than 12 inches above the top of the pipe. Soils above this height may be placed in lifts up to 12 inches in thickness. All pipe backfill should be compacted to at least 95 percent of the soil's modified Proctor maximum dry density (ASTM D1557).

Structural fill and pipe backfill are defined as a non-plastic, inorganic, granular soil having less than 10 to 12 percent material passing the No. 200 mesh sieve and containing less than 4 percent organic material. The fine sands and fine sands with silt, without roots, as encountered across the site are suitable for reuse as fill material and, with proper moisture control, should densify using conventional compaction methods. It should be noted that soils with more than 12 percent passing the No. 200 sieve will be more difficult to compact, due to their nature to retain soil moisture, and may require drying. Typically, the material should exhibit moisture contents within ± 2 percent of the modified Proctor optimum moisture content (ASTM D 1557) during the compaction operations. Compaction should continue until densities of at least 95 percent (for pipeline) and 98 percent (for tanks and building) of the modified Proctor maximum dry density (ASTM D 1557) have been achieved within each lift of the compacted structural fill.

Care should be exercised to avoid damaging any nearby structures while the compaction operation is underway. Prior to commencing compaction, occupants of adjacent structures should be notified, and the existing conditions of the structures should be documented with photographs and survey. Compaction should cease if deemed detrimental to adjacent structures, and MAE should be contacted immediately. It is recommended that the vibratory roller remain a minimum of 50 feet from existing structures. Within this zone, use of a track-mounted bulldozer or a vibratory roller, operating in the static mode, is recommended. Soils containing excessive amounts of organic fines, such as the sands with significant root fragments and organic fines encountered at boring location B-7, are not suitable for reuse and will need to be removed and separated from the stockpiled soils intended for reuse. These soils can be used in landscape areas.

6.6 Foundation Areas

After satisfactory placement and compaction of the required structural fill, the foundation areas may be excavated to the planned bearing levels. The foundation bearing level soils, after compaction, should exhibit densities equivalent to 98 percent of the modified Proctor maximum dry density (ASTM D 1557), to a depth of one foot below the bearing level. For confined areas, such as the footing excavations, any additional compaction operations can probably best be performed by the use of a lightweight vibratory sled or roller having a total weight on the order of 500 to 2000 pounds.

6.7 Access Roadway & Parking/Driveway Areas

After completing the clearing/stripping operations in the pavement areas, any underlying sands containing significant organic fines and/or root content that are within 2 feet of the bottom of the pavement base should be over-excavated from within the pavement areas. Structural backfill and fill required to achieve the finish pavement grades then can be placed and compacted as described Section 6.5 above. As an exception, densities of at least 98 percent of the modified Proctor maximum dry density (ASTM D1557) should be obtained within the upper one foot of the materials immediately below the proposed base course.

For the access road leading to the Facility, once the construction area has been stripped and grubbed of all surface vegetation, the exposed subgrade soils should then be compacted as described in Section 6.4 above. Temporary dewatering, as discussed in Section 6.2 above, may be necessary depending on the groundwater level at the time of construction. Soil densities of at least 98 percent of the modified Proctor maximum dry density (AASHTO T180) should be obtained within the upper one foot of the subgrade soils immediately below the roadway base. Once the subgrade has been adequately compacted, the GAB or RCA should be placed in equal lifts not greater than 6 inches in thickness, with each lift compacted to 100 percent of the materials modified Proctor maximum dry density (AASHTO T180).

6.8 Excavation Protection

Excavation work for utility pipeline construction will be required to meet OSHA Excavation Standard Subpart P regulations for Type C Soils. The use of excavation support systems will be necessary where there is not sufficient space to allow the side slopes of the excavation to be laidback to at least 2H:1V (2 horizontal to 1 vertical) to provide a safe and stable working area and to facilitate adequate compaction along the sides of the excavation.

The method of excavation support should be determined by the contractor but can consist of a trench box, drilled-in soldier piles with lagging, interlocking steel sheeting or other methods. The support structure should be designed according to OSHA sheeting and bracing requirements by a Florida registered Professional Engineer.

7.0 QUALITY CONTROL TESTING

A representative number of field in-place density tests should be made in the upper 2 feet of compacted natural soils, in each lift of compacted backfill and fill, and in the upper 12 inches below the bearing levels in the footing excavations. The density tests are considered necessary to verify that satisfactory compaction operations have been performed. We recommend density testing be performed as listed below:

- one location for every 5,000 square feet of building and tank areas,
- 25 percent of any isolated column footing locations,

- one location for every 100 linear feet of continuous wall footings,
- one location for every 10,000 square feet of pavement area,
- one location per 200 feet of roadway length for the Access Road,
- one location for every 500 feet of below-grade pipeline,
- minimum of 2 locations at each manhole structure.

8.0 REPORT LIMITATIONS

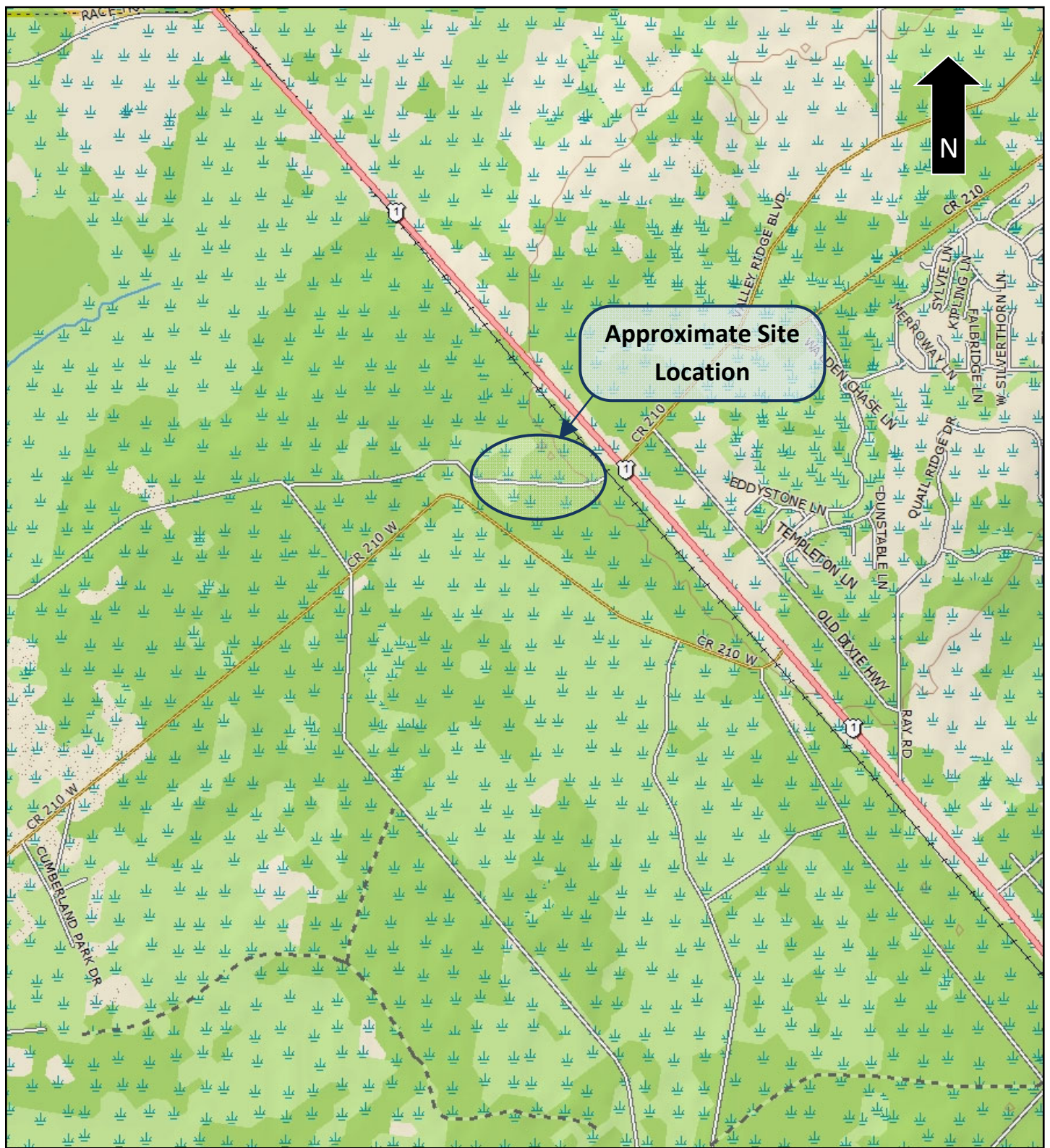
This report has been prepared for the exclusive use of Mott MacDonald Florida, LLC and the JEA for specific application to the design and construction of the proposed structures and access roadway portions of the *JEA Twin Creeks Reclaimed Water Storage Tanks and Re-Pump Station* project, as identified in this report. An electronically signed and sealed version, and a version of our report that is signed and sealed in blue ink, may be considered an original of the report. Copies of an original should not be relied on unless specifically allowed by MAE in writing. Our work for this project was performed in accordance with generally accepted geotechnical engineering practice. No warranty, express or implied, is made.

The analyses and recommendations contained in this report are based on the data obtained from this project. This testing indicates subsurface conditions only at the specific locations and times, and only to the depths explored. These results do not reflect subsurface variations that may exist away from the boring locations and/or at depths below the boring termination depths. Subsurface conditions and water levels at other locations may differ from conditions occurring at the tested locations. In addition, it should be understood that the passage of time may result in a change in the conditions at the tested locations. If variations in subsurface conditions from those described in this report are observed during construction, the recommendations in this report must be re-evaluated.

The scope of our services did not include any environmental assessment or testing for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the subject site. Any statements made in this report, and/or notations made on the generalized soil profiles or boring logs, regarding odors or other potential environmental concerns are based on observations made during execution of our scope of services and as such are strictly for the information of our client. No opinion of any environmental concern of such observations is made or implied. Unless complete environmental information regarding the site is already available, an environmental assessment is recommended.

If changes in the design or location of the structures or associated roadway occur, the conclusions and recommendations contained in this report may need to be modified. We recommend that these changes be provided to us for our consideration. MAE is not responsible for conclusions, interpretations, opinions or recommendations made by others based on the data contained in this report.

Figures



Site Location Map

PREPARED BY



PREPARED FOR

Mott MacDonald Florida, LLC

PROJECT NAME

**JEA Twin Creeks Reclaimed Water Storage
Tanks and Booster Pump Station
St. Johns County, Florida**

REFERENCE

Delorme XMap 7.0
MAE PROJECT NO.

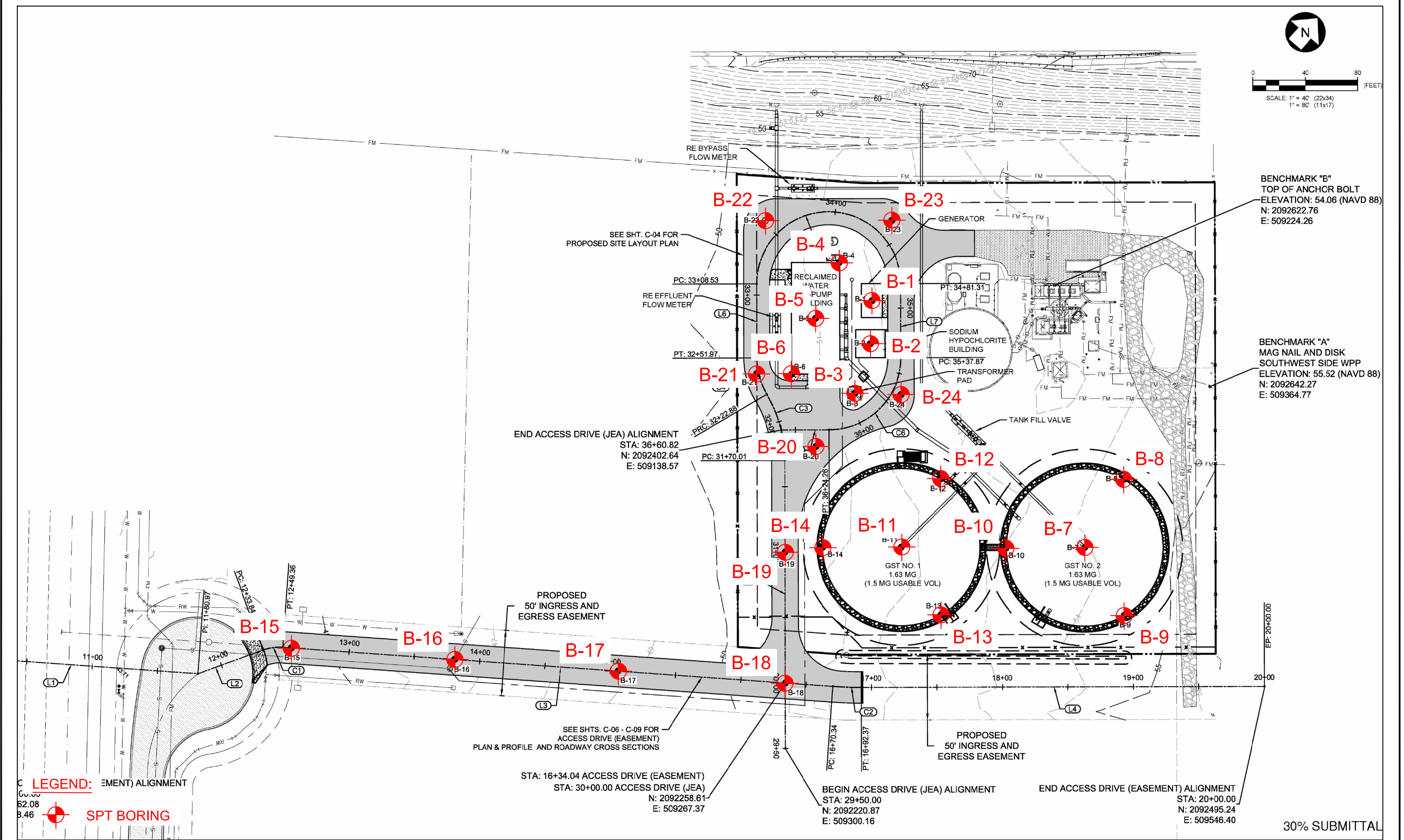
SCALE


NTS

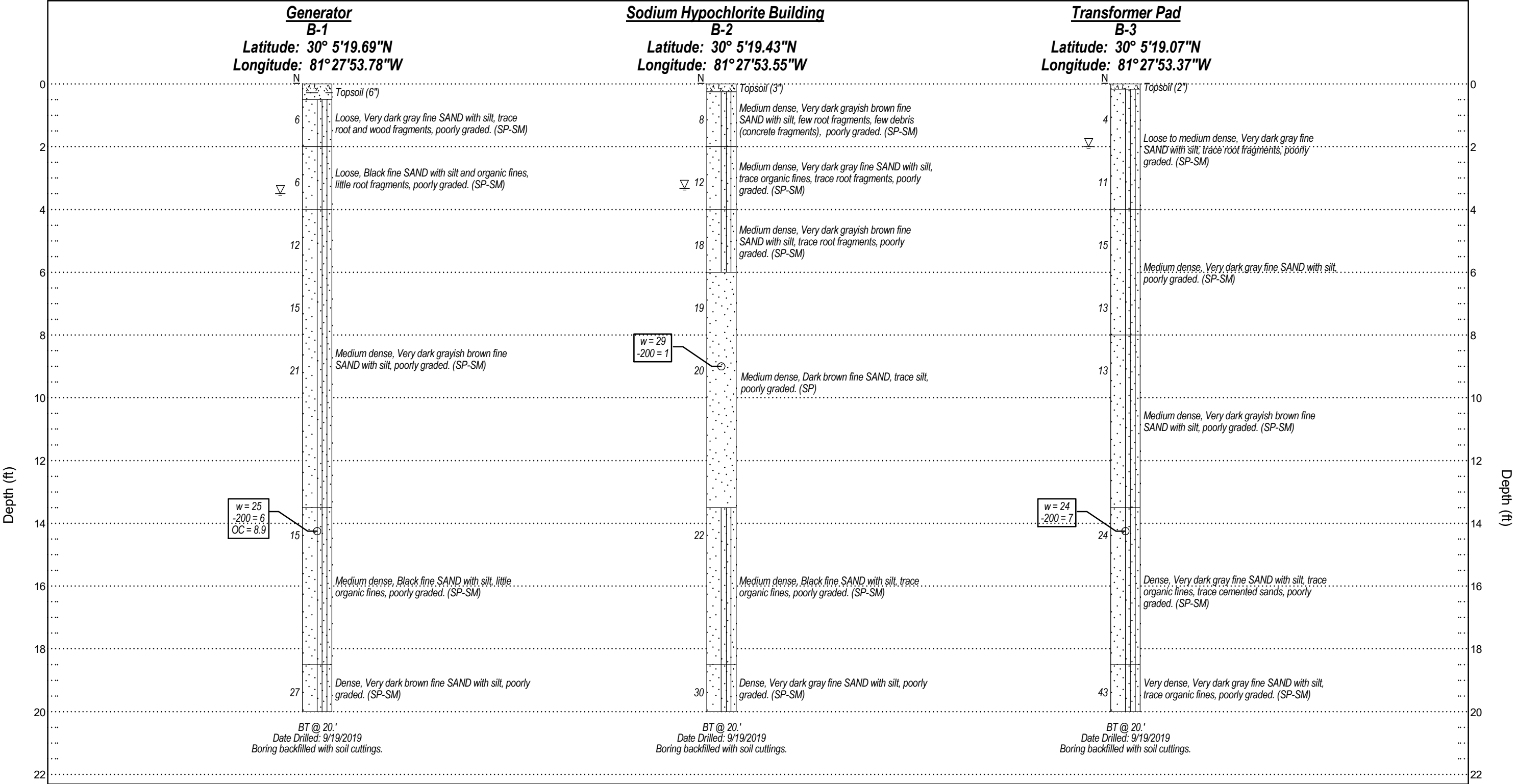
FIGURE NO.

0103-0017

1



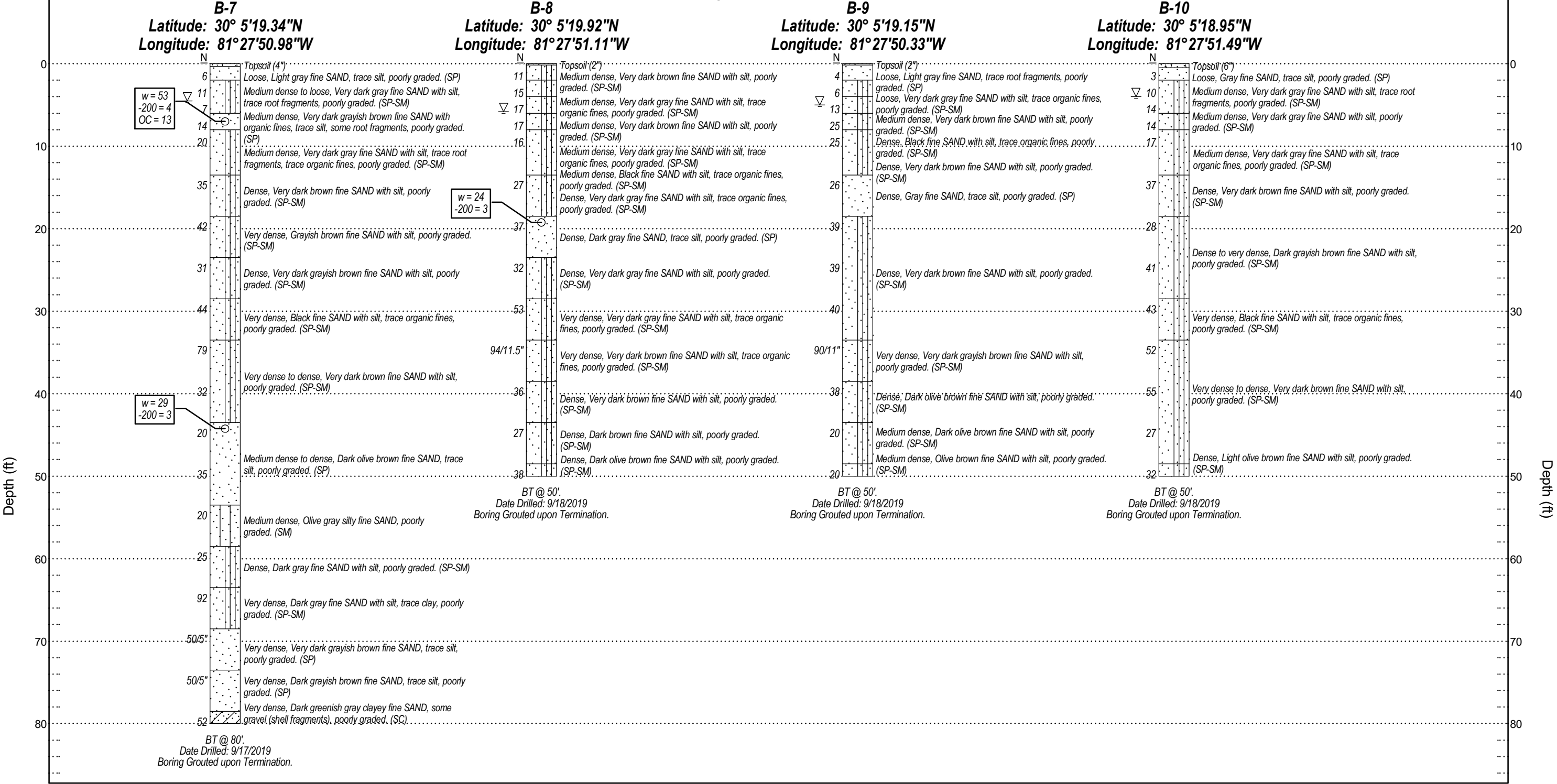
NOTE: Project Control & Overall Site Layout 30% Submittal dated September 2019 as provided by Mott MacDonald Florida, LLC.										
REVISIONS						<div>P. RODNEY MANK, P.E. P.E. NO.: 41986</div> <div></div> <div>Meskel & Associates Engineering</div> <div>Geotechnical • Environmental • Inspection • Testing</div> <div>FL Certificate of Authorization No. 28142</div> <div>3728 Philips Highway, Suite 208, Jacksonville, FL 32207</div>	CLIENT:		SHEET TITLE:	
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION		Mott MacDonald Florida, LLC		BORING LOCATION PLAN	
							DATE:	MAE PROJECT NO.	PROJECT NAME:	FIGURE NO.
							10/11/2019	0103-0017	JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station St. Johns County, Florida	2



REVISIONS						DATE		BY		DESCRIPTION	

P. RODNEY MANK, P.E. P.E. NO.: 41986		Mott MacDonald Florida, LLC		SHEET TITLE: Generalized Soil Profiles	
10/11/2019		MAE PROJECT NO. 0103-0017		PROJECT NAME: JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station	
3728 Philips Highway, Suite 208, Jacksonville, FL 32207				FIGURE NO. 3	

Ground Storage Tank 2



Legend

Topsoil

Silty Fine Sand

Fine Sand

Clayey Fine Sand

Fine Sand with Silt

Standard Penetration Resistance, Blows/Foot

Boring Terminated at Depth Below Existing Grade

Unified Soil Classification System (USCS)

Natural Moisture Content (%)

50/5" Indicates 50 Hammer blows drove split spoon sampler 5 inches.

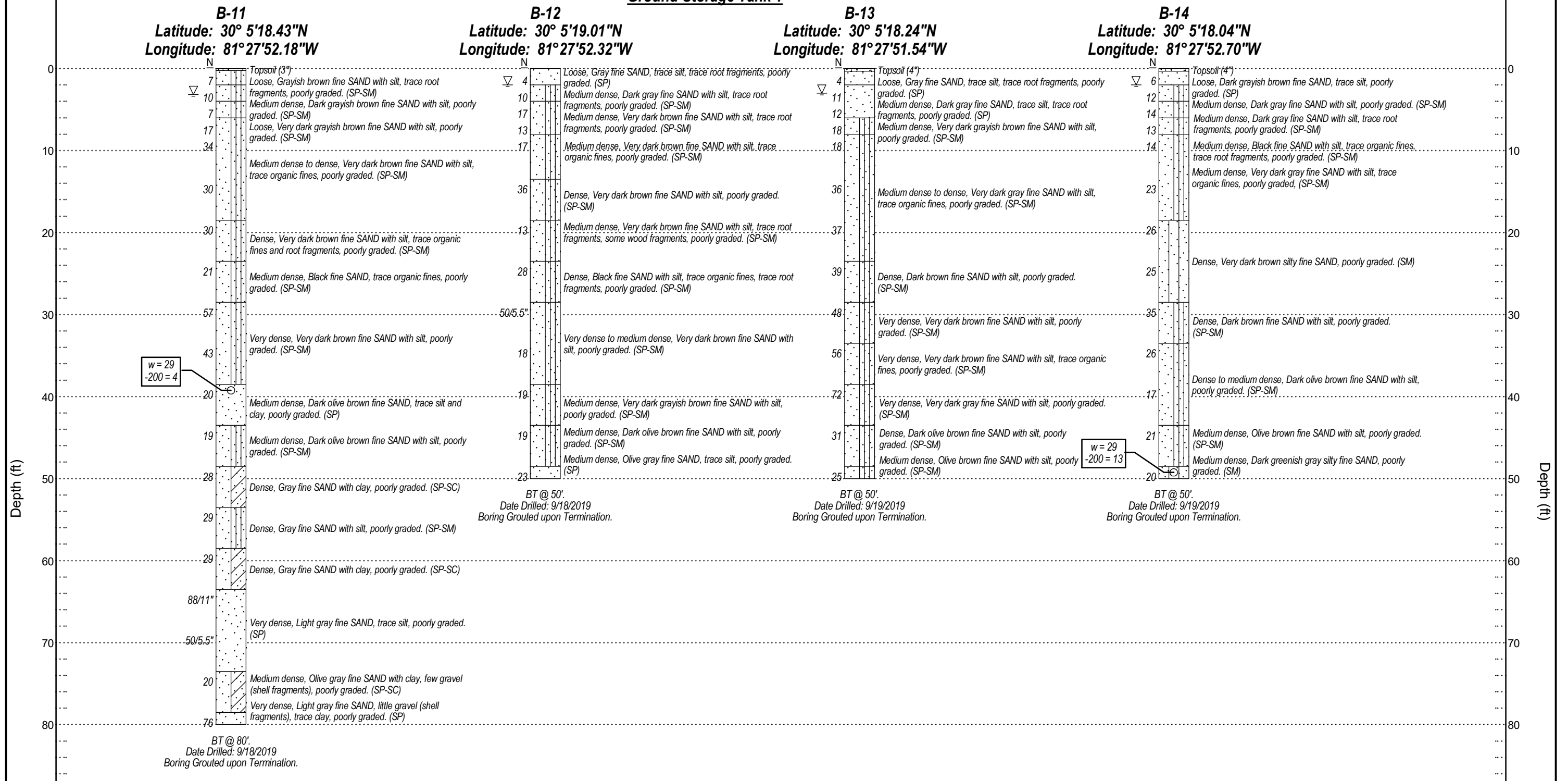
Depth to Groundwater at Time of Drilling

% Passing No. 200 U.S. Standard Sieve

Organic Content (%)

REVISIONS						P. RODNEY MANK, P.E. P.E. NO.: 41986		Mott MacDonald Florida, LLC		SHEET TITLE: Generalized Soil Profiles	
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	Meskel & Associates Engineering Geotechnical • Environmental • Inspection • Testing FL Certificate of Authorization No. 28142 3728 Philips Highway, Suite 208, Jacksonville, FL 32207		DATE:	MAE PROJECT NO.	PROJECT NAME:	FIGURE NO.
								10/11/2019	0103-0017	JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station St. Johns County, Florida	5

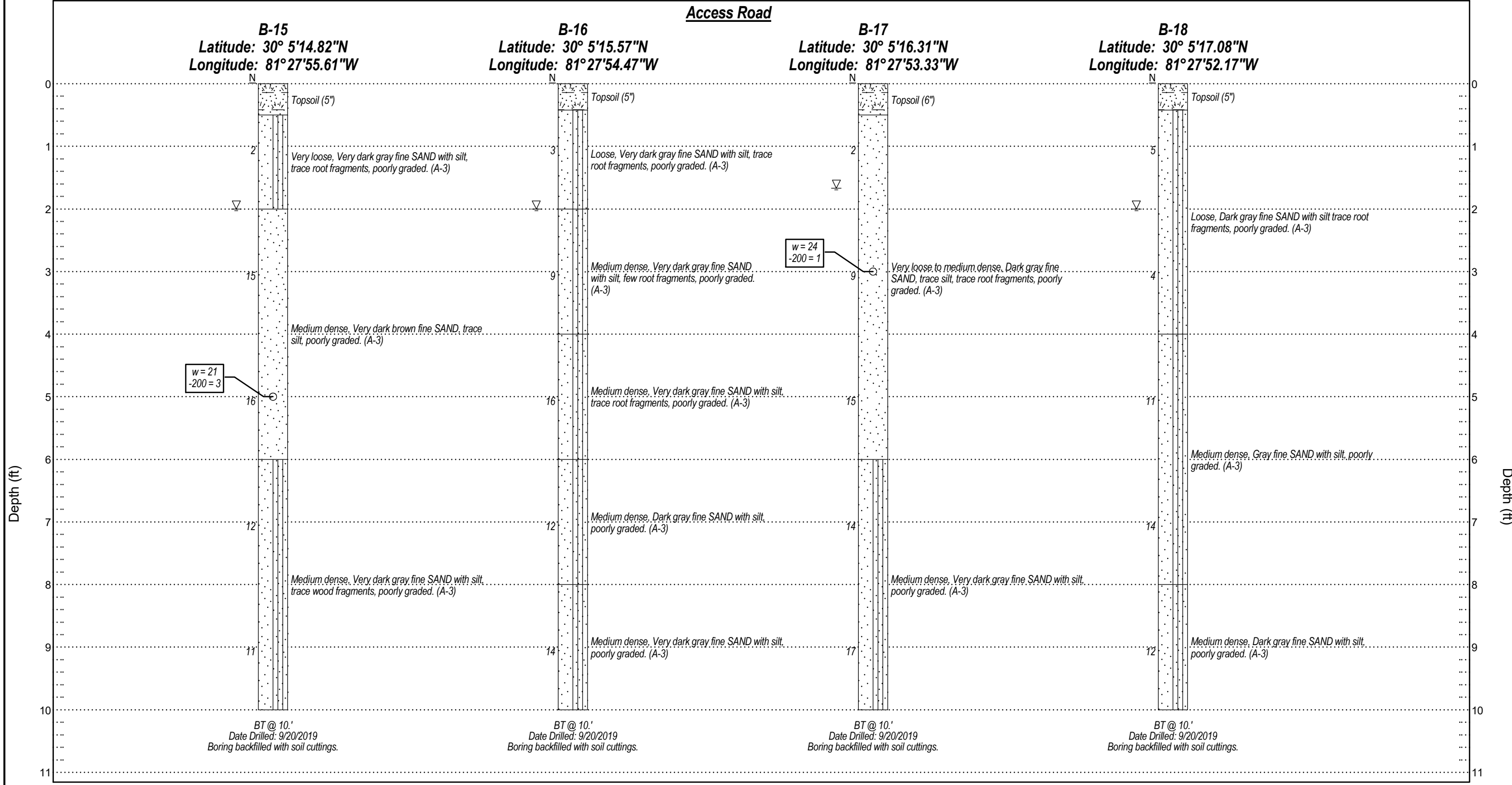
Ground Storage Tank 1

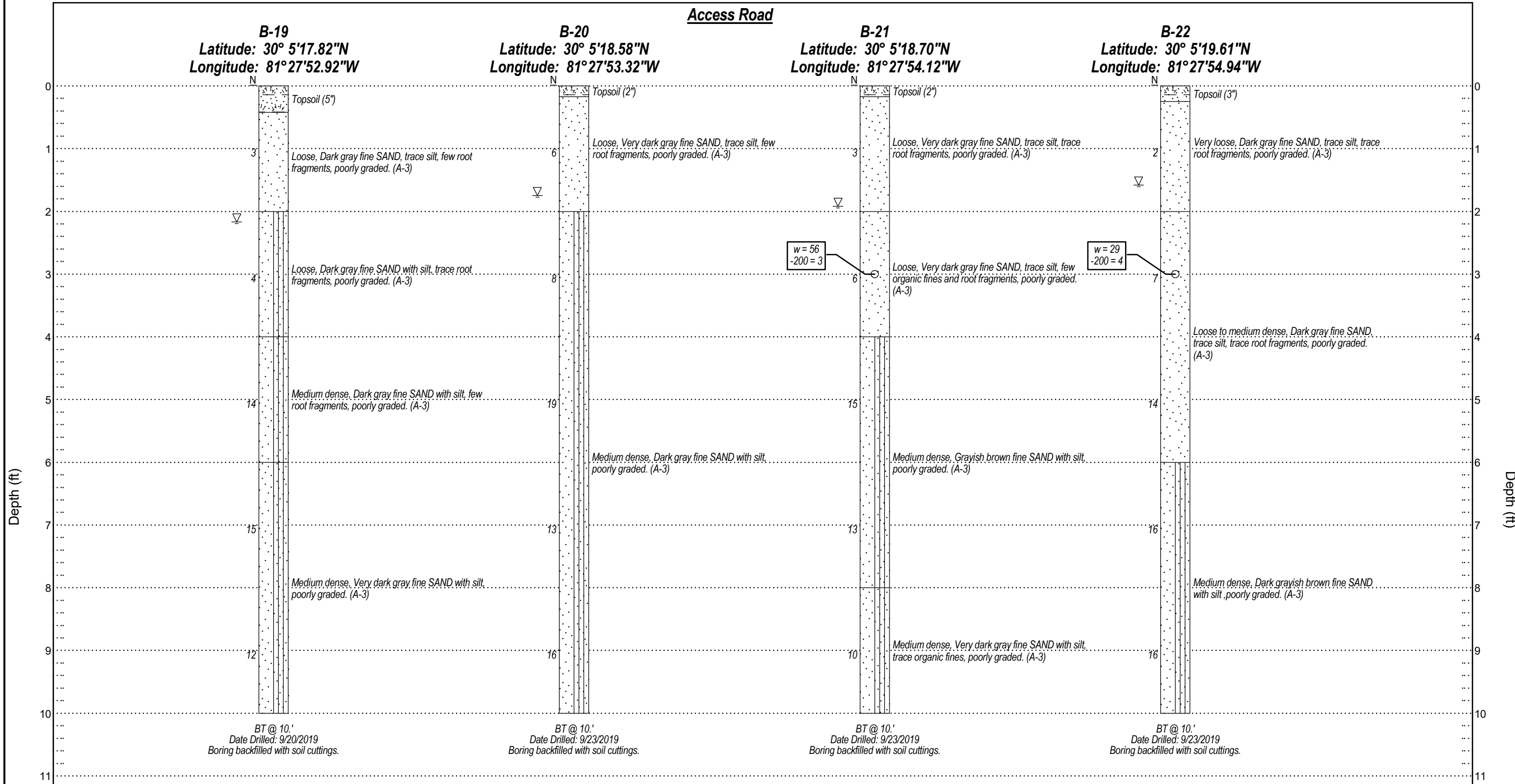



Legend


	Topsoil		Fine Sand with Silt		Fine Sand		Standard Penetration Resistance, Blows/Foot		(SP) Unified Soil Classification System (USCS)		w Natural Moisture Content (%)		50/5" Indicates 50 Hammer blows drove split spoon sampler 5 inches.
	Fine Sand with Clay		Silty Fine Sand		BT Boring Terminated at Depth Below Existing Grade		Depth to Groundwater at Time of Drilling		-200 % Passing No. 200 U.S. Standard Sieve				


REVISIONS						P. RODNEY MANK, P.E. P.E. NO.: 41986		Mott MacDonald Florida, LLC		SHEET TITLE: Generalized Soil Profiles		
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	 Meskel & Associates Engineering Geotechnical • Environmental • Inspection • Testing FL Certificate of Authorization No. 28142 3728 Philips Highway, Suite 208, Jacksonville, FL 32207		DATE:	MAE PROJECT NO.	PROJECT NAME:	FIGURE NO.	
								10/11/2019	0103-0017	JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station St. Johns County, Florida	6	





 Topsoil

 Fine Sand

 Fine Sand with Silt

Legend

N Standard Penetration Resistance, Blows/Foot

BT Boring Terminated at Depth Below Existing Grade

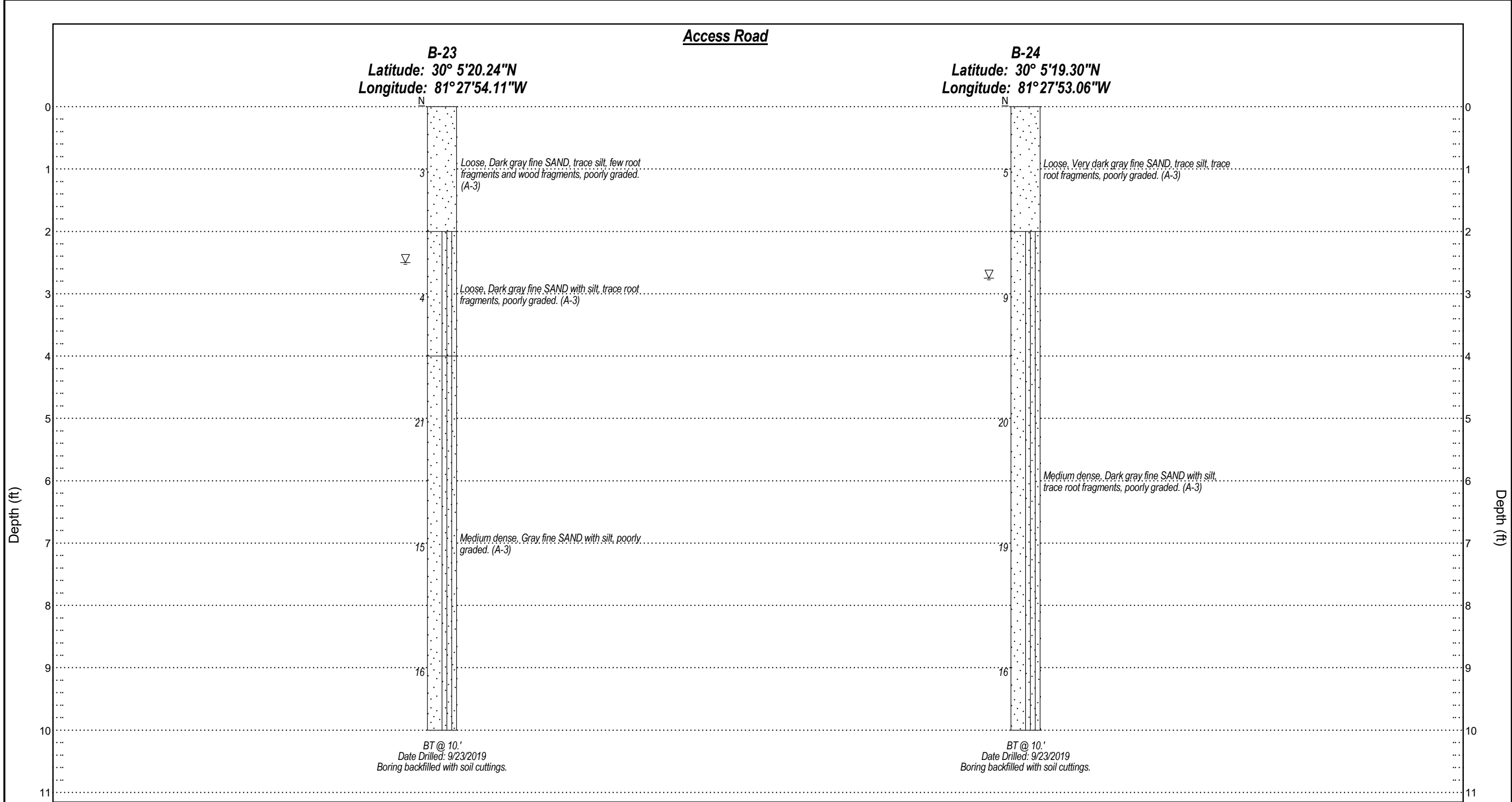
(A-3) AASHTO Soil Classification System

▽ Depth to Groundwater at Time of Drilling

w Natural Moisture Content (%)

-200 % Passing No. 200 U.S. Standard Sieve

REVISIONS						<div><div>P. RODNEY MANK, P.E. P.E. NO.: 41986</div><div> Meskel & Associates Engineering Geotechnical • Environmental • Inspection • Testing FL Certificate of Authorization No. 28142 3728 Philips Highway, Suite 208, Jacksonville, FL 32207</div></div>	Mott MacDonald Florida, LLC		SHEET TITLE: Generalized Soil Profiles		
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION		DATE:	MAE PROJECT NO.	PROJECT NAME: JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station		FIGURE NO.
							10/11/2019	0103-0017	St. Johns County, Florida		8



Fine Sand

Fine Sand with Silt

Legend

N Standard Penetration Resistance, Blows/Foot

BT Boring Terminated at Depth Below Existing Grade

(A-3) AASHTO Soil Classification System

▽ Depth to Groundwater at Time of Drilling

REVISIONS						<div><div><div>P. RODNEY MANK, P.E. P.E. NO.: 41986</div><div><div>Meskel & Associates Engineering Geotechnical • Environmental • Inspection • Testing FL Certificate of Authorization No. 28142 3728 Philips Highway, Suite 208, Jacksonville, FL 32207</div></div></div></div>	Mott MacDonald Florida, LLC		SHEET TITLE:		<i>Generalized Soil Profiles</i>	
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION		DATE:	MAE PROJECT NO.	PROJECT NAME:	FIGURE NO.		
							10/11/2019	0103-0017	JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station St. Johns County, Florida	9		

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PROJECT NO. 0103-0017

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station
PROJECT LOCATION St. Johns County, Florida **CLIENT** Mott MacDonald Florida, LLC
DATE STARTED 9/19/19 **COMPLETED** 9/19/19 **LATITUDE** 30° 5'19.69"N **LONGITUDE** 81°27'53.78"W
DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test
LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

NEW MAE LOG LAT/LONG-EOD CUTTINGS - NEW TEMPLATE 7-30-12 GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (6")												
	1	Loose, Very dark gray fine SAND with silt, trace root and wood fragments, poorly graded.	SP-SM		1 2 4 4	6								
	2	Loose, Black fine SAND with silt and organic fines, little root fragments, poorly graded.	SP-SM		2 2 4 3	6								
5	3				3 5 7 9	12								
	4				4 7 8 10	15								
	5	Medium dense, Very dark grayish brown fine SAND with silt, poorly graded.	SP-SM		6 8 13 12	21								
10														
	6				10 7 8	15	25	6	8.9					
15		Medium dense, Black fine SAND with silt, little organic fines, poorly graded.	SP-SM											
	7	Dense, Very dark brown fine SAND with silt, poorly graded.	SP-SM		8 11 16	27								
20														

Bottom of borehole at 20 feet.

NOTES Boring backfilled with soil cuttings.

GROUND WATER LEVELS

▽ AT TIME OF DRILLING 3 ft 6 in *▽ END OF DAY ---

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**BORING B-2**

PAGE 1 OF 1

PROJECT NO. 0103-0017

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station**PROJECT LOCATION** St. Johns County, Florida**CLIENT** Mott MacDonald Florida, LLC**DATE STARTED** 9/19/19**COMPLETED** 9/19/19**LATITUDE** 30° 5'19.43"N**LONGITUDE** 81°27'53.55"W**DRILLING CONTRACTOR** MAE, PLLC**DRILLING METHOD** Standard Penetration Test**LOGGED BY** P.R.Young**CHECKED BY** W. Josh Mele**GROUND ELEVATION** —**HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (3")												
	1	Medium dense, Very dark grayish brown fine SAND with silt, few root fragments, few debris (concrete fragments), poorly graded.	SP-SM		2 5 3 6	8								
	2	Medium dense, Very dark gray fine SAND with silt, trace organic fines, trace root fragments, poorly graded.	SP-SM		4 6 6 9	12								
5	3	Medium dense, Very dark grayish brown fine SAND with silt, trace root fragments, poorly graded.	SP-SM		5 8 10 12	18								
	4				6 8 11 11	19								
	5				6 10 10 12	20	29	1						
10		Medium dense, Dark brown fine SAND, trace silt, poorly graded.	SP											
	6				8 10 12	22								
15		Medium dense, Black fine SAND with silt, trace organic fines, poorly graded.	SP-SM											
	7	Dense, Very dark gray fine SAND with silt, poorly graded.	SP-SM		10 10 20	30								
20														
Bottom of borehole at 20 feet.														
NOTES Boring backfilled with soil cuttings.					GROUND WATER LEVELS									
					▽ AT TIME OF DRILLING 3 ft 4 in *▽ END OF DAY ---									

NEW MAE LOG LAT/LONG-EOD CUTTINGS - NEW TEMPLATE 7-30-12 GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

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PROJECT NO. 0103-0017

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station
PROJECT LOCATION St. Johns County, Florida **CLIENT** Mott MacDonald Florida, LLC
DATE STARTED 9/19/19 **COMPLETED** 9/19/19 **LATITUDE** 30° 5'19.07"N **LONGITUDE** 81°27'53.37"W
DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test
LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

NEW MAE LOG LAT/LONG-EOD, CUTTINGS - NEW TEMPLATE 7-30-12.GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ														
DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (2")												
	1	▽ Loose to medium dense, Very dark gray fine SAND with silt, trace root fragments, poorly graded.	SP-SM		1 2 2 2	4								
	2				2 4 7 7	11								
5	3				3 6 9 14	15								
	4	Medium dense, Very dark gray fine SAND with silt, poorly graded.	SP-SM		5 7 6 7	13								
	5				6 6 7 9	13								
10		Medium dense, Very dark grayish brown fine SAND with silt, poorly graded.	SP-SM											
	6				15 12 12	24								
15		Dense, Very dark gray fine SAND with silt, trace organic fines, cemented sands, poorly graded.	SP-SM											
	7				16 20 23	43								
20		Very dense, Very dark gray fine SAND with silt, trace organic fines, poorly graded.	SP-SM											
Bottom of borehole at 20 feet.														
NOTES Boring backfilled with soil cuttings.					GROUND WATER LEVELS									
					▽ AT TIME OF DRILLING 2 ft 0 in * ▽ END OF DAY ---									

NEW MAE LOG LAT/LONG-EOD_CUTTINGS - NEW TEMPLATE 7-30-12.GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

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PROJECT NO. 0103-0017

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station
PROJECT LOCATION St. Johns County, Florida **CLIENT** Mott MacDonald Florida, LLC
DATE STARTED 9/20/19 **COMPLETED** 9/20/19 **LATITUDE** 30° 5'19.74"N **LONGITUDE** 81°27'54.22"W
DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test
LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (4")												
	1	Loose, Very dark gray fine SAND with silt, few organic fines, poorly graded.	SP-SM		1 1 1 1	2								
	2	Medium dense, Dark gray fine SAND with silt, poorly graded.	SP-SM		1 3 6 8	9								
5	3	Medium dense, Dark grayish brown fine SAND with silt, poorly graded.	SP-SM		4 6 9 10	15								
	4				5 8 12 15	20								
	5				6 8 9 13	17								
10														
	6	Medium dense to very dense, Very dark gray fine SAND with silt, poorly graded.	SP-SM		4 6 11	17								
15														
	7				14 28 33	61								
20														
Bottom of borehole at 20 feet.														
NOTES Boring backfilled with soil cuttings.					GROUND WATER LEVELS									
					▽ AT TIME OF DRILLING 2 ft 6 in *▽ END OF DAY ---									

NEW MAE LOG LAT/LONG-EOD_CUTTINGS - NEW TEMPLATE 7-30-12 GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ



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PROJECT NO. 0103-0017

CLIENT Mott MacDonald Florida, LLC

LONGITUDE 81°27'54.05"W

DRILLING METHOD Standard Penetration Test

HAMMER TYPE Automatic

NEW MAE LOG LAT/LONG-EOD, CUTTINGS - NEW TEMPLATE 7-30-12.GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ														
DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (6")												
	1	Very loose to medium dense, Dark gray fine SAND, trace silt, poorly graded.	SP		1 1 1 1	2	40	3						
	2				1 1 1 4	2								
5	3				2 5 7 8	12								
	4				4 8 10 14	18								
	5				5 9 11 16	20								
10														
	6	Medium dense, Gray fine SAND with silt, poorly graded.	SP-SM		7 10 10	20								
15														
	7	Very dense, Very dark brown fine SAND with silt, poorly graded.	SP-SM		14 20 25	45								
20		Bottom of borehole at 20 feet.												
NOTES				GROUND WATER LEVELS										
Boring backfilled with soil cuttings.				AT TIME OF DRILLING 3 ft 0 in * END OF DAY ---										

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PROJECT NO. 0103-0017

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station
PROJECT LOCATION St. Johns County, Florida **CLIENT** Mott MacDonald Florida, LLC
DATE STARTED 9/20/19 **COMPLETED** 9/20/19 **LATITUDE** 30° 5'18.87"N **LONGITUDE** 81°27'53.89"W
DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test
LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (6")			1									
1		Loose, Dark gray fine SAND with silt, poorly graded.	SP-SM		3	6								
2		Medium dense, Dark brown fine SAND with silt, trace root fragments, poorly graded.	SP-SM		2	10								
3					5	17								
4					4	18								
5					6	21								
6		Medium dense to dense, Dark grayish brown fine SAND with silt, poorly graded.	SP-SM		6	20								
7					10	29								
20		Bottom of borehole at 20 feet.												
NOTES Boring backfilled with soil cuttings.														GROUND WATER LEVELS ∇ AT TIME OF DRILLING 2 ft 4 in * ∇ END OF DAY ---

(Continued Next Page)

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station
PROJECT LOCATION St. Johns County, Florida **CLIENT** Mott MacDonald Florida, LLC
DATE STARTED 9/17/19 **COMPLETED** 9/17/19 **LATITUDE** 30° 5'19.34"N **LONGITUDE** 81°27'50.98"W
DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test
LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (4")												
	1	Loose, Light gray fine SAND, trace silt, poorly graded.	SP		2 3 3 2	6								
	2	Medium dense to loose, Very dark gray fine SAND with silt, trace root fragments, poorly graded.	SP-SM		3 4 7 8	11								
5	3				3 3 4 5	7								
	4	Medium dense, Very dark grayish brown fine SAND with organic fines, trace silt, some root fragments, poorly graded.	SP		4 6 8 13	14	53	4	13.0					
	5				10 9 11 13	20								
10		Medium dense, Very dark gray fine SAND with silt, trace root fragments, trace organic fines, poorly graded.	SP-SM											
	6				11 17 18	35								
15		Dense, Very dark brown fine SAND with silt, poorly graded.	SP-SM											
	7	Very dense, Grayish brown fine SAND with silt, poorly graded.	SP-SM		11 18 24	42								
20														
NOTES				GROUND WATER LEVELS										
				▽ AT TIME OF DRILLING 4 ft 6 in *▽ END OF DAY ---										

NEW MAE LOG LAT/LONG-EOD_CUTTINGS - NEW TEMPLATE 7-30-12 GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

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PROJECT NO. 0103-0017

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station**PROJECT LOCATION** St. Johns County, Florida**CLIENT** Mott MacDonald Florida, LLC

NEW MAE LOG LAT/LONG-EOD_CUTTINGS - NEW TEMPLATE 7-30-12 GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20														
		Very dense, Grayish brown fine SAND with silt, poorly graded. (continued)	SP-SM											
25	8				10 14 17	31								
		Dense, Very dark grayish brown fine SAND with silt, poorly graded.	SP-SM											
30	9				14 21 23	44								
		Very dense, Black fine SAND with silt, trace organic fines, poorly graded.	SP-SM											
35	10				15 31 48	79								
		Very dense to dense, Very dark brown fine SAND with silt, poorly graded.	SP-SM											
40	11				7 12 20	32								
NOTES					GROUND WATER LEVELS									
					▽ AT TIME OF DRILLING 4 ft 6 in *▽ END OF DAY ---									

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PROJECT NO. 0103-0017

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station**PROJECT LOCATION** St. Johns County, Florida**CLIENT** Mott MacDonald Florida, LLC

NEW MAE LOG LAT/LONG-EOD CUTTINGS - NEW TEMPLATE 7-30-12.GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
		Very dense to dense, Very dark brown fine SAND with silt, poorly graded. (continued)	SP-SM											
45	12				5 8 12	20	29	3						
50	13	Medium dense to dense, Dark olive brown fine SAND, trace silt, poorly graded.	SP		5 10 25	35								
55	14				6 8 12	20								
		Medium dense, Olive gray silty fine SAND, poorly graded.	SM											
60	15				12 15 10	25								
		Dense, Dark gray fine SAND with silt, poorly graded.	SP-SM											
NOTES					GROUND WATER LEVELS									
					▽ AT TIME OF DRILLING 4 ft 6 in * ▽ END OF DAY ---									

(Continued Next Page)

▽ AT TIME OF DRILLING 4 ft 6 in *▽ END OF DAY ---

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station
PROJECT LOCATION St. Johns County, Florida **CLIENT** Mott MacDonald Florida, LLC
DATE STARTED 9/18/19 **COMPLETED** 9/18/19 **LATITUDE** 30° 5'19.92"N **LONGITUDE** 81°27'51.11"W
DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test
LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (2")												
	1	Medium dense, Very dark brown fine SAND with silt, poorly graded.	SP-SM		2 4 7 7	11								
	2	Medium dense, Very dark gray fine SAND with silt, trace organic fines, poorly graded.	SP-SM		4 6 9 17	15								
5	3	Medium dense, Very dark brown fine SAND with silt, poorly graded.	SP-SM		4 7 10 11	17								
	4	Medium dense, Very dark gray fine SAND with silt, trace organic fines, poorly graded.	SP-SM		5 7 10 12	17								
	5				7 8 8 10	16								
10		Medium dense, Black fine SAND with silt, trace organic fines, poorly graded.	SP-SM											
	6				7 12 15	27								
15		Dense, Very dark gray fine SAND with silt, trace organic fines, poorly graded.	SP-SM											
	7	Dense, Dark gray fine SAND, trace silt, poorly graded.	SP		8 16 21	37	24	3						
20														
NOTES				GROUND WATER LEVELS										
				▽ AT TIME OF DRILLING 5 ft 10 in *▽ END OF DAY ---										

NEW MAE LOG LAT/LONG-EOD CUTTINGS - NEW TEMPLATE 7-30-12 GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

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PROJECT NO. 0103-0017

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station**PROJECT LOCATION** St. Johns County, Florida**CLIENT** Mott MacDonald Florida, LLC

NEW MAE LOG LAT/LONG-EOD CUTTINGS - NEW TEMPLATE 7-30-12.GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Dense, Dark gray fine SAND, trace silt, poorly graded. <i>(continued)</i>	SP											
25	8	Dense, Very dark gray fine SAND with silt, poorly graded.	SP-SM		11 12 20	32								
30	9	Very dense, Very dark gray fine SAND with silt, trace organic fines, poorly graded.	SP-SM		14 21 32	53								
35	10	Very dense, Very dark brown fine SAND with silt, trace organic fines, poorly graded.	SP-SM		24 44 50/5.5"	94/11.5"								
40	11	Dense, Very dark brown fine SAND with silt, poorly graded.	SP-SM		10 15 21	36								
NOTES 50/5.5" Indicates 50 hammer blows drove split spoon sampler 5.5 inches.					GROUND WATER LEVELS									
					▽ AT TIME OF DRILLING 5 ft 10 in * ▽ END OF DAY ---									

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PROJECT NO. 0103-0017

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station**PROJECT LOCATION** St. Johns County, Florida**CLIENT** Mott MacDonald Florida, LLC

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
45	12	Dense, Very dark brown fine SAND with silt, poorly graded. <i>(continued)</i>	SP-SM											
			5 11 16		27									
		Dense, Dark brown fine SAND with silt, poorly graded.	SP-SM											
50	13	Dense, Dark olive brown fine SAND with silt, poorly graded.	SP-SM		9 16 22	38								
		Bottom of borehole at 50 feet. Boring Grouted upon Termination.												
NOTES					GROUND WATER LEVELS									
					▽ AT TIME OF DRILLING 5 ft 10 in * ▽ END OF DAY ---									

NEW MAE LOG LAT/LONG-EOD_CUTTINGS - NEW TEMPLATE 7-30-12.GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

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**BORING B-9**

PAGE 1 OF 3

PROJECT NO. 0103-0017

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station**PROJECT LOCATION** St. Johns County, Florida**CLIENT** Mott MacDonald Florida, LLC**DATE STARTED** 9/18/19**COMPLETED** 9/18/19**LATITUDE** 30° 5'19.15"N**LONGITUDE** 81°27'50.33"W**DRILLING CONTRACTOR** MAE, PLLC**DRILLING METHOD** Standard Penetration Test**LOGGED BY** P.R.Young**CHECKED BY** W. Josh Mele**GROUND ELEVATION** —**HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (2")												
	1	Loose, Light gray fine SAND, trace root fragments, poorly graded.	SP		1 2 2 3	4								
	2	Loose, Very dark gray fine SAND with silt, trace organic fines, poorly graded.	SP-SM		3 3 3 3	6								
5	3	∇ Medium dense, Very dark brown fine SAND with silt, poorly graded.	SP-SM		4 6 7 7	13								
	4	Dense, Black fine SAND with silt, trace organic fines, poorly graded.	SP-SM		6 9 16 18	25								
	5				7 11 14 20	25								
10		Dense, Very dark brown fine SAND with silt, poorly graded.	SP-SM											
	6				8 11 15	26								
15		Dense, Gray fine SAND, trace silt, poorly graded.	SP											
	7	Dense, Very dark brown fine SAND with silt, poorly graded.	SP-SM		13 18 21	39								
20														
NOTES				GROUND WATER LEVELS										
				∇ AT TIME OF DRILLING 5 ft 0 in * ∇ END OF DAY ---										

NEW MAE LOG LAT/LONG-EOD CUTTINGS - NEW TEMPLATE 7-30-12 GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

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PROJECT NO. 0103-0017

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station**PROJECT LOCATION** St. Johns County, Florida**CLIENT** Mott MacDonald Florida, LLC

NEW MAE LOG LAT/LONG-EOD CUTTINGS - NEW TEMPLATE 7-30-12.GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20														
25	8				12 17 22	39								
		Dense, Very dark brown fine SAND with silt, poorly graded. (continued)	SP-SM											
30	9				10 18 22	40								
35	10				17 40 50/5"	90/11"								
		Very dense, Very dark grayish brown fine SAND with silt, poorly graded.	SP-SM											
40	11				9 15 23	38								
		Dense, Dark olive brown fine SAND with silt, poorly graded.	SP-SM											
NOTES 50/5" Indicates 50 hammer blows drove split spoon sampler 5 inches.					GROUND WATER LEVELS									
					▽ AT TIME OF DRILLING 5 ft 0 in * ▽ END OF DAY ---									

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PROJECT NO. 0103-0017

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station**PROJECT LOCATION** St. Johns County, Florida**CLIENT** Mott MacDonald Florida, LLC

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
		Dense, Dark olive brown fine SAND with silt, poorly graded. <i>(continued)</i>	SP-SM											
45	12		SP-SM		5 8 12	20								
		Medium dense, Dark olive brown fine SAND with silt, poorly graded.	SP-SM											
50	13	Medium dense, Olive brown fine SAND with silt, poorly graded.	SP-SM		5 10 10	20								
		Bottom of borehole at 50 feet. Boring Grouted upon Termination.												
NOTES					GROUND WATER LEVELS									
					▽ AT TIME OF DRILLING 5 ft 0 in * ▽ END OF DAY ---									

NEW MAE LOG LAT/LONG-EOD_CUTTINGS - NEW TEMPLATE 7-30-12.GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station
PROJECT LOCATION St. Johns County, Florida **CLIENT** Mott MacDonald Florida, LLC
DATE STARTED 9/18/19 **COMPLETED** 9/18/19 **LATITUDE** 30° 5'18.95"N **LONGITUDE** 81°27'51.49"W
DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test
LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (6")			1									
	1	Loose, Gray fine SAND, trace silt, poorly graded.	SP		1 1 2 2	3								
	2				3 4 6 3	10								
	3	Medium dense, Very dark gray fine SAND with silt, trace root fragments, poorly graded.	SP-SM		4 6 8 5	14								
	4	Medium dense, Very dark gray fine SAND with silt, poorly graded.	SP-SM		5 6 8 9	14								
	5				6 7 10 10	17								
		Medium dense, Very dark gray fine SAND with silt, trace organic fines, poorly graded.	SP-SM											
	6				10 16 21	37								
		Dense, Very dark brown fine SAND with silt, poorly graded.	SP-SM											
	7	Dense to very dense, Dark grayish brown fine SAND with silt, poorly graded.	SP-SM		10 13 15	28								
20														
NOTES				GROUND WATER LEVELS										
				∇ AT TIME OF DRILLING 4 ft 0 in * ∇ END OF DAY ---										

NEW MAE LOG LAT/LONG-EOD CUTTINGS - NEW TEMPLATE 7-30-12 GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

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PROJECT NO. 0103-0017

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station**PROJECT LOCATION** St. Johns County, Florida**CLIENT** Mott MacDonald Florida, LLC

NEW MAE LOG LAT/LONG-EOD_CUTTINGS - NEW TEMPLATE 7-30-12 GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20														
25	8	Dense to very dense, Dark grayish brown fine SAND with silt, poorly graded. (continued)	SP-SM		10 16 25	41								
30	9				11 19 24	43								
		Very dense, Black fine SAND with silt, trace organic fines, poorly graded.	SP-SM											
35	10				14 21 31	52								
		Very dense to dense, Very dark brown fine SAND with silt, poorly graded.	SP-SM											
40	11				16 25 30	55								
NOTES					GROUND WATER LEVELS									
					▽ AT TIME OF DRILLING 4 ft 0 in * ▽ END OF DAY ---									

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PROJECT NO. 0103-0017

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station**PROJECT LOCATION** St. Johns County, Florida**CLIENT** Mott MacDonald Florida, LLC

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
45	12	Very dense to dense, Very dark brown fine SAND with silt, poorly graded. (continued)	SP-SM		6 11 16	27								
50	13				7 16 16	32								
		Bottom of borehole at 50 feet. Boring Grouted upon Termination.												

NOTES**GROUND WATER LEVELS**

▽ AT TIME OF DRILLING 4 ft 0 in * ▽ END OF DAY ---

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PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station
PROJECT LOCATION St. Johns County, Florida **CLIENT** Mott MacDonald Florida, LLC
DATE STARTED 9/18/19 **COMPLETED** 9/18/19 **LATITUDE** 30° 5'18.43"N **LONGITUDE** 81°27'52.18"W
DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test
LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (3")												
1	1	Loose, Grayish brown fine SAND with silt, trace root fragments, poorly graded.	SP-SM		3 4 3 3	7								
2	2	Medium dense, Dark grayish brown fine SAND with silt, poorly graded.	SP-SM		4 4 6 3	10								
5	3	Loose, Very dark grayish brown fine SAND with silt, poorly graded.	SP-SM		3 3 4 5	7								
4	4				5 6 11 20	17								
5	5				20 18 16 18	34								
10		Medium dense to dense, Very dark brown fine SAND with silt, trace organic fines, poorly graded.	SP-SM											
15	6				13 10 20	30								
20	7	Dense, Very dark brown fine SAND with silt, trace organic fines and root fragments, poorly graded.	SP-SM		10 12 18	30								
NOTES				GROUND WATER LEVELS										
				∇ AT TIME OF DRILLING 3 ft 2 in * ∇ END OF DAY ---										

NEW MAE LOG LAT/LONG-EOD_CUTTINGS - NEW TEMPLATE 7-30-12.GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

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PROJECT NO. 0103-0017

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station**PROJECT LOCATION** St. Johns County, Florida**CLIENT** Mott MacDonald Florida, LLC

NEW MAE LOG LAT/LONG-EOD_CUTTINGS - NEW TEMPLATE 7-30-12 GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Dense, Very dark brown fine SAND with silt, trace organic fines and root fragments, poorly graded. (continued)	SP-SM											
25	8		SP-SM		8 10 11	21								
		Medium dense, Black fine SAND, trace organic fines, poorly graded.	SP-SM											
30	9				18 23 34	57								
35	10		SP-SM		10 17 26	43								
		Very dense, Very dark brown fine SAND with silt, poorly graded.												
40	11		SP		7 9 11	20	29	4						
		Medium dense, Dark olive brown fine SAND, trace silt and clay, poorly graded.												
NOTES				GROUND WATER LEVELS										
				∇ AT TIME OF DRILLING 3 ft 2 in * ∇ END OF DAY ---										

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PROJECT NO. 0103-0017

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station**PROJECT LOCATION** St. Johns County, Florida**CLIENT** Mott MacDonald Florida, LLC

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
		Medium dense, Dark olive brown fine SAND, trace silt and clay, poorly graded. (continued)	SP											
45	12				7 9 10	19								
		Medium dense, Dark olive brown fine SAND with silt, poorly graded.	SP-SM											
50	13				10 13 15	28								
		Dense, Gray fine SAND with clay, poorly graded.	SP-SC											
55	14				12 15 14	29								
		Dense, Gray fine SAND with silt, poorly graded.	SP-SM											
60	15				8 10 19	29								
		Dense, Gray fine SAND with clay, poorly graded.	SP-SC											

NOTES**GROUND WATER LEVELS**

▽ AT TIME OF DRILLING 3 ft 2 in * ▽ END OF DAY ---

NEW MAE LOG LAT/LONG-EOD CUTTINGS - NEW TEMPLATE 7-30-12.GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

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PROJECT NO. 0103-0017

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station**PROJECT LOCATION** St. Johns County, Florida**CLIENT** Mott MacDonald Florida, LLC**DATE STARTED** 9/18/19**COMPLETED** 9/18/19**LATITUDE** 30° 5'19.01"N**LONGITUDE** 81°27'52.32"W**DRILLING CONTRACTOR** MAE, PLLC**DRILLING METHOD** Standard Penetration Test**LOGGED BY** P.R.Young**CHECKED BY** W. Josh Mele**GROUND ELEVATION** —**HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0														
	1	Loose, Gray fine SAND, trace silt, trace root fragments, poorly graded.	SP		2 2 2 3	4								
	2	Medium dense, Dark gray fine SAND with silt, trace root fragments, poorly graded.	SP-SM		2 5 5 8	10								
5	3	Medium dense, Very dark brown fine SAND with silt, trace root fragments, poorly graded.	SP-SM		5 6 11 12	17								
	4				6 6 7 6	13								
10	5	Medium dense, Very dark brown fine SAND with silt, trace organic fines, poorly graded.	SP-SM		11 6 11 12	17								
	6				15 18 18	36								
15		Dense, Very dark brown fine SAND with silt, poorly graded.	SP-SM											
	7	Medium dense, Very dark brown fine SAND with silt, trace root fragments, some wood fragments, poorly graded.	SP-SM		6 6 7	13								
20														
NOTES				GROUND WATER LEVELS										
				▽ AT TIME OF DRILLING 2 ft 0 in *▽ END OF DAY ---										

NEW MAE LOG LAT/LONG-EOD_CUTTINGS - NEW TEMPLATE 7-30-12 GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

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PROJECT NO. 0103-0017

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station**PROJECT LOCATION** St. Johns County, Florida**CLIENT** Mott MacDonald Florida, LLC

NEW MAE LOG LAT/LONG-EOD_CUTTINGS - NEW TEMPLATE 7-30-12 GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Medium dense, Very dark brown fine SAND with silt, trace root fragments, some wood fragments, poorly graded. <i>(continued)</i>	SP-SM											
25	8		SP-SM		15 13 15	28								
		Dense, Black fine SAND with silt, trace organic fines, trace root fragments, poorly graded.	SP-SM											
30	9				22 50/5.5" 0	50/5.5"								
		Very dense to medium dense, Very dark brown fine SAND with silt, poorly graded.	SP-SM											
35	10		SP-SM		7 6 12	18								
40	11		SP-SM		5 8 11	19								
		Medium dense, Very dark grayish brown fine SAND with silt, poorly graded.												
NOTES 50/5.5" Indicates 50 hammer blows drove split spoon sampler 5.5 inches.					GROUND WATER LEVELS									
					▽ AT TIME OF DRILLING 2 ft 0 in * ▽ END OF DAY ---									

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PROJECT NO. 0103-0017

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station**PROJECT LOCATION** St. Johns County, Florida**CLIENT** Mott MacDonald Florida, LLC

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
		Medium dense, Very dark grayish brown fine SAND with silt, poorly graded. <i>(continued)</i>	SP-SM											
45	12		SP-SM		9 9 10	19								
		Medium dense, Dark olive brown fine SAND with silt, poorly graded.	SP-SM											
50	13	Medium dense, Olive gray fine SAND, trace silt, poorly graded.	SP		11 8 15	23								
		Bottom of borehole at 50 feet. Boring Grouted upon Termination.												

NOTES**GROUND WATER LEVELS**

▽ AT TIME OF DRILLING 2 ft 0 in * ▽ END OF DAY ---

NEW MAE LOG LAT/LONG-EOD_CUTTINGS - NEW TEMPLATE 7-30-12.GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station
PROJECT LOCATION St. Johns County, Florida **CLIENT** Mott MacDonald Florida, LLC
DATE STARTED 9/19/19 **COMPLETED** 9/19/19 **LATITUDE** 30° 5'18.24"N **LONGITUDE** 81°27'51.54"W
DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test
LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (4")												
1		Loose, Gray fine SAND, trace silt, trace root fragments, poorly graded.	SP		1 2 2 4	4								
2	▽	Medium dense, Dark gray fine SAND, trace silt, trace root fragments, poorly graded.	SP		3 5 6 7	11								
5					4 5 7 8	12								
4		Medium dense, Very dark grayish brown fine SAND with silt, poorly graded.	SP-SM		4 8 10 10	18								
5					5 7 11 20	18								
10														
6		Medium dense to dense, Very dark gray fine SAND with silt, trace organic fines, poorly graded.	SP-SM		12 20 16	36								
15														
7					13 20 17	37								
20														
NOTES					GROUND WATER LEVELS									
					▽ AT TIME OF DRILLING 3 ft 0 in *▽ END OF DAY ---									

NEW MAE LOG LAT/LONG-EOD_CUTTINGS - NEW TEMPLATE 7-30-12.GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

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PROJECT NO. 0103-0017

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station**PROJECT LOCATION** St. Johns County, Florida**CLIENT** Mott MacDonald Florida, LLC

NEW MAE LOG LAT/LONG-EOD CUTTINGS - NEW TEMPLATE 7-30-12 GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Medium dense to dense, Very dark gray fine SAND with silt, trace organic fines, poorly graded. (continued)	SP-SM											
25	8				10 16 23	39								
		Dense, Dark brown fine SAND with silt, poorly graded.	SP-SM											
30	9				12 17 31	48								
		Very dense, Very dark brown fine SAND with silt, poorly graded.	SP-SM											
35	10				13 26 30	56								
		Very dense, Very dark brown fine SAND with silt, trace organic fines, poorly graded.	SP-SM											
40	11				18 37 35	72								
		Very dense, Very dark gray fine SAND with silt, poorly graded.	SP-SM											
NOTES				GROUND WATER LEVELS										
				∇ AT TIME OF DRILLING 3 ft 0 in * ∇ END OF DAY ---										

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PROJECT NO. 0103-0017

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station**PROJECT LOCATION** St. Johns County, Florida**CLIENT** Mott MacDonald Florida, LLC

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS	
		Very dense, Very dark gray fine SAND with silt, poorly graded. <i>(continued)</i>	SP-SM												
45	12		SP-SM		12 15 16	31									
		Dense, Dark olive brown fine SAND with silt, poorly graded.	SP-SM												
50	13	Medium dense, Olive brown fine SAND with silt, poorly graded.	SP-SM		6 10 15	25									
		Bottom of borehole at 50 feet. Boring Grouted upon Termination.													
NOTES					GROUND WATER LEVELS										
					▽ AT TIME OF DRILLING 3 ft 0 in * ▽ END OF DAY ---										

NEW MAE LOG LAT/LONG-EOD_CUTTINGS - NEW TEMPLATE 7-30-12.GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station
PROJECT LOCATION St. Johns County, Florida **CLIENT** Mott MacDonald Florida, LLC
DATE STARTED 9/19/19 **COMPLETED** 9/19/19 **LATITUDE** 30° 5'18.04"N **LONGITUDE** 81°27'52.70"W
DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test
LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (4")												
1	1	Loose, Dark grayish brown fine SAND, trace silt, poorly graded.	SP		1 3 3 4	6								
2	2	Medium dense, Dark gray fine SAND with silt, poorly graded.	SP-SM		3 5 7 7	12								
5	3	Medium dense, Dark gray fine SAND with silt, trace root fragments, poorly graded.	SP-SM		4 6 8 8	14								
4	4	Medium dense, Black fine SAND with silt, trace organic fines, trace root fragments, poorly graded.	SP-SM		4 6 7 7	13								
5	5				3 6 8 10	14								
10														
15	6	Medium dense, Very dark gray fine SAND with silt, trace organic fines, poorly graded,	SP-SM		6 10 13	23								
20	7	Dense, Very dark brown silty fine SAND, poorly graded.	SM		9 12 14	26								
NOTES					GROUND WATER LEVELS									
					▽ AT TIME OF DRILLING 2 ft 0 in *▽ END OF DAY ---									

NEW MAE LOG LAT/LONG-EOD_CUTTINGS - NEW TEMPLATE 7-30-12.GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

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**BORING B-14**

PAGE 2 OF 3

PROJECT NO. 0103-0017

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station**PROJECT LOCATION** St. Johns County, Florida**CLIENT** Mott MacDonald Florida, LLC

NEW MAE LOG LAT/LONG-EOD_CUTTINGS - NEW TEMPLATE 7-30-12 GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20														
25	8	Dense, Very dark brown silty fine SAND, poorly graded. (continued)	SM		7 9 16	25								
30	9	Dense, Dark brown fine SAND with silt, poorly graded.	SP-SM		9 15 20	35								
35	10				6 10 16	26								
40	11	Dense to medium dense, Dark olive brown fine SAND with silt, poorly graded.	SP-SM		3 7 10	17								
NOTES					GROUND WATER LEVELS									
					▽ AT TIME OF DRILLING 2 ft 0 in * ▽ END OF DAY ---									

(Continued Next Page)

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**BORING B-14**

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



PROJECT NO. 0103-0017

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station**PROJECT LOCATION** St. Johns County, Florida**CLIENT** Mott MacDonald Florida, LLC

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
		Dense to medium dense, Dark olive brown fine SAND with silt, poorly graded. <i>(continued)</i>	SP-SM											
45	12		SP-SM		5 8 13	21								
		Medium dense, Olive brown fine SAND with silt, poorly graded.	SP-SM											
50	13	Medium dense, Dark greenish gray silty fine SAND, poorly graded.	SM		6 8 12	20	29	13						
		Bottom of borehole at 50 feet. Boring Grouted upon Termination.												
NOTES				GROUND WATER LEVELS										
				▽ AT TIME OF DRILLING 2 ft 0 in * ▽ END OF DAY ---										

NEW MAE LOG LAT/LONG-EOD_CUTTINGS - NEW TEMPLATE 7-30-12.GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station
PROJECT LOCATION St. Johns County, Florida **CLIENT** Mott MacDonald Florida, LLC
DATE STARTED 9/20/19 **COMPLETED** 9/20/19 **LATITUDE** 30° 5'14.82"N **LONGITUDE** 81°27'55.61"W
DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test
LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (5")			1	2								
	1	Very loose, Very dark gray fine SAND with silt, trace root fragments, poorly graded.	A-3		1 1 1 1									
	2	Medium dense, Very dark brown fine SAND, trace silt, poorly graded.	A-3		3 6 9 9	15								
5	3				6 7 9 10	16	21	3						
	4	Medium dense, Very dark gray fine SAND with silt, trace wood fragments, poorly graded.	A-3		5 6 6 6	12								
	5				3 5 6 10	11								
10		Bottom of borehole at 10 feet.												
<div> <div>NOTES</div> <div>Boring backfilled with soil cuttings.</div> </div> <div> <div>GROUND WATER LEVELS</div> <div> AT TIME OF DRILLING 2 ft 0 in *END OF DAY --- </div> </div>														

NEW MAE LOG LAT/LONG-EOD_CUTTINGS - NEW TEMPLATE 7-30-12.GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

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BORING B-16

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PROJECT NO. 0103-0017

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station
PROJECT LOCATION St. Johns County, Florida **CLIENT** Mott MacDonald Florida, LLC
DATE STARTED 9/20/19 **COMPLETED** 9/20/19 **LATITUDE** 30° 5'15.57"N **LONGITUDE** 81°27'54.47"W
DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test
LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (5")												
	1	Loose, Very dark gray fine SAND with silt, trace root fragments, poorly graded.	A-3		1 1 2 2	3								
	2	Medium dense, Very dark gray fine SAND with silt, few root fragments, poorly graded.	A-3		1 3 6 7	9								
5	3	Medium dense, Very dark gray fine SAND with silt, trace root fragments, poorly graded.	A-3		5 7 9 10	16								
	4	Medium dense, Dark gray fine SAND with silt, poorly graded.	A-3		4 6 6 10	12								
	5	Medium dense, Very dark gray fine SAND with silt, poorly graded.	A-3		4 7 7 7	14								
10		Bottom of borehole at 10 feet.												

NOTES Boring backfilled with soil cuttings.

GROUND WATER LEVELS

▽ AT TIME OF DRILLING 2 ft 0 in *▽ END OF DAY ---

NEW MAE LOG LAT/LONG-EOD_CUTTINGS - NEW TEMPLATE 7-30-12.GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

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BORING B-17

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PROJECT NO. 0103-0017

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station
PROJECT LOCATION St. Johns County, Florida **CLIENT** Mott MacDonald Florida, LLC
DATE STARTED 9/20/19 **COMPLETED** 9/20/19 **LATITUDE** 30° 5'16.31"N **LONGITUDE** 81°27'53.33"W
DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test
LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

NEW MAE LOG LAT/LONG-EOD_CUTTINGS - NEW TEMPLATE 7-30-12.GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (6")			1									
	1	▽			1 1 1 1	2								
	2	Very loose to medium dense, Dark gray fine SAND, trace silt, trace root fragments, poorly graded.	A-3		1 4 5 7	9	24	1						
5	3				4 7 8 8	15								
	4	Medium dense, Very dark gray fine SAND with silt, poorly graded.	A-3		5 6 8 10	14								
	5				6 7 10 12	17								
10		Bottom of borehole at 10 feet.												

NOTES Boring backfilled with soil cuttings.

GROUND WATER LEVELS

▽ AT TIME OF DRILLING 1 ft 8 in *▽ END OF DAY ---

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BORING B-18

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PROJECT NO. 0103-0017

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station
PROJECT LOCATION St. Johns County, Florida **CLIENT** Mott MacDonald Florida, LLC
DATE STARTED 9/20/19 **COMPLETED** 9/20/19 **LATITUDE** 30° 5'17.08"N **LONGITUDE** 81°27'52.17"W
DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test
LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (5")			1									
1					2	5								
2		Loose, Dark gray fine SAND with silt trace root fragments, poorly graded.	A-3		3									
3					4	4								
4					5									
5		Medium dense, Gray fine SAND with silt, poorly graded.	A-3		6	11								
6					7									
7					8	14								
8					9									
9		Medium dense, Dark gray fine SAND with silt, poorly graded.	A-3		10	12								
10					11									
		Bottom of borehole at 10 feet.												

NOTES Boring backfilled with soil cuttings.

GROUND WATER LEVELS

▽ AT TIME OF DRILLING 2 ft 0 in *▽ END OF DAY ---

NEW MAE LOG LAT/LONG-EOD_CUTTINGS - NEW TEMPLATE 7-30-12.GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

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**BORING B-19**

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PROJECT NO. 0103-0017

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station**PROJECT LOCATION** St. Johns County, Florida**CLIENT** Mott MacDonald Florida, LLC**DATE STARTED** 9/20/19**COMPLETED** 9/20/19**LATITUDE** 30° 5'17.82"N**LONGITUDE** 81°27'52.92"W**DRILLING CONTRACTOR** MAE, PLLC**DRILLING METHOD** Standard Penetration Test**LOGGED BY** P.R.Young**CHECKED BY** W. Josh Mele**GROUND ELEVATION** —**HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (5")			1									
1		Loose, Dark gray fine SAND, trace silt, few root fragments, poorly graded.	A-3		1 1 2 2	3								
2		Loose, Dark gray fine SAND with silt, trace root fragments, poorly graded.	A-3		1 2 2 2	4								
5		Medium dense, Dark gray fine SAND with silt, few root fragments, poorly graded.	A-3		3 6 8 8	14								
4		Medium dense, Very dark gray fine SAND with silt, poorly graded.	A-3		4 6 9 7	15								
5					4 3 9 10	12								
10		Bottom of borehole at 10 feet.												
<div> <div>NOTES</div> <div>Boring backfilled with soil cuttings.</div> </div> <div> <div>GROUND WATER LEVELS</div> <div> <div>AT TIME OF DRILLING</div> <div>2 ft 2 in</div> <div>END OF DAY</div> <div>---</div> </div> </div>														

NEW MAE LOG LAT/LONG-EOD_CUTTINGS - NEW TEMPLATE 7-30-12.GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

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**BORING B-20**

PAGE 1 OF 1

PROJECT NO. 0103-0017

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station**PROJECT LOCATION** St. Johns County, Florida**CLIENT** Mott MacDonald Florida, LLC**DATE STARTED** 9/23/19**COMPLETED** 9/23/19**LATITUDE** 30° 5'18.58"N**LONGITUDE** 81°27'53.32"W**DRILLING CONTRACTOR** MAE, PLLC**DRILLING METHOD** Standard Penetration Test**LOGGED BY** D.McLellan**CHECKED BY** W. Josh Mele**GROUND ELEVATION** —**HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (2")												
1		Loose, Very dark gray fine SAND, trace silt, few root fragments, poorly graded.	A-3		3 3 3 3	6								
2					4 3 5 4	8								
3					6 7 12 12	19								
4		Medium dense, Dark gray fine SAND with silt, poorly graded.	A-3		9 7 6 7	13								
5					6 7 9 9	16								
10		Bottom of borehole at 10 feet.												
NOTES Boring backfilled with soil cuttings.					GROUND WATER LEVELS									
					▽ AT TIME OF DRILLING 1 ft 9 in *▽ END OF DAY ---									

NEW MAE LOG LAT/LONG-EOD_CUTTINGS - NEW TEMPLATE 7-30-12.GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station
PROJECT LOCATION St. Johns County, Florida **CLIENT** Mott MacDonald Florida, LLC
DATE STARTED 9/23/19 **COMPLETED** 9/23/19 **LATITUDE** 30° 5'18.70"N **LONGITUDE** 81°27'54.12"W
DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test
LOGGED BY D.McLellan **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (2")												
1	1	Loose, Very dark gray fine SAND, trace silt, trace root fragments, poorly graded.	A-3		1 1 2 1	3								
2	2	Loose, Very dark gray fine SAND, trace silt, few organic fines and root fragments, poorly graded.	A-3		2 1 5 6	6	56	3						
5	3	Medium dense, Grayish brown fine SAND with silt, poorly graded.	A-3		6 8 7 7	15								
4	4				6 6 7 7	13								
10	5	Medium dense, Very dark gray fine SAND with silt, trace organic fines, poorly graded.	A-3		5 6 4 7	10								
		Bottom of borehole at 10 feet.												

NOTES Boring backfilled with soil cuttings.

GROUND WATER LEVELS

▽ AT TIME OF DRILLING 1 ft 11 in *▽ END OF DAY ---

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station
PROJECT LOCATION St. Johns County, Florida **CLIENT** Mott MacDonald Florida, LLC
DATE STARTED 9/23/19 **COMPLETED** 9/23/19 **LATITUDE** 30° 5'19.61"N **LONGITUDE** 81°27'54.94"W
DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test
LOGGED BY D.McLellan **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (3")												
1	1	Very loose, Dark gray fine SAND, trace silt, trace root fragments, poorly graded.	A-3		2	2								
2	2	Loose to medium dense, Dark gray fine SAND, trace silt, trace root fragments, poorly graded.	A-3		3	7	29	4						
3	3				4									
4	4				5									
5	5	Medium dense, Dark grayish brown fine SAND with silt, poorly graded.	A-3		6	14								
6	6				7									
7	7				8									
8	8				9	16								
9	9				10									
10	10													Bottom of borehole at 10 feet.
NOTES Boring backfilled with soil cuttings.				GROUND WATER LEVELS										
				∇ AT TIME OF DRILLING 1 ft 7 in * ∇ END OF DAY ---										

NEW MAE LOG LAT/LONG-EOD_CUTTINGS - NEW TEMPLATE 7-30-12.GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station
PROJECT LOCATION St. Johns County, Florida **CLIENT** Mott MacDonald Florida, LLC
DATE STARTED 9/23/19 **COMPLETED** 9/23/19 **LATITUDE** 30° 5'20.24"N **LONGITUDE** 81°27'54.11"W
DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test
LOGGED BY D.McLellan **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0														
	1	Loose, Dark gray fine SAND, trace silt, few root fragments and wood fragments, poorly graded.	A-3		1 1 2 2	3								
	2	Loose, Dark gray fine SAND with silt, trace root fragments, poorly graded.	A-3		2 2 2 4	4								
5	3	Medium dense, Gray fine SAND with silt, poorly graded.	A-3		8 9 12 12	21								
	4				9 8 7 7	15								
	5				6 7 9 9	16								
10		Bottom of borehole at 10 feet.												
<div> <div>NOTES</div> <div>Boring backfilled with soil cuttings.</div> </div> <div> <div>GROUND WATER LEVELS</div> <div> AT TIME OF DRILLING 2 ft 6 in *END OF DAY --- </div> </div>														

NEW MAE LOG LAT/LONG-EOD_CUTTINGS - NEW TEMPLATE 7-30-12.GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ



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PROJECT NO. 0103-0017

CLIENT Mott MacDonald Florida, LLC

COMPLETED 9/23/19

LATITUDE 30° 5'19.30"N

LONGITUDE 81°27'53.06"W

DRILLING CONTRACTOR MAE, PLLC

DRILLING METHOD Standard Penetration Test

LOGGED BY D.McLellan

CHECKED BY W. Josh Mele

GROUND ELEVATION

HAMMER TYPE Automatic

[illegible]

NOTES Boring backfilled with soil cuttings.

GROUND WATER LEVELS

▽ AT TIME OF DRILLING 2 ft 9 in *▽ END OF DAY ---

NEW MAE LOG LAT/LONG-EOD CUTTINGS - NEW TEMPLATE 7-30-12.GDT - 10/8/19 16:15 - F:\GINT\GINT FILES\PROJECTS\0103-0017\TWIN CREEKS.GPJ

FIELD EXPLORATION PROCEDURES

Standard Penetration Test (SPT) Borings

The Standard Penetration Test (SPT) boring(s) are performed in general accordance with the latest revision of ASTM D1586, "Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils." In some cases, the borings are advanced manually from the ground surface using a hand-held bucket auger to a depth of approximately 5 feet if there are possible shallow utility conflicts. Otherwise, the borings are advanced using rotary drilling techniques. A split-barrel sampler is inserted to the bottom of the borehole at each sampling interval. The sampler is driven 18 to 24 inches into the soil using a 140-pound hammer falling an average height of 30 inches per hammer blow. The number of hammer blows for the final 12 inches of penetration (18" sample) or for the sum of the middle 12 inches of penetration (24" sample) is termed the "penetration resistance, blow count, or N-value." This value is an index to several in-situ geotechnical properties of the material tested, such as relative density and Young's Modulus.

After driving the sampler, it was retrieved from the borehole and representative samples of the material within the split-barrel were containerized and sealed. After completing the drilling operations, the samples for each boring were transported to the laboratory where they were examined by our engineer in order to verify the field descriptions.

Once the boring is complete and the groundwater level is measured, the borehole is backfilled with soil, or it is backfilled from bottom to top with a lean cementitious grout.

KEY TO BORING LOGS – AASHTO

Soil Classification

Soil classification of samples obtained at the boring locations is based on the American Association of State Highway and Transportation Officials (AASHTO) Classification System. Coarse grained soils have more than 50% of their dry weight retained on a #200 sieve. Their principal descriptors are: sand, cobbles and boulders. Fine grained soils have less than 50% of their dry weight retained on a #200 sieve. They are principally described as clays if they are plastic and silts if they are slightly to non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

BORING LOG LEGEND	
Symbol	Description
N	Standard Penetration Resistance, the number of blows required to advance a standard spoon sampler 12" when driven by a 140-lb hammer dropping 30".
WOR	Split Spoon sampler advanced under the weight of the drill rods
WOH	Split Spoon sampler advanced under the weight of the SPT hammer
50/2"	Indicates 50 hammer blows drove the split spoon 2 inches; 50 Hammer blows for less than 6-inches of split spoon driving is considered "Refusal".
(SP)	Unified Soil Classification System
-200	Fines content, % Passing No. 200 U.S. Standard Sieve
w	Natural Moisture Content (%)
OC	Organic Content (%)
LL	Liquid Limit
PI	Plasticity Index
NP	Non-Plastic
PP	Pocket Penetrometer in tons per square foot (tsf)

MODIFIERS	
SECONDARY CONSTITUENTS (Sand, Silt or Clay)	
Trace	Less than 5%
With	5% to 12%
Sandy, Silty or Clayey	12% to 35%
Very Sandy, Very Silty or Very Clayey	35% to 50%
ORGANIC CONTENT	
Trace	2% or less
With	3% to 5%
Organic Soils	5% to 20%
Highly Organic Soils (Muck)	20% to 75%
PEAT	Greater than 75%
MINOR COMPONENTS (Shell, Rock, Debris, Roots, etc.)	
Trace	Less than 5%
Few	5% to 10%
Little	15% to 25%
Some	30% to 45%

RELATIVE DENSITY (Coarse-Grained Soils)	
Relative Density	N-Value *
Very Loose	Less than 3
Loose	3 to 8
Medium Dense	8 to 24
Dense	24 to 40
Very Dense	Greater than 40
CONSISTENCY (Fine-Grained Soils)	
Consistency	N-Value *
Very Soft	Less than 1
Soft	1 to 3
Firm	3 to 6
Stiff	6 to 12
Very Stiff	12 to 24
Hard	Greater than 24
RELATIVE HARDNESS (Limestone)	
Relative Hardness	N-Value *
Soft	Less than 50
Hard	Greater than 50

* Using Automatic Hammer

KEY TO BORING LOGS – USCS

Soil Classification

Soil classification of samples obtained at the boring locations is based on the Unified Soil Classification System (USCS). Coarse grained soils have more than 50% of their dry weight retained on a #200 sieve. Their principal descriptors are: sand, cobbles and boulders. Fine grained soils have less than 50% of their dry weight retained on a #200 sieve. They are principally described as clays if they are plastic and silts if they are slightly to non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

BORING LOG LEGEND	
Symbol	Description
N	Standard Penetration Resistance, the number of blows required to advance a standard spoon sampler 12" when driven by a 140-lb hammer dropping 30".
WOR	Split Spoon sampler advanced under the weight of the drill rods
WOH	Split Spoon sampler advanced under the weight of the SPT hammer
50/2"	Indicates 50 hammer blows drove the split spoon 2 inches; 50 Hammer blows for less than 6-inches of split spoon driving is considered "Refusal".
(SP)	Unified Soil Classification System
-200	Fines content, % Passing No. 200 U.S. Standard Sieve
w	Natural Moisture Content (%)
OC	Organic Content (%)
LL	Liquid Limit
PI	Plasticity Index
NP	Non-Plastic
PP	Pocket Penetrometer in tons per square foot (tsf)

MODIFIERS	
SECONDARY CONSTITUENTS (Sand, Silt or Clay)	
Trace	Less than 5%
With	5% to 12%
Sandy, Silty or Clayey	12% to 35%
Very Sandy, Very Silty or Very Clayey	35% to 50%
ORGANIC CONTENT	
Trace	Less than 5%
Organic Soils	5% to 20%
Highly Organic Soils (Muck)	20% to 75%
PEAT	Greater than 75%
MINOR COMPONENTS (Shell, Rock, Debris, Roots, etc.)	
Trace	Less than 5%
Few	5% to 10%
Little	15% to 25%
Some	30% to 45%

RELATIVE DENSITY (Coarse-Grained Soils)	
Relative Density	N-Value *
Very Loose	Less than 3
Loose	3 to 8
Medium Dense	8 to 24
Dense	24 to 40
Very Dense	Greater than 40
CONSISTENCY (Fine-Grained Soils)	
Consistency	N-Value *
Very Soft	Less than 1
Soft	1 to 3
Firm	3 to 6
Stiff	6 to 12
Very Stiff	12 to 24
Hard	Greater than 24
RELATIVE HARDNESS (Limestone)	
Relative Hardness	N-Value *
Soft	Less than 50
Hard	Greater than 50

* Using Automatic Hammer

AASHTO Soil Classification System

(from AASHTO M 145 or ASTM D 3282)

General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5* A-7-6*
Sieve Analysis, % passing:											
2.00 mm (No. 10)	50 max	...	...	...	...	...	...	...	...	...	...
0.425 (No. 40)	30 max	50 max	51 min	...	...	...	...	...	...	...	...
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40):											
Liquid Limit	...		...	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General <i>local</i> ** rating as a subgrade	excellent to good			fair to poor							

* Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL - 30

** Northeast Florida

Unified Soil Classification System (USCS)

(from ASTM D 2487)

Major Divisions			Group Symbol	Typical Names
Coarse-Grained Soils More than 50% retained on the 0.075 mm (No. 200) sieve	Gravels 50% or more of coarse fraction retained on the 4.75 mm (No. 4) sieve	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		Gravels with Fines	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands 50% or more of coarse fraction passes the 4.75 (No. 4) sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		Sands with Fines	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
Fine-Grained Soils More than 50% passes the 0.075 mm (No. 200) sieve	Silts and Clays Liquid Limit 50% or less		ML	Inorganic silts, very fine sands, rock four, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly/sandy/silty/lean clays
			OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays Liquid Limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
			CH	Inorganic clays or high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat, muck, and other highly organic soils

Prefix: G = Gravel, S = Sand, M = Silt, C = Clay, O = Organic

Suffix: W = Well Graded, P = Poorly Graded, M = Silty, L = Clay, LL < 50%, H = Clay, LL > 50%

Appendix B

TABLE 1
Summary of Laboratory Test Results
JEA Twin Creeks Reclaimed Water Storage Tanks and Booster Pump Station
MAE Project No.: 0103-0017

Boring No.	Sample No.	Approximate Depth (ft) ⁽¹⁾	Natural Moisture Content (%)	Percent Passing #200 (%)	Liquid Limit	Plasticity Index	Organic Content (%)	USCS/AASHTO Classification
B-1	6	13.5 to 15	25	6	---	---	8.9	SP-SM
B-2	5	8 to 10	29	1	---	---	---	SP
B-3	6	13.5 to 15	24	7	---	---	---	SP-SM
B-5	2	2 to 4	40	3	---	---	---	SP
B-7	4	6 to 8	53	4	---	---	13.0	SP
B-7	12	43.5 to 45	29	3	---	---	---	SP
B-8	7	18.5 to 20	24	3	---	---	---	SP
B-11	11	38.5 to 40	29	4	---	---	---	SP
B-14	13	48.5 to 50	29	13	---	---	---	SM
B-15	3	4 to 6	21	3	---	---	---	A-3
B-17	2	2 to 4	24	1	---	---	---	A-3
B-21	2	2 to 4	56	3	---	---	---	A-3
B-22	2	2 to 4	29	4	---	---	---	A-3
(1) Feet below existing ground surface.								

LABORATORY TEST PROCEDURES

Percent Fines Content

The percent fines or material passing the No. 200 mesh sieve of the sample tested was determined in general accordance with the latest revision of ASTM D 1140. The percent fines are the soil particles in the silt and clay size range.

Natural Moisture Content

The water content of the tested sample was determined in general accordance with the latest revision of ASTM D 2216. The water content is defined as the ratio of “pore” or “free” water in a given mass of material to the mass of solid material particles.

Organic Loss on Ignition (Percent Organics)

The organic loss on ignition or percent organic material in the sample tested was determined in general accordance with ASTM D 2974. The percent organics is the material, expressed as a percentage, which is burned off in a muffle furnace at 455 ± 10 degrees Celsius.

November 13, 2019

Ms. Leslie Samel, P.E.
Mott MacDonald Florida, LLC
10245 Centurion Parkway, Suite 320
Jacksonville, Florida 32256

Reference: Report of Supplemental Test Pit Exploration
JEA Twin Creeks Reclaimed Water Storage Tanks and Re-Pump Station
St. Johns County, Florida
MAE Project No. 0103-0017A

Dear Ms. Samel:

Meskel & Associates Engineering, PLLC (MAE) has completed a supplemental test pit exploration at the referenced site. Per your request, we revisited the site on November 8, 2019 and observed back-hoe excavated test pits at several locations within the footprint area of the two planned Ground Storage Tanks (GST). This report was prepared to document our findings and related recommendations and should be considered as an addendum to our final geotechnical report for the project.

1.0 PROJECT INFORMATION

The site is currently developed with the JEA Twin Creeks WRF, which is being expanded to the south and west. One of the borings (B-7) advanced during our subsurface exploration for the proposed expansion encountered fine sands with organic fines and some root fragments within the footprint area of the planned GST No. 2, from a depth of 6 to 8 feet below the existing grade. Our draft geotechnical report for the project, dated October 11, 2019, contained recommendations for shallow foundation support of the planned GST with the provision that any deleterious materials/soils be removed to their entire extent below the proposed GST footprint. The intent of this supplemental test pit exploration was to provide data to better evaluate the lateral and vertical extents of the unsuitable soils and deleterious materials that would require removal and replacement.

2.0 TEST PIT EXPLORATION

A MAE representative visited the site on November 8, 2019 to observe test pits excavated with a track-mounted excavator. Our field representative documented the subsurface conditions encountered at each explored location. The test pit locations are indicated on the attached *Test Pit Location Plan*, Figure 2A. Before our exploration, the approximate centers of each of the planned GSTs were located via the staked locations from our previous exploration. Using these stakes as reference, the test pit locations were measured approximately 30 feet off of the center of each GST within the tank peripheries. As an exception, test pit TP-1 was excavated at the center of GST No. 2 at the location of boring B-7 where the deleterious material was originally encountered. The test pit locations, as shown on Figure 2A, should be considered accurate only to the degree implied by the method of measurement used. A total of 9 test pits were excavated to a maximum depth of approximately 10 feet below the existing ground surface. Upon completion, the test pits were backfilled with excavated soils that were compacted in lifts with the backhoe shovel.



3.0 SUBSURFACE CONDITIONS

The attached *Generalized Soil Profiles*, Figures 10 through 11, graphically illustrate the subsurface conditions encountered at each test pit location. A summary of the encountered conditions is discussed below.

In general, the test pits encountered fine sands and fine sands with silt (SP, SP-SM) to their termination depths of up to 10 feet below the existing ground surface. Sands containing trace to few amounts of small roots and organic fines were encountered from ground surface to up to 8 feet below the existing grade. Despite not being noted on the Test Pit logs, a surficial topsoil layer was identified and approximated to be between 4 to 6 inches thick.

Groundwater was encountered at all of the test pit locations at depths ranging from approximately 4 to 7.5 feet below the existing ground surface at the time of excavation.

4.0 CONCLUSIONS

As described above, this supplemental exploration was performed to better estimate the lateral and vertical extents of any unsuitable soils and deleterious materials that would require removal and replacement. Boring B-7, advanced within the center of the planned GST No. 2 encountered a layer of potentially unsuitable soils between depths of 6 to 8 feet. Test pit TP-1, excavated at the original boring B-7 location (i.e., the center of the planned GST No. 2) encountered the same layer, and supported the information recorded from our initial exploration. However, the roots encountered were small in size (i.e., typically ¼-inch to no greater than 1-inch in diameter) and not of a significant abundance. The same conditions were encountered at the other excavated test pits throughout the vertical depths explored. Therefore, it is our opinion that the soil conditions within the area of the planned GST's are suitable for support of the planned GST structures provided that the site preparation and earthwork recommendations in Section 6.0 of our final geotechnical report dated November 13, 2019 are followed.

5.0 REPORT LIMITATIONS

This report has been prepared for the exclusive use of Mott MacDonald Florida, LLC and the JEA for specific application to the design and construction of the *JEA Twin Creeks Reclaimed Water Storage and Re-Pump Station* project. Our work for this project was performed in accordance with generally accepted geotechnical engineering practice. No warranty, express or implied, is made.

The conclusions contained in this supplemental report are based on the data obtained from the test pits performed at the referenced site. This testing indicates subsurface conditions only at the specific locations and times, and only to the depths explored. These results do not reflect subsurface variations that may exist away from the test pit locations and/or at depths below the test pit termination depths. Subsurface conditions and water levels at other locations may differ from conditions occurring at the tested locations. In addition, it should be understood that the passage of time may result in a change in the conditions at the tested locations. If variations in subsurface conditions from those described in this report are observed during construction, the recommendations in this report must be reevaluated.

If changes in the design or location of the GST structures occur, the conclusions contained in this report may need to be modified. We recommend that these changes be provided to us for our consideration. MAE is not responsible for conclusions, interpretations, opinions or recommendations made by others based on the data contained in this report.

6.0 CLOSURE

We appreciate this opportunity to be of continued service as your geotechnical consultant on this phase of the project. If you have any questions, or if we may be of any further service, please contact us.

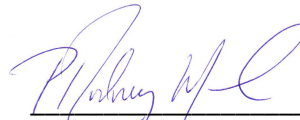
Sincerely,

MESKEL & ASSOCIATES ENGINEERING, PLLC

MAE FL Certificate of Authorization No. 28142



W. Josh Mele, E.I.
Staff Engineer



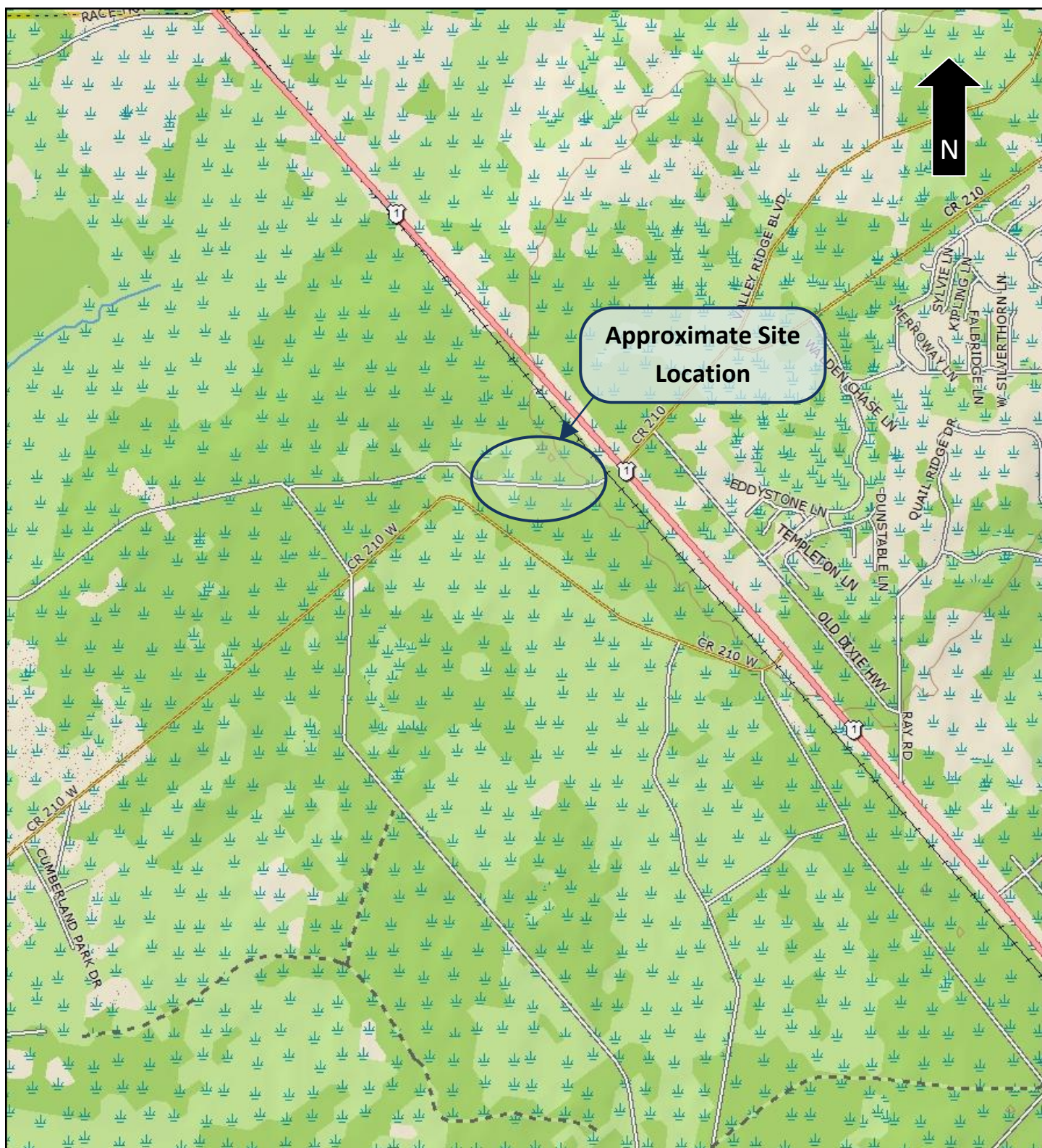
P. Rodney Mank, P.E.
Principal Engineer
Licensed, Florida No. 41986

Distribution: Ms. Leslie Samel, P.E., – Mott MacDonald Florida, LLC


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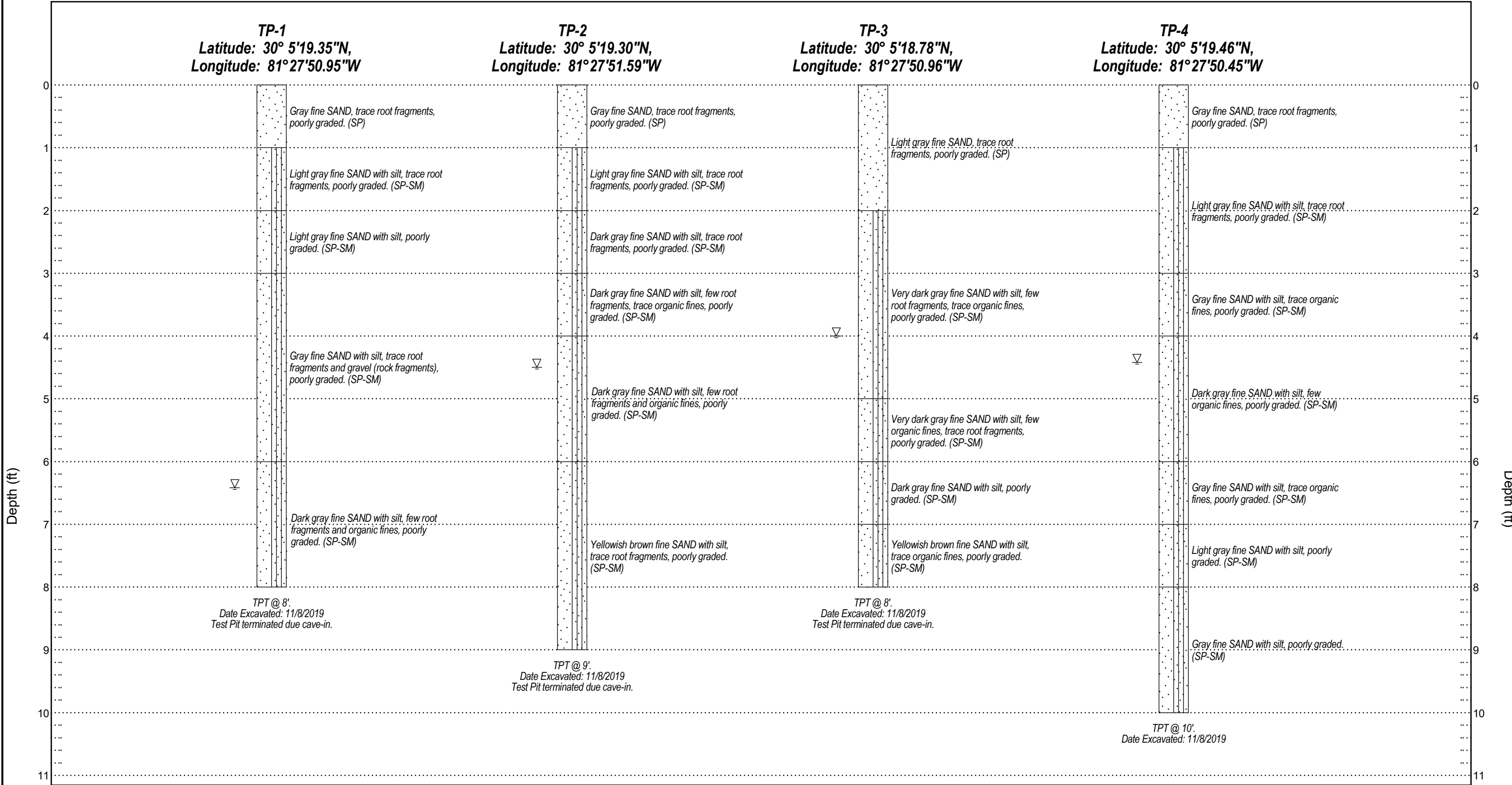
ATTACHMENTS

- Figure 1. Site Location Map
- Figure 2A. Test Pit Location Plan
- Figures 10-11. Generalized Soil Profiles
- Test Pit Logs



Site Location Map

PREPARED BY		PROJECT NAME	
		JEA Twin Creeks Reclaimed Water Storage Tanks and Re-Pump Station Supplemental Test Pit Exploration St. Johns County, Florida	
		REFERENCE	SCALE
		Delorme XMap 7.0	NTS
PREPARED FOR		MAE PROJECT NO.	FIGURE NO.
Mott MacDonald Florida, LLC		0103-0017A	1



Fine Sand

Fine Sand with Silt

(SP)

Unified Soil Classification System (USCS)

▽

Depth to Groundwater at Time of Drilling

TPT

Test Pit Terminated at Depth Below Grade

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
------	----	-------------	------	----	-------------

P. RODNEY MANK, P.E. P.E. NO.: 41986

MAE

Meskel & Associates Engineering

FL Certificate of Authorization No. 28142

3728 Philips Highway, Suite 208, Jacksonville, FL 32207

Mott MacDonald Florida, LLC

DATE	MAE PROJECT NO.
11/12/2019	0103-0017A

SHEET TITLE:

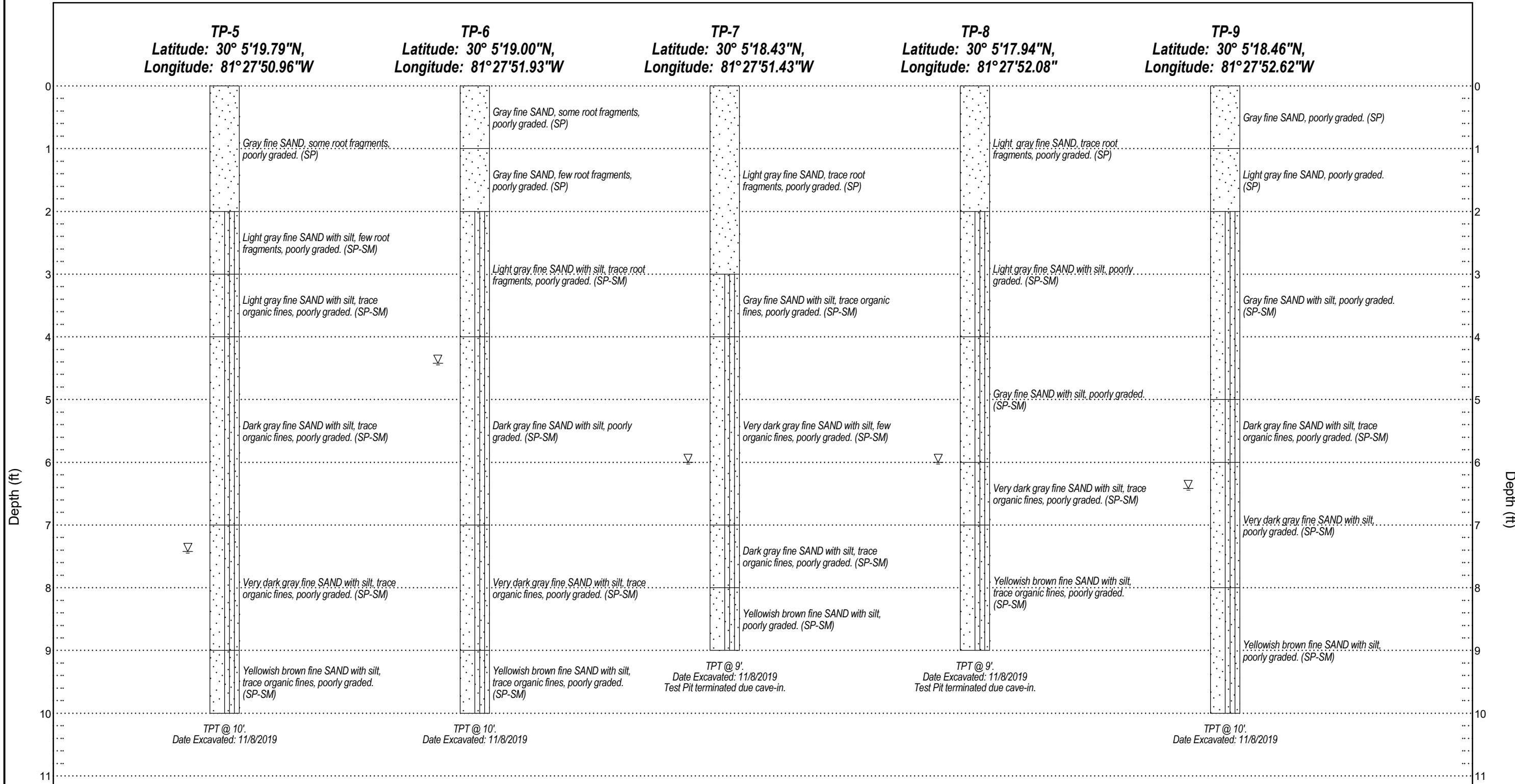
Generalized Soil Profiles

PROJECT NAME:

JEA Twin Creeks Reclaimed Water Storage Tanks and Re-Pump Station
Supplemental Test Pit Exploration
St. Johns County, Florida

FIGURE NO.

10



Legend

 Fine Sand

 Fine Sand with Silt

(SP) Unified Soil Classification System (USCS)

 Depth to Groundwater at Time of Drilling

TPT Test Pit Terminated at Depth Below Grade

REVISIONS					<div><div>P. RODNEY MANK, P.E. P.E. NO.: 41986</div><div> Meskel & Associates Engineering FL Certificate of Authorization No. 28142 3728 Philips Highway, Suite 208, Jacksonville, FL 32207</div></div>	Mott MacDonald Florida, LLC		SHEET TITLE: <i>Generalized Soil Profiles</i>		
DATE	BY	DESCRIPTION	DATE	BY		DESCRIPTION	DATE	MAE PROJECT NO.	PROJECT NAME:	FIGURE NO.
							11/12/2019	0103-0017A	JEA Twin Creeks Reclaimed Water Storage Tanks and Re-Pump Station Supplemental Test Pit Exploration St. Johns County, Florida	11

Meskel & Associates Engineering, PLLC

FL Certificate of Authorization No. 28142

3728 Philips Highway, Suite 208

Jacksonville, FL 32207

P: (904)519-6990 F: (904)519-6992

**TEST PIT TP-1**

PAGE 1 OF 1

PROJECT NO. 0103-0017A

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Re-Pump Station-Supplemental Test Pit Exploration**PROJECT LOCATION** St. Johns County, Florida**CLIENT** Mott MacDonald Florida, LLC**DATE STARTED** 11/8/19**COMPLETED** 11/8/19**LATITUDE** 30° 5'19.35"N**LONGITUDE** 81°27'50.95"W**EXCAVATION CONTRACTOR** MAE, PLLC**EXCAVATION METHOD** Test Pit**LOGGED BY** C.Arteaga**CHECKED BY** W. Josh Mele**GROUND ELEVATION** —**HAMMER TYPE** —






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DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	REMARKS
0.0										
	1	Gray fine SAND, trace root fragments, poorly graded.	SP							
	2	Light gray fine SAND with silt, trace root fragments, poorly graded.	SP-SM							
2.5	3	Light gray fine SAND with silt, poorly graded.	SP-SM							
	4									
	5	Gray fine SAND with silt, trace root fragments and gravel (rock fragments), poorly graded.	SP-SM							
5.0	6									
	7	▽								
	8	Dark gray fine SAND with silt, few root fragments and organic fines, poorly graded.	SP-SM							
7.5										
		Bottom of test pit at 8 feet. Test Pit terminated due cave-in.								

NOTES**GROUND WATER LEVELS**

▽ AT TIME OF EXCAVATION 6 ft 5 in *▽ END OF DAY ---

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Re-Pump Station-Supplemental Test Pit Exploration
PROJECT LOCATION St. Johns County, Florida **CLIENT** Mott MacDonald Florida, LLC
DATE STARTED 11/8/19 **COMPLETED** 11/8/19 **LATITUDE** 30° 5'18.78"N **LONGITUDE** 81°27'50.96"W
EXCAVATION CONTRACTOR MAE, PLLC **EXCAVATION METHOD** Test Pit
LOGGED BY C.Arteaga **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** —

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	REMARKS
0.0	1	Light gray fine SAND, trace root fragments, poorly graded.	SP							
	2									
2.5	3	Very dark gray fine SAND with silt, few root fragments, trace organic fines, poorly graded.	SP-SM							
	4									
	5									
5.0	6	Very dark gray fine SAND with silt, few organic fines, trace root fragments, poorly graded.	SP-SM							
	7	Dark gray fine SAND with silt, poorly graded.	SP-SM							
7.5	8	Yellowish brown fine SAND with silt, trace organic fines, poorly graded.	SP-SM							
		Bottom of test pit at 8 feet. Test Pit terminated due cave-in.								

NOTES _____

GROUND WATER LEVELS

▽ AT TIME OF EXCAVATION 4 ft 0 in *▽ END OF DAY ---



Meskel & Associates Engineering

PAGE 1 OF 1

PROJECT NO. 0103-0017A

PROJECT LOCATION St. Johns County, Florida

CLIENT Mott MacDonald Florida, LLC

DATE STARTED 11/8/19

COMPLETED 11/8/19

LATITUDE 30° 5'19.46"N

LONGITUDE 81°27'50.45"W

EXCAVATION CONTRACTOR MAE, PLLC

EXCAVATION METHOD Test Pit

LOGGED BY C.Arteaga

CHECKED BY W. Josh Mele

GROUND ELEVATION

HAMMER TYPE —

[illegible]

Bottom of test pit at 10 feet.

NOTES

GROUND WATER LEVELS

▽ AT TIME OF EXCAVATION 4 ft 5 in * ▽ END OF DAY ---

NEW MAE TEST PIT-USCS2018 - NEW TEMPLATE 7-30-12.GDT - 11/12/19 11:26 - F:\GINT\GINT FILES\PROJECTS\0103-0017A\TWIN CREEK-TEST PIT\S.GPJ

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Re-Pump Station-Supplemental Test Pit Exploration
PROJECT LOCATION St. Johns County, Florida **CLIENT** Mott MacDonald Florida, LLC
DATE STARTED 11/8/19 **COMPLETED** 11/8/19 **LATITUDE** 30° 5'19.79"N **LONGITUDE** 81°27'50.96"W
EXCAVATION CONTRACTOR MAE, PLLC **EXCAVATION METHOD** Test Pit
LOGGED BY C.Arteaga **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** —

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	REMARKS
0.0	1									
	2	Gray fine SAND, some root fragments, poorly graded.	SP							
2.5	3	Light gray fine SAND with silt, few root fragments, poorly graded.	SP-SM							
	4	Light gray fine SAND with silt, trace organic fines, poorly graded.	SP-SM							
5.0	5									
	6	Dark gray fine SAND with silt, trace organic fines, poorly graded.	SP-SM							
	7									
7.5	8	▽								
	9	Very dark gray fine SAND with silt, trace organic fines, poorly graded.	SP-SM							
	10	Yellowish brown fine SAND with silt, trace organic fines, poorly graded.	SP-SM							
10.0										
Bottom of test pit at 10 feet.										
NOTES				GROUND WATER LEVELS						
				▽ AT TIME OF EXCAVATION 7 ft 5 in *▽ END OF DAY ---						

NEW MAE TEST PIT-USCS2018 - NEW TEMPLATE 7-30-12 GDT - 11/12/19 11:26 - F:\GINT\GINT FILES\PROJECTS\0103-0017A\TWIN CREEK-TEST PITS.GPJ

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Re-Pump Station-Supplemental Test Pit Exploration
PROJECT LOCATION St. Johns County, Florida **CLIENT** Mott MacDonald Florida, LLC
DATE STARTED 11/8/19 **COMPLETED** 11/8/19 **LATITUDE** 30° 5'19.00"N **LONGITUDE** 81°27'51.93"W
EXCAVATION CONTRACTOR MAE, PLLC **EXCAVATION METHOD** Test Pit
LOGGED BY C.Arteaga **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** —

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	REMARKS
0.0	1	Gray fine SAND, some root fragments, poorly graded.	SP							
	2	Gray fine SAND, few root fragments, poorly graded.	SP							
2.5	3	Light gray fine SAND with silt, trace root fragments, poorly graded.	SP-SM							
	4									
	5	Dark gray fine SAND with silt, poorly graded.	SP-SM							
5.0	6									
	7									
	8	Very dark gray fine SAND with silt, trace organic fines, poorly graded.	SP-SM							
7.5	9									
	10	Yellowish brown fine SAND with silt, trace organic fines, poorly graded.	SP-SM							
10.0										

NOTES Bottom of test pit at 10 feet.

GROUND WATER LEVELS

▽ AT TIME OF EXCAVATION 4 ft 5 in *▽ END OF DAY ---

NEW MAE TEST PIT-USCS2018 - NEW TEMPLATE 7-30-12.GDT - 11/12/19 11:26 - F:\GINT\GINT FILES\PROJECTS\0103-0017A\TWIN CREEK-TEST PITS.GPJ

Meskel & Associates Engineering, PLLC

FL Certificate of Authorization No. 28142

3728 Philips Highway, Suite 208

Jacksonville, FL 32207

P: (904)519-6990 F: (904)519-6992

**TEST PIT TP-7**

PAGE 1 OF 1

PROJECT NO. 0103-0017A

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Re-Pump Station-Supplemental Test Pit Exploration**PROJECT LOCATION** St. Johns County, Florida**CLIENT** Mott MacDonald Florida, LLC**DATE STARTED** 11/8/19**COMPLETED** 11/8/19**LATITUDE** 30° 5'18.43"N**LONGITUDE** 81°27'51.43"W**EXCAVATION CONTRACTOR** MAE, PLLC**EXCAVATION METHOD** Test Pit**LOGGED BY** C.Arteaga**CHECKED BY** W. Josh Mele**GROUND ELEVATION** —**HAMMER TYPE** —






NEW MAE TEST PIT-USCS2018 - NEW TEMPLATE 7-30-12.GDT - 11/12/19 11:26 - F:\GINT\GINT FILES\PROJECTS\0103-0017A\TWIN CREEK-TEST PITS.GPJ

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	REMARKS
0.0	1									
	2									
	3	Light gray fine SAND, trace root fragments, poorly graded.	SP							
2.5	4									
	5	Gray fine SAND with silt, trace organic fines, poorly graded.	SP-SM							
5.0	6									
	7	Very dark gray fine SAND with silt, few organic fines, poorly graded.	SP-SM							
	8									
7.5	9	Dark gray fine SAND with silt, trace organic fines, poorly graded.	SP-SM							
		Yellowish brown fine SAND with silt, poorly graded.	SP-SM							
		Bottom of test pit at 9 feet. Test Pit terminated due cave-in.								

NOTES**GROUND WATER LEVELS**

▽ AT TIME OF EXCAVATION 6 ft 0 in *▽ END OF DAY ---

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Re-Pump Station-Supplemental Test Pit Exploration
PROJECT LOCATION St. Johns County, Florida **CLIENT** Mott MacDonald Florida, LLC
DATE STARTED 11/8/19 **COMPLETED** 11/8/19 **LATITUDE** 30° 5'17.94"N **LONGITUDE** 81°27'52.08"
EXCAVATION CONTRACTOR MAE, PLLC **EXCAVATION METHOD** Test Pit
LOGGED BY C.Arteaga **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** —

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	REMARKS
0.0	1	Light gray fine SAND, trace root fragments, poorly graded.	SP							
	2									
2.5	3	Light gray fine SAND with silt, poorly graded.	SP-SM							
	4									
5.0	5	Gray fine SAND with silt, poorly graded.	SP-SM							
	6									
	7	Very dark gray fine SAND with silt, trace organic fines, poorly graded.	SP-SM							
7.5	8	Yellowish brown fine SAND with silt, trace organic fines, poorly graded.	SP-SM							
	9									
		Bottom of test pit at 9 feet. Test Pit terminated due cave-in.								

NOTES _____

GROUND WATER LEVELS

▽ AT TIME OF EXCAVATION 6 ft 0 in *▽ END OF DAY ---

PROJECT NAME JEA Twin Creeks Reclaimed Water Storage Tanks and Re-Pump Station-Supplemental Test Pit Exploration
PROJECT LOCATION St. Johns County, Florida **CLIENT** Mott MacDonald Florida, LLC
DATE STARTED 11/8/19 **COMPLETED** 11/8/19 **LATITUDE** 30° 5'18.46"N **LONGITUDE** 81°27'52.62"W
EXCAVATION CONTRACTOR MAE, PLLC **EXCAVATION METHOD** Test Pit
LOGGED BY C.Arteaga **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** —

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	REMARKS
0.0	1	Gray fine SAND, poorly graded.	SP							
	2	Light gray fine SAND, poorly graded.	SP							
2.5	3	Gray fine SAND with silt, poorly graded.	SP-SM							
	4									
	5									
5.0	6	Dark gray fine SAND with silt, trace organic fines, poorly graded.	SP-SM							
	7	Very dark gray fine SAND with silt, poorly graded.	SP-SM							
	8									
7.5	9	Yellowish brown fine SAND with silt, poorly graded.	SP-SM							
	10									
10.0										

NOTES	Bottom of test pit at 10 feet. Test Pit terminated due cave-in.	GROUND WATER LEVELS
		▽ AT TIME OF EXCAVATION 6 ft 5 in *▽ END OF DAY ---

NEW MAE TEST PIT-USCS2018 - NEW TEMPLATE 7-30-12.GDT - 11/12/19 11:26 - F:\GINT\GINT FILES\PROJECTS\0103-0017A\TWIN CREEK-TEST PITS.GPJ

Appendix B

Permits



FLORIDA DEPARTMENT OF Environmental Protection

Northeast District
8800 Baymeadows Way West, Suite 100
Jacksonville, Florida 32256

Ron DeSantis
Governor

Jeanette Nuñez
Lt. Governor

Noah Valenstein
Secretary

Notification of Acceptance of Use of a General Permit

Mr. Brian Phillips
Manager
JEA
21 W Church Street, T4
Jacksonville, Florida 32202
philbr@jea.com

General Permit Number: 0159044-862-DSGP
**Project Name: JEA Twin Creeks Reclaimed
Water Re-Pump Station Improvements**
County: St. Johns
Effective Date: May 14, 2020
Expiration Date: May 13, 2025
Water Supplier: JEA Major Grid
PWS ID: 2161328

Dear Mr. Phillips:

On May 14, 2020, the Florida Department of Environmental Protection received a “*Notice of Intent to Use the General Permit for Construction of Water Main Extensions for PWSs*” [DEP Form No 62-555.900(7)], under the provisions of Rule 62-4.530 and Chapter 62-555, Florida Administrative Code (F.A.C.). The proposed project includes 515 LF of 8" PVC watermain, 5 LF of 6" PVC watermain, and 1,590 LF of 1.5" PVC watermain.

Based upon the submitted Notice and accompanying documentation, this correspondence is being sent to advise that the Department does not object to the use of such general permit at this time. Please be advised that the permittee is required to abide by Rule 62-555.405, F.A.C., all applicable rules in Chapters 62-4, 62-550, 62-555, F.A.C., and the General Conditions for All General Drinking Water Permits (found in 62-4.540, F.A.C.).

The permittee shall comply with all sampling requirements specific to this project. These requirements are attached for review and implementation.

Pursuant to Rule 62-555.345, F.A.C., the permittee shall submit a certification of construction completion [DEP Form No. 62-555.900(9)] to the Department and obtain approval, or clearance, from the Department before placing any water main extension constructed under this general permit into operation for any purpose other than disinfection or testing for leaks.

Within 30 days after the sale or legal transfer of ownership of the permitted project that has not been cleared for service in total by the Department, both the permittee and the proposed permittee shall sign and submit an application for transfer of the permit using Form 62-555.900(8), F.A.C., with the appropriate fee. The permitted construction is not authorized past the 30-day period unless the permit has been transferred.

JEA Twin Creeks Reclaimed Water Re-Pump Station Improvements

0159044-862-DSGP

Page 2 of 3

May 14, 2020

This permit will expire five years from the effective date. If the project has been started and not completed by that time, a new permit must be obtained before the expiration date in order to continue work on the project, per Rule 62-4.030, F.A.C.

Sincerely,

A handwritten signature in black ink that reads "Jeffrey S. Martin". The signature is written in a cursive, flowing style.

Jeffrey S. Martin, P.E.

Chief Engineer

Permitting Program

c:

Leslie S. Samel, PE., leslie.samel@mottmac.com

Danielle Jacobs, danielle.jacobs@mottmac.com

Thomas Bartol, bartTJ@jea.com, waldzw@jea.com, hayngp@jea.com, jeaenvsrtc@jea.com,
wrigjt@jea.com

DEP: Jeff Martin, P.E., Brian Durden, Olivia Miserandino

**A Civil Penalty May Be Incurred
if this project is placed into operation before obtaining a clearance from this office.**

Requirements for clearance upon completion of projects are as follows:

1) Clearance Form

Submission of a fully completed Department of Environmental Protection (DEP) Form 62-555.900(9), *Certification of Construction Completion and Request for Clearance to Place Permitted PWS Components into Operation*.

2) Record Drawings, if deviations were made

Submission of the portion of record drawings showing deviations from the DEP construction permit, including preliminary design report or drawings and specifications, if there are any deviations from said permit. (Note that it is necessary to submit a copy of only the portion of record drawings showing deviations and not a complete set of record drawings.)

3) Bacteriological Results

Copies of satisfactory bacteriological analysis (a.k.a. Main Clearance), taken within sixty (60) days of completion of construction, from locations within the distribution system or water main extension to be cleared, in accordance with Rules 62-555.315(6), 62-555.340, and 62-555.330, F.A.C. and American Water Works Association (AWWA) Standard C 651-92, as follows:

- The endpoint of the proposed addition;
- Any water lines branching off a main extension;
- Every 1,200 feet of water main;
- Each location shall be sampled on two consecutive days (at least 6 hours apart) with sample point locations and chlorine residual readings clearly indicated on the report and/or drawings.
- A sketch or description of all bacteriological sampling locations must also be provided.
- Bacteriological sample results will be considered unacceptable if the tests were completed more than 60 days before the Department receives the results.

For further clarification, contact:
FDEP – Northeast District
Potable Water Permitting
8800 Baymeadows Way West, Suite 100
Jacksonville, Florida 32256
(904) 256-1700



FLORIDA DEPARTMENT OF Environmental Protection

Northeast District
8800 Baymeadows Way West, Suite 100
Jacksonville, Florida 32256

Ron DeSantis
Governor

Jeanette Nuñez
Lt. Governor

Noah Valenstein
Secretary

April 3, 2020

In the Matter of an
Application for Permit by:

Mr. Paul K Steinbrecher, PE
Vice President, Environmental Services
JEA
21 West Church Street, T-8
Jacksonville, Florida 32202-3155
Phone: (904) 665-5653
Email: steipk@jea.com

File Number: FL0174441-026-DW1/MR
St. Johns County
Blacks Ford WRF

NOTICE OF PERMIT REVISION

Enclosed is Permit Number FL0174441 to operate the Blacks Ford WRF, which is an existing 6.0 MGD annual average daily flow (AADF) domestic wastewater treatment facility. The final treated effluent/reclaimed water is reused via spray irrigation to public access sites as a primary method of disposal. The surface water discharge (discharge to Blacks Ford Wetland) is used as an alternative disposal method.

This permit revision includes construction of the Twin Creeks Reclaimed Water Ground Storage and Re-Pump Station project. The reclaimed water ground storage will have a capacity of 3.0 million gallon consisting of two new 1.5-million-gallon tanks (*Tank (1): 120 ft interior diameter, 19.75 ft wall height, 1.672 million gallons nominal volume; Tank (2): 90 ft interior diameter, 34.33 ft wall height, 1.635 million gallons nominal volume*). The re-pump station will be constructed in three phases. Phase 1 includes three 200 Hp (2,750 gpm at 199.7 ft) horizontal split case centrifugal pumps (two duty and one standby) and one 125 Hp (1,375 gpm at 190.2 ft) jockey re-pump operating in parallel to provide a rated capacity of 6,875 gpm. Phase 2 includes four 200 Hp (2,750 gpm at 199.7 ft) horizontal split case centrifugal pumps (three duty and one standby) and one 125 Hp (1,375 gpm at 190.2 ft) jockey re-pump operating in parallel to provide a rated capacity of 9,625 gpm. Phase 3 includes five 200 Hp (2,750 gpm at 199.7 ft) horizontal split case centrifugal pumps (four duty and one standby) to provide a rated capacity of 11,000 gpm.

The re-pump station will also include a pump building, chemical feed system (sodium hypochlorite), yard piping, electrical and instrumentation facilities, and a generator. New reclaimed water supply and discharge mains are proposed to connect the Twin Creeks re-pumping station to the existing 20-inch reclaimed water main on the northwest side of the facility property. The proposed supply main will be 20-inch and the proposed discharge main from the facility will be 24-inch decreasing to 20-inch to tie into the existing reclaimed water main. There are not any changes to the permit conditions or monitoring requirements. All requirements and conditions of

the existing permit shall remain in effect and enforceable until the permit expires. The facility is located at latitude 30° 04' 39.38" N, longitude 81° 35' 5.56" W at 1310-100 Roberts Road, southeast of Fruit Cove, Jacksonville, Florida 32259, St. Johns County.

The permit is issued under Chapter 403, Florida Statutes, Chapters 62-4, 62-110, 62-160, 62-302, 62-303, 62-522, 62-600, 62-602, 62-604, 62-610, 62-611, 62-620, 62-640, 62-650, 62-699 and other applicable rules of the Florida Administrative Code.

The permittee shall continue to monitor and report in accordance with the permit requirements.

NOTICE OF RIGHTS

This action is final and effective on the date filed with the Clerk of the Department unless a petition for an administrative hearing is timely filed under Sections 120.569 and 120.57, F.S., before the deadline for filing a petition. On the filing of a timely and sufficient petition, this action will not be final and effective until further order of the Department. Because the administrative hearing process is designed to formulate final agency action, the hearing process may result in a modification of the agency action or even denial of the application.

Petition for Administrative Hearing

A person whose substantial interests are affected by the Department's action may petition for an administrative proceeding (hearing) under Sections 120.569 and 120.57, F.S. Pursuant to Rules 28-106.201 and 28-106.301, F.A.C., a petition for an administrative hearing must contain the following information:

- (a) The name and address of each agency affected and each agency's file or identification number, if known;
- (b) The name, address, any e-mail address, any facsimile number, and telephone number of the petitioner, if the petitioner is not represented by an attorney or a qualified representative; the name, address, and telephone number of the petitioner's representative, if any, which shall be the address for service purposes during the course of the proceeding; and an explanation of how the petitioner's substantial interests will be affected by the agency determination;
- (c) A statement of when and how the petitioner received notice of the agency decision;
- (d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate;
- (e) A concise statement of the ultimate facts alleged, including the specific facts that the petitioner contends warrant reversal or modification of the agency's proposed action;
- (f) A statement of the specific rules or statutes that the petitioner contends require reversal or modification of the agency's proposed action, including an explanation of how the alleged facts relate to the specific rules or statutes; and
- (g) A statement of the relief sought by the petitioner, stating precisely the action that the petitioner wishes the agency to take with respect to the agency's proposed action.

The petition must be filed (received by the Clerk) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-

3000, or via electronic correspondence at Agency_Clerk@dep.state.fl.us. Also, a copy of the petition shall be mailed to the applicant at the address indicated above at the time of filing.

Time Period for Filing a Petition

In accordance with Rule 62-110.106(3), F.A.C., petitions for an administrative hearing by the applicant and persons entitled to written notice under Section 120.60(3), F.S., must be filed within 14 days of receipt of this written notice. Petitions filed by any persons other than the applicant, and other than those entitled to written notice under Section 120.60(3), F.S., must be filed within 14 days of publication of the notice or within 14 days of receipt of the written notice, whichever occurs first. You cannot justifiably rely on the finality of this decision unless notice of this decision and the right of substantially affected persons to challenge this decision has been duly published or otherwise provided to all persons substantially affected by the decision. While you are not required to publish notice of this action, you may elect to do so pursuant Rule 62-110.106(10)(a), F.A.C.

The failure to file a petition within the appropriate time period shall constitute a waiver of that person's right to request an administrative determination (hearing) under Sections 120.569 and 120.57, F.S., or to intervene in this proceeding and participate as a party to it. Any subsequent intervention (in a proceeding initiated by another party) will be only at the discretion of the presiding officer upon the filing of a motion in compliance with Rule 28-106.205, F.A.C. If you do not publish notice of this action, this waiver may not apply to persons who have not received a clear point-of-entry.

Extension of Time

Under Rule 62-110.106(4), F.A.C., a person whose substantial interests are affected by the Department's action may also request an extension of time to file a petition for an administrative hearing. The Department may, for good cause shown, grant the request for an extension of time. Requests for extension of time must be filed with the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000, or via electronic correspondence at Agency_Clerk@dep.state.fl.us, before the deadline for filing a petition for an administrative hearing. A timely request for extension of time shall toll the running of the time period for filing a petition until the request is acted upon.

Mediation

Mediation is not available in this proceeding.

Judicial Review

Once this decision becomes final, any party to this action has the right to seek judicial review pursuant to Section 120.68, F.S., by filing a Notice of Appeal pursuant to Florida Rules of Appellate Procedure 9.110 and 9.190 with the Clerk of the Department in the Office of General Counsel (Station #35, 3900 Commonwealth Boulevard, Tallahassee, Florida 32399-3000) and by filing a copy of the Notice of Appeal accompanied by the applicable filing fees with the appropriate district court of appeal. The notice must be filed within 30 days from the date this action is filed with the Clerk of the Department.

EXECUTION AND CLERKING

Executed in Jacksonville, Florida.

STATE OF FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION



Thomas G. Kallemeyn
Permitting Program Administrator

Enclosure

CC:

Ed Cordova, P.E. (JEA), corded@jea.com

Katie Bizub, P.E. (JEA), bizukj@jea.com

Leslie S. Samel, P.E. (Mott McDonald), Leslie.Samel@mottmac.com

Lindsey Tracey, Lindsey.Tracey@mottmac.com

Danielle Jacobs, danielle.jacobs@mottmac.com

St. Johns County Health Department, noreen.nickola-williams@flhealth.gov

Thomas G. Kallemeyn, FDEP

D. Anh Vo, PE, FDEP

CERTIFICATE OF SERVICE-FILING AND ACKNOWLEDGMENT

FILED, on April 3, 2020, pursuant to Section 120.52, F.S., with the designated Department Clerk, receipt of which is hereby acknowledged. The undersigned duly designated deputy clerk hereby certifies that this permit and all copies were sent on the filing date below to the following listed persons:



Clerk

April 3, 2020

Date



St. Johns River

Water Management District

Ann B. Shortelle, Ph.D., Executive Director

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

April 21, 2020

Brian Phillips
JEA
21 W. Church St
Jacksonville, FL 32202

SUBJECT: 93875-11
JEA Reclaimed Water Re-Pump Station @ Twin Creeks Light Industrial Park

Dear Sir/Madam:

Enclosed is your individual permit issued by the St. Johns River Water Management District on April 21, 2020. This permit is a legal document and should be kept with your other important documents. Permit issuance does not relieve you from the responsibility of obtaining any necessary permits from any federal, state, or local agencies for your project.

Technical Staff Report:

If you wish to review a copy of the Technical Staff Report (TSR) that provides the District's staff analysis of your permit application, you may view the TSR by going to the Permitting section of the District's website at www.sjrwmd.com/permitting. Using the "search applications and permits" feature, you can use your permit number or project name to find information about the permit. When you see the results of your search, click on the permit number and then on the TSR folder.

Noticing Your Permit:

For noticing instructions, please refer to the noticing materials in this package regarding closing the point of entry for someone to challenge the issuance of your permit. Please note that if a timely petition for administrative hearing is filed, your permit will become non-final and any activities that you choose to undertake pursuant to your permit will be at your own risk. Please refer to the attached Notice of Rights to determine any legal rights you may have concerning the District's agency action.

Compliance with Permit Conditions:

To submit your required permit compliance information, go to the District's website at www.sjrwmd.com/permitting. Under the "Apply for a permit or submit compliance data" section, click to sign-in to your existing account or to create a new account. Select the "Compliance Submittal" tab, enter your permit number, and select "No Specific Date" for the Compliance Due Date Range. You will then be able to view all the compliance submittal requirements for your project. Select the compliance item that you are ready to submit and then attach the appropriate information or form. The forms to comply with your permit conditions are available at www.sjrwmd.com/permitting under the section "Handbooks, forms, fees, final orders". Click on forms to view all permit compliance forms, then scroll to the ERP application forms section and select the applicable compliance forms. Alternatively, if you have difficulty finding forms or need

GOVERNING BOARD

Douglas Burnett, CHAIRMAN
ST. AUGUSTINE

Ron Howse, TREASURER
COCOA

Douglas C. Bournique
VERO BEACH

Daniel Davis
JACKSONVILLE

Susan Dolan
SANFORD

copies of the appropriate forms, please contact the Bureau of Regulatory Support at (386) 329-4570.

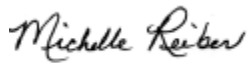
Transferring Your Permit:

Your permit requires you to notify the District within 30 days of any change in ownership or control of the project or activity covered by the permit, or within 30 days of any change in ownership or control of the real property on which the permitted project or activity is located or occurs. You will need to provide the District with the information specified in rule 62-330.340, Florida Administrative Code (F.A.C.). Generally, this will require you to complete and submit Form 62-330.340(1), "Request to Transfer Permit," available at <http://www.sjrwmd.com/permitting/permitforms.html>.

Please note that a permittee is liable for compliance with the permit before the permit is transferred. The District, therefore, recommends that you request a permit transfer in advance in accordance with the applicable rules. You are encouraged to contact District staff for assistance with this process.

Thank you and please let us know if you have additional questions. For general questions contact e-permit@sjrwmd.com or (386) 329-4570.

Sincerely,



Michelle Reiber, Bureau Chief
Division of Regulatory Services
St. Johns River Water Management District
525 Community College Parkway, S.E.
Palm Bay, FL 32909
(321) 409-2129

Enclosures: Permit
Notice of Rights
List of Newspapers for Publication

cc: District Permit File

Steven D. White
Mott MacDonald
220 W. Garden St.
Ste. 700
Pensacola, FL 32502

ST. JOHNS RIVER WATER MANAGEMENT DISTRICT
Post Office Box 1429
Palatka, Florida 32178-1429

PERMIT NO: 93875-11

DATE ISSUED: April 21, 2020

PROJECT NAME: JEA Reclaimed Water Re-Pump Station @ Twin Creeks Light Industrial Park

A PERMIT AUTHORIZING:

Minor Modification of Permit No. 93875-9 for JEA Reclaimed Water Re-Pump station @ Twin Creeks Light Industrial Park to include the construction and operation of a 3.02 project as per plans received by the District on April 17, 2020.

LOCATION:

Section(s): 16, 11, 10, 9 Township(s): 5S Range(s): 28E
St. Johns County

Receiving Water Body:

Name	Class
Sampson Creek	III Fresh

ISSUED TO:

JEA
21 W. Church St
Jacksonville, FL 32202

The permittee agrees to hold and save the St. Johns River Water Management District and its successors harmless from any and all damages, claims, or liabilities which may arise from permit issuance. Said application, including all plans and specifications attached thereto, is by reference made a part hereof.

This permit does not convey to the permittee any property rights nor any rights or privileges other than those specified herein, nor relieve the permittee from complying with any law, regulation or requirement affecting the rights of other bodies or agencies. All structures and works installed by permittee hereunder shall remain the property of the permittee.

This permit may be revoked, modified or transferred at any time pursuant to the appropriate provisions of Chapter 373, Florida Statutes.

PERMIT IS CONDITIONED UPON:

See conditions on attached "Exhibit A", dated April 21, 2020

AUTHORIZED BY: St. Johns River Water Management District
Division of Regulatory Services



By:

Lisl Townsend
Supervising Regulatory Scientist

"EXHIBIT A"
CONDITIONS FOR ISSUANCE OF PERMIT NUMBER 93875-11
JEA Reclaimed Water Re-Pump Station @ Twin Creeks Light Industrial Park
DATED April 21, 2020

1. All activities shall be implemented following the plans, specifications and performance criteria approved by this permit. Any deviations must be authorized in a permit modification in accordance with Rule 62-330.315, F.A.C. Any deviations that are not so authorized may subject the permittee to enforcement action and revocation of the permit under Chapter 373, F.S.
2. A complete copy of this permit shall be kept at the work site of the permitted activity during the construction phase, and shall be available for review at the work site upon request by the District staff. The permittee shall require the contractor to review the complete permit prior to beginning construction.
3. Activities shall be conducted in a manner that does not cause or contribute to violations of state water quality standards. Performance-based erosion and sediment control best management practices shall be installed immediately prior to, and be maintained during and after construction as needed, to prevent adverse impacts to the water resources and adjacent lands. Such practices shall be in accordance with the State of Florida Erosion and Sediment Control Designer and Reviewer Manual (Florida Department of Environmental Protection and Florida Department of Transportation June 2007), and the Florida Stormwater Erosion and Sedimentation Control Inspector's Manual (Florida Department of Environmental Protection, Nonpoint Source Management Section, Tallahassee, Florida, July 2008), which are both incorporated by reference in subparagraph 62-330.050(9)(b)5, F.A.C., unless a project-specific erosion and sediment control plan is approved or other water quality control measures are required as part of the permit.
4. At least 48 hours prior to beginning the authorized activities, the permittee shall submit to the District a fully executed Form 62-330.350(1), "Construction Commencement Notice," (October 1, 2013) (<http://www.flrules.org/Gateway/reference.asp?No=Ref-02505>), incorporated by reference herein, indicating the expected start and completion dates. A copy of this form may be obtained from the District, as described in subsection 62-330.010(5), F.A.C., and shall be submitted electronically or by mail to the Agency. However, for activities involving more than one acre of construction that also require a NPDES stormwater construction general permit, submittal of the Notice of Intent to Use Generic Permit for Stormwater Discharge from Large and Small Construction Activities, DEP Form 62-621.300(4)(b), shall also serve as notice of commencement of construction under this chapter and, in such a case, submittal of Form 62-330.350(1) is not required.
5. Unless the permit is transferred under Rule 62-330.340, F.A.C., or transferred to an operating entity under Rule 62-330.310, F.A.C., the permittee is liable to comply with the plans, terms and conditions of the permit for the life of the project or activity.
6. Within 30 days after completing construction of the entire project, or any independent portion of the project, the permittee shall provide the following to the Agency, as applicable:
 - a. For an individual, private single-family residential dwelling unit, duplex, triplex, or quadruplex — "Construction Completion and Inspection Certification for Activities Associated with a Private Single-Family Dwelling Unit" [Form 62-330.310(3)]; or
 - b. For all other activities — "As-Built Certification and Request for Conversion to Operation Phase" [Form 62-330.310(1)].

c. If available, an Agency website that fulfills this certification requirement may be used in lieu of the form.

7. If the final operation and maintenance entity is a third party:

a. Prior to sales of any lot or unit served by the activity and within one year of permit issuance, or within 30 days of as-built certification, whichever comes first, the permittee shall submit, as applicable, a copy of the operation and maintenance documents (see sections 12.3 thru 12.3.4 of Volume I) as filed with the Florida Department of State, Division of Corporations and a copy of any easement, plat, or deed restriction needed to operate or maintain the project, as recorded with the Clerk of the Court in the County in which the activity is located.

b. Within 30 days of submittal of the as- built certification, the permittee shall submit "Request for Transfer of Environmental Resource Permit to the Perpetual Operation and Maintenance Entity" [Form 62-330.310(2)] to transfer the permit to the operation and maintenance entity, along with the documentation requested in the form. If available, an Agency website that fulfills this transfer requirement may be used in lieu of the form.

8. The permittee shall notify the District in writing of changes required by any other regulatory District that require changes to the permitted activity, and any required modification of this permit must be obtained prior to implementing the changes.

9. This permit does not:

a. Convey to the permittee any property rights or privileges, or any other rights or privileges other than those specified herein or in Chapter 62-330, F.A.C.;

b. Convey to the permittee or create in the permittee any interest in real property;

c. Relieve the permittee from the need to obtain and comply with any other required federal, state, and local authorization, law, rule, or ordinance; or

d. Authorize any entrance upon or work on property that is not owned, held in easement, or controlled by the permittee.

10. Prior to conducting any activities on state-owned submerged lands or other lands of the state, title to which is vested in the Board of Trustees of the Internal Improvement Trust Fund, the permittee must receive all necessary approvals and authorizations under Chapters 253 and 258, F.S. Written authorization that requires formal execution by the Board of Trustees of the Internal Improvement Trust Fund shall not be considered received until it has been fully executed.

11. The permittee shall hold and save the District harmless from any and all damages, claims, or liabilities that may arise by reason of the construction, alteration, operation, maintenance, removal, abandonment or use of any project authorized by the permit.

12. The permittee shall notify the District in writing:

a. Immediately if any previously submitted information is discovered to be inaccurate; and

b. Within 30 days of any conveyance or division of ownership or control of the property or the system, other than conveyance via a long-term lease, and the new owner shall

request transfer of the permit in accordance with Rule 62-330.340, F.A.C. This does not apply to the sale of lots or units in residential or commercial subdivisions or condominiums where the stormwater management system has been completed and converted to the operation phase.

13. Upon reasonable notice to the permittee, District staff with proper identification shall have permission to enter, inspect, sample and test the project or activities to ensure conformity with the plans and specifications authorized in the permit.
14. If prehistoric or historic artifacts, such as pottery or ceramics, projectile points, stone tools, dugout canoes, metal implements, historic building materials, or any other physical remains that could be associated with Native American, early European, or American settlement are encountered at any time within the project site area, the permitted project shall cease all activities involving subsurface disturbance in the vicinity of the discovery. The permittee or other designee shall contact the Florida Department of State, Division of Historical Resources, Compliance Review Section (DHR), at (850) 245-6333, as well as the appropriate permitting agency office. Project activities shall not resume without verbal or written authorization from the Division of Historical Resources. If unmarked human remains are encountered, all work shall stop immediately and the proper authorities notified in accordance with Section 872.05, F.S. For project activities subject to prior consultation with the DHR and as an alternative to the above requirements, the permittee may follow procedures for unanticipated discoveries as set forth within a cultural resources assessment survey determined complete and sufficient by DHR and included as a specific permit condition herein.
15. Any delineation of the extent of a wetland or other surface water submitted as part of the permit application, including plans or other supporting documentation, shall not be considered binding unless a specific condition of this permit or a formal determination under Rule 62-330.201, F.A.C., provides otherwise.
16. The permittee shall provide routine maintenance of all components of the stormwater management system to remove trapped sediments and debris. Removed materials shall be disposed of in a landfill or other uplands in a manner that does not require a permit under Chapter 62-330, F.A.C., or cause violations of state water quality standards.
17. This permit is issued based on the applicant's submitted information that reasonably demonstrates that adverse water resource-related impacts will not be caused by the completed permit activity. If any adverse impacts result, the District will require the permittee to eliminate the cause, obtain any necessary permit modification, and take any necessary corrective actions to resolve the adverse impacts.
18. A Recorded Notice of Environmental Resource Permit may be recorded in the county public records in accordance with Rule 62-330.090(7), F.A.C. Such notice is not an encumbrance upon the property.
19. This permit for construction will expire five years from the date of issuance.
20. All wetland areas or water bodies that are outside the specific limits of construction authorized by this permit must be protected from erosion, siltation, scouring or excess turbidity, and dewatering.
21. This permit does not authorize the permittee to cause any adverse impact to or "take" of state listed species and other regulated species of fish and wildlife. Compliance with state laws regulating the take of fish and wildlife is the responsibility of the owner or applicant associated with this project. Please refer to Chapter 68A-27 of the Florida Administrative Code for definitions of "take" and a list of fish and wildlife species. If listed species are

observed onsite, FWC staff are available to provide decision support information or assist in obtaining the appropriate FWC permits. Most marine endangered and threatened species are statutorily protected and a “take” permit cannot be issued. Requests for further information or review can be sent to FWCConservationPlanningServices@MyFWC.com.

22. The site improvements must be constructed and operated in accordance with the plans received by the District on April 17, 2020.
23. This permit does not authorize impacts to wetlands or any other surface waters.

Notice Of Rights

1. A person whose substantial interests are or may be affected has the right to request an administrative hearing by filing a written petition with the St. Johns River Water Management District (District). Pursuant to Chapter 28-106 and Rule 40C-1.1007, Florida Administrative Code, the petition must be filed (received) either by delivery at the office of the District Clerk at District Headquarters, P. O. Box 1429, Palatka Florida 32178-1429 (4049 Reid St., Palatka, FL 32177) or by e-mail with the District Clerk at Clerk@sjrwmd.com, within twenty-six (26) days of the District depositing the notice of District decision in the mail (for those persons to whom the District mails actual notice), within twenty-one (21) days of the District emailing the notice of District decision (for those persons to whom the District emails actual notice), or within twenty-one (21) days of newspaper publication of the notice of District decision (for those persons to whom the District does not mail or email actual notice). A petition must comply with Sections 120.54(5)(b)4. and 120.569(2)(c), Florida Statutes, and Chapter 28-106, Florida Administrative Code. The District will not accept a petition sent by facsimile (fax), as explained in paragraph no. 4 below.
2. Please be advised that if you wish to dispute this District decision, mediation may be available and that choosing mediation does not affect your right to an administrative hearing. If you wish to request mediation, you must do so in a timely-filed petition. If all parties, including the District, agree to the details of the mediation procedure, in writing, within 10 days after the time period stated in the announcement for election of an administrative remedy under Sections 120.569 and 120.57, Florida Statutes, the time limitations imposed by Sections 120.569 and 120.57, Florida Statutes, shall be tolled to allow mediation of the disputed District decision. The mediation must be concluded within 60 days of the date of the parties' written agreement, or such other timeframe agreed to by the parties in writing. Any mediation agreement must include provisions for selecting a mediator, a statement that each party shall be responsible for paying its pro-rata share of the costs and fees associated with mediation, and the mediating parties' understanding regarding the confidentiality of discussions and documents introduced during mediation. If mediation results in settlement of the administrative dispute, the District will enter a final order consistent with the settlement agreement. If mediation terminates without settlement of the dispute, the District will notify all the parties in writing that the administrative hearing process under Sections 120.569 and 120.57, Florida Statutes, is resumed. Even if a party chooses not to engage in formal mediation, or if formal mediation does not result in a settlement agreement, the District will remain willing to engage in informal settlement discussions.
3. A person whose substantial interests are or may be affected has the right to an informal administrative hearing pursuant to Sections 120.569 and 120.57(2), Florida Statutes, where no material facts are in dispute. A petition for an informal hearing must also comply with the requirements set forth in Rule 28-106.301, Florida Administrative Code.

Notice Of Rights

4. A petition for an administrative hearing is deemed filed upon receipt of the complete petition by the District Clerk at the District Headquarters in Palatka, Florida during the District's regular business hours. The District's regular business hours are 8:00 a.m. – 5:00 p.m., excluding weekends and District holidays. Petitions received by the District Clerk after the District's regular business hours shall be deemed filed as of 8:00 a.m. on the District's next regular business day. The District's acceptance of petitions filed by e-mail is subject to certain conditions set forth in the District's Statement of Agency Organization and Operation (issued pursuant to Rule 28-101.001, Florida Administrative Code), which is available for viewing at sjrwmd.com. These conditions include, but are not limited to, the petition being in the form of a PDF or TIFF file and being capable of being stored and printed by the District. Further, pursuant to the District's Statement of Agency Organization and Operation, attempting to file a petition by facsimile is prohibited and shall not constitute filing.
5. Failure to file a petition for an administrative hearing within the requisite timeframe shall constitute a waiver of the right to an administrative hearing. (Rule 28-106.111, Florida Administrative Code).
6. The right to an administrative hearing and the relevant procedures to be followed are governed by Chapter 120, Florida Statutes, Chapter 28-106, Florida Administrative Code, and Rule 40C-1.1007, Florida Administrative Code. Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means the District's final action may be different from the position taken by it in this notice. A person whose substantial interests are or may be affected by the District's final action has the right to become a party to the proceeding, in accordance with the requirements set forth above.
7. Pursuant to Section 120.68, Florida Statutes, a party to the proceeding before the District who is adversely affected by final District action may seek review of the action in the District Court of Appeal by filing a notice of appeal pursuant to Rules 9.110 and 9.190, Florida Rules of Appellate Procedure, within 30 days of the rendering of the final District action.
8. A District action is considered rendered, as referred to in paragraph no. 7 above, after it is signed on behalf of the District and filed by the District Clerk.
9. Failure to observe the relevant timeframes for filing a petition for judicial review as described in paragraph no. 7 above will result in waiver of that right to review.

NOTICING INFORMATION

Please be advised that the St. Johns River Water Management District will not publish a notice in the newspaper advising the public that it has issued a permit for this project.

Newspaper publication, using the District's notice form, notifies members of the public of their right to challenge the issuance of the permit. If proper notice is given by newspaper publication, then there is a 21-day time limit for someone to file a petition for an administrative hearing to challenge the issuance of the permit.

To close the point of entry for filing a petition, you may publish (at your own expense) a one-time notice of the District's decision in a newspaper of general circulation within the affected area as defined in Section 50.011 of the Florida Statutes. If you do not publish a newspaper notice to close the point of entry, the time to challenge the issuance of your permit will not expire and someone could file a petition even after your project is constructed.

A copy of the notice form and a partial list of newspapers of general circulation are attached for your convenience. However, you are not limited to those listed newspapers. If you choose to close the point of entry and the notice is published, the newspaper will return to you an affidavit of publication. In that event, it is important that you either submit a scanned copy of the affidavit by emailing it to compliancesupport@sjrwmd.com (preferred method) **or** send a copy of the original affidavit to:

Office of Business and Administrative Services
4049 Reid Street
Palatka, FL 32177

If you have any questions, please contact the Office of Business and Administrative Services at (386) 329-4570.

NOTICE OF AGENCY ACTION TAKEN BY THE
ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

Notice is given that the following permit was issued on _____:

(Name and address of applicant) _____
permit# _____. The project is located in _____ County, Section
_____, Township _____ South, Range _____ East. The permit authorizes a surface
water management system on _____ acres for _____ known as
_____. The receiving water body is _____.

A person whose substantial interests are or may be affected has the right to request an administrative hearing by filing a written petition with the St. Johns River Water Management District (District). Pursuant to Chapter 28-106 and Rule 40C-1.1007, Florida Administrative Code (F.A.C.), the petition must be filed (received) either by delivery at the office of the District Clerk at District Headquarters, P.O. Box 1429, Palatka FL 32178-1429 (4049 Reid St, Palatka, FL 32177) or by e-mail with the District Clerk at Clerk@sjrwmd.com, within twenty-one (21) days of newspaper publication of the notice of District decision (for those persons to whom the District does not mail or email actual notice). A petition must comply with Sections 120.54(5)(b)4. and 120.569(2)(c), Florida Statutes (F.S.), and Chapter 28-106, F.A.C. The District will not accept a petition sent by facsimile (fax). Mediation pursuant to Section 120.573, F.S., may be available and choosing mediation does not affect your right to an administrative hearing.

A petition for an administrative hearing is deemed filed upon receipt of the complete petition by the District Clerk at the District Headquarters in Palatka, Florida during the District's regular business hours. The District's regular business hours are 8 a.m. – 5 p.m., excluding weekends and District holidays. Petitions received by the District Clerk after the District's regular business hours shall be deemed filed as of 8 a.m. on the District's next regular business day. The District's acceptance of petitions filed by e-mail is subject to certain conditions set forth in the District's Statement of Agency Organization and Operation (issued pursuant to Rule 28-101.001, Florida Administrative Code), which is available for viewing at www.sjrwmd.com. These conditions include, but are not limited to, the petition being in the form of a PDF or TIFF file and being capable of being stored and printed by the District. Further, pursuant to the District's Statement of Agency Organization and Operation, attempting to file a petition by facsimile (fax) is prohibited and shall not constitute filing.

The right to an administrative hearing and the relevant procedures to be followed are governed by Chapter 120, Florida Statutes, Chapter 28-106, Florida Administrative Code, and Rule 40C-1.1007, Florida Administrative Code. Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means the District's final action may be different from the position taken by it in this notice. **Failure to file a petition for an administrative hearing within the requisite time frame shall constitute a waiver of the right to an administrative hearing. (Rule 28-106.111, F.A.C.).**

If you wish to do so, please visit http://www.sjrwmd.com/nor_dec/ to read the complete Notice of Rights to determine any legal rights you may have concerning the District's decision(s) on the permit application(s) described above. You can also request the Notice of Rights by contacting the Director of Business and Administrative Services, 4049 Reid St., Palatka, FL 32177-2529, tele. no. (386)329-4570.

NEWSPAPER ADVERTISING

ALACHUA

The Alachua County Record, Legal Advertising
P. O. Box 806
Gainesville, FL 32602
352-377-2444/ fax 352-338-1986

BRAFORD

Bradford County Telegraph, Legal Advertising
P. O. Drawer A
Starke, FL 32901
904-964-6305/ fax 904-964-8628

CLAY

Clay Today, Legal Advertising
1560 Kinsley Ave., Suite 1
Orange Park, FL 32073
904-264-3200/ fax 904-264-3285

FLAGLER

Flagler Tribune, c/o News Journal
P. O. Box 2831
Daytona Beach, FL 32120-2831
386- 681-2322

LAKE

Daily Commercial, Legal Advertising
P. O. Drawer 490007
Leesburg, FL 34749
352-365-8235/fax 352-365-1951

NASSAU

News-Leader, Legal Advertising
P. O. Box 766
Fernandina Beach, FL 32035
904-261-3696/fax 904-261-3698

ORANGE

Sentinel Communications, Legal Advertising
633 N. Orange Avenue
Orlando, FL 32801
407-420-5160/ fax 407-420-5011

PUTNAM

Palatka Daily News, Legal Advertising
P. O. Box 777
Palatka, FL 32178
386-312-5200/ fax 386-312-5209

SEMINOLE

Sanford Herald, Legal Advertising
300 North French Avenue
Sanford, FL 32771
407-323-9408

BAKER

Baker County Press, Legal Advertising
P. O. Box 598
Macclenny, FL 32063
904-259-2400/ fax 904-259-6502

BREVARD

Florida Today, Legal Advertising
P. O. Box 419000
Melbourne, FL 32941-9000
321-242-3832/ fax 321-242-6618

DUVAL

Daily Record, Legal Advertising
P. O. Box 1769
Jacksonville, FL 32201
904-356-2466 / fax 904-353-2628

INDIAN RIVER

Vero Beach Press Journal, Legal Advertising
P. O. Box 1268
Vero Beach, FL 32961-1268
772-221-4282/ fax 772-978-2340

MARION

Ocala Star Banner, Legal Advertising
2121 SW 19th Avenue Road
Ocala, FL 34474
352-867-4010/fax 352-867-4126

OKEECHOBEE

Okeechobee News, Legal Advertising
P. O. Box 639
Okeechobee, FL 34973-0639
863-763-3134/fax 863-763-5901

OSCEOLA

Little Sentinel, Legal Advertising
633 N. Orange Avenue
Orlando, FL 32801
407-420-5160/ fax 407-420-5011

ST. JOHNS

St. Augustine Record, Legal Advertising
P. O. Box 1630
St. Augustine, FL 32085
904-819-3439

VOLUSIA

News Journal Corporation, Legal Advertising
P. O. Box 2831
Daytona Beach, FL 32120-2831
(386) 681-2322

Appendix C

Enterprise Asset Management



Instructions: Equipment Attribute Worksheets Twin Creeks Reclaimed Water Re-Pump Station

JEA employs an Enterprise Asset Management system (EAM) to assist in efficient management of its many assets. One component of the EAM is an Asset Management Database. JEA uses IBM's Maximo database software for this purpose. The data allows JEA to make sound business decisions regarding its assets. Data collected includes specification information on assets and locations, Vendor and Manufacturer contact information, Local representatives for each asset, spare parts associated with each asset and preventative maintenance requirements for each asset.

Step One:

1. Go to the "Assets" tab.
2. For each asset in column E, fill in the information indicated in Columns G through AA.
3. For reference, see "Assets Sample" tab for example of filled out form.

Step Two:

1. Go to the "Asset Costs" tab.
2. For each asset in column F, fill in the information indicated in Columns H through P.
3. Total cost of the project must equal the total cost of the contract.

Step Three:

1. Go to the "Vendor-Manufacturer" tab.
2. For each Vendor and/or Manufacturer listed on the "Assets" tab, fill in a row with the Vendor and/or Manufacturer contact information.
3. Assign each Vendor/Manufacturer a unique Vendor ID.
4. For reference, see "Vendor/Manufacturer Sample" tab for example of filled out form.

Step Four:

1. Go to the "Local Representative" tab.
2. For each Vendor and/or Manufacturer listed on the "Vendor-Manufacturer" tab, fill in a row with the associated Local Representative contact information.
3. Indicate which Vendor is associated with each Local Representative by filling in the Vendor ID / Man. ID column.
4. For reference, see "Local Representative Sample" tab for example of filled out form.

Step Five:

1. Go to the "Spare Parts" tab.
2. For each Asset ID Description for which spare parts are required / provided, fill in a row with the spare part data requested.
3. For reference, see "Spare Parts Sample" tab for example of filled out form.

Step Six:

1. Go to the "Preventative Maintenance" tab.
2. For each Asset ID Description that requires preventative maintenance, fill in a row on the Preventative Maintenance Header Table.
3. Assign a PM ID number to each row. Reference the appropriate Asset ID Descriptions.
4. For reference, see "Preventative Maintenance Sample" tab for example of filled out form.

Step Seven:

1. On the "Preventative Maintenance" Tab, for each PM listed in the Preventative Maintenance Header Table, provide a step by step description of the preventative maintenance required. Associate the Preventative Maintenance steps with the associated Preventative Maintenance with the PM ID.
2. For reference, see "Preventative Maintenance Sample" tab for example of filled out form.

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New Location	Location Description	Asset Temp #	Asset Description	Tag Number	Capital Asset?	Equipment Purchase Price	Final Installed Cost, Modification Cost or Demo Cost	Install Date	Size	Oracle Project Number	Oracle Work Order Number
1. MOBILIZATION, GENERAL CONDITIONS, STARTUP, DEMOB											
			GENERAL CONDITIONS	-	-						
			MOBILIZATION	-	-						
			DEMOBILIZATION	-	-						
			SURVEY AND LAYOUT								
			STARTUP	-	-						
			AS-BUILTS								
1. TOTAL SCHEDULED VALUE: MOBILIZATION, GENERAL CONDITIONS, STARTUP, DEMOB \$							-				

2. PUMPS AND MOTORS											
New Location	Location Description	Asset Temp #	Asset Description	Tag Number	Capital Asset?	Equipment Purchase Price	Final Installed Cost, Modification Cost or Demo Cost	Install Date	Size	Oracle Project Number	Oracle Work Order Number
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	MOTOR-01	MOTOR, BOOSTER PUMP #1 (P-401)	P-401	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	MOTOR-02	MOTOR, BOOSTER PUMP #2 (P-402)	P-402	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	MOTOR-03	MOTOR, BOOSTER PUMP #3 (P-403)	P-403	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	MOTOR-04	MOTOR, BOOSTER PUMP #4 (P-404)	P-404	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP #1 (P-401), 1375 GPM @ 203 FT	P-401	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP #2 (P-402), 2750 GPM @ 203 FT	P-402	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP #3 (P-402), 2750 GPM @ 203 FT	P-403	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP #4 (P-402), 2750 GPM @ 203 FT	P-404	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ROTEL-01	ROTATING ELEMENT, BOOSTER PUMP #1 (P-401)	P-401	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ROTEL-02	ROTATING ELEMENT, BOOSTER PUMP #2 (P-402)	P-402	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ROTEL-03	ROTATING ELEMENT, BOOSTER PUMP #3 (P-403)	P-403	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ROTEL-04	ROTATING ELEMENT, BOOSTER PUMP #4 (P-404)	P-404	Y						
2. TOTAL SCHEDULED VALUE: PUMPS AND MOTORS \$							-				

3. PIPES, FITTINGS AND VALVES											
New Location	Location Description	Asset Temp #	Asset Description	Tag Number	Capital Asset?	Equipment Purchase Price	Final Installed Cost, Modification Cost or Demo Cost	Install Date	Size	Oracle Project Number	Oracle Work Order Number
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ARV-01	2" SS ARV; 2" 316 SS BV AND 2" SCH 40; SS PIPE AND FITTINGS TO SUIT		Y				2"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ARV-02	1" SST AIR RELEASE VALVE; 1" PVC BV AND 1" SCH 80 PVC PIPE AND FITTINGS TO SUIT DISCHARGE TO TRENCH (TYP EA PUMP)		Y				1"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ARV-03	1" SST AIR RELEASE VALVE; 1" PVC BV AND 1" SCH 80 PVC PIPE AND FITTINGS TO SUIT DISCHARGE TO TRENCH (TYP EA PUMP)		Y				1"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ARV-04	1" SST AIR RELEASE VALVE; 1" PVC BV AND 1" SCH 80 PVC PIPE AND FITTINGS TO SUIT DISCHARGE TO TRENCH (TYP EA PUMP)		Y				1"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ARV-05	1" SST AIR RELEASE VALVE; 1" PVC BV AND 1" SCH 80 PVC PIPE AND FITTINGS TO SUIT DISCHARGE TO TRENCH (TYP EA PUMP)		Y				1"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ARV-06	2" SS ARV; 2" 316 SS BV AND 2" SCH 40; SS PIPE AND FITTINGS TO SUIT		Y				2"		

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RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ARV-07	2" SS ARV; 2" 316 SS BV AND 2" SCH 40; SS PIPE AND FITTINGS TO SUIT		Y				2"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-01	20" INFLUENT VALVE , RESERVIOR 1, TWIN CREEKS REPUMP STATION		Y				20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-02	24" EFFLUENT VALVE , RESERVIOR 1, TWIN CREEKS REPUMP STATION		Y				24"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-03	6" DRAIN VALVE, RESERVIOR 1, TWIN CREEKS REPUMP		Y				6"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-04	20" INFLUENT VALVE , RESERVIOR 2, TWIN CREEKS REPUMP STATION		Y				20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-05	24" EFFLUENT VALVE , RESERVIOR 2, TWIN CREEKS REPUMP STATION		Y				24"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-06	6" DRAIN VALVE, RESERVIOR 2, TWIN CREEKS REPUMP		Y				6"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-07	18" FLG BUTTERFLY VALVE (BFV-101)		Y				18"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-08	20" PROPORTIONAL PRESSURE REDUCING VALVE (PRV-101)		Y				20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-09	20" PRESSURE SUSTAINING VALVE (PSV-101)		Y				20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-10	20" FLG BUTTERLY VALVE (BFV-102)		Y				20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-11	20" FLG BUTTERFLY VALVE (BFV-702)		Y				20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-12	20" FLG BUTTERFLY VALVE (BFV-701)		Y				20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-13	16" FLG BUTTERFLY VALVE (BFV-1112B)		Y				16"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-14	16" FLG RUBBER FLAPPER CHECK VALVE WITH LIMIT SWITCH (CV-111)		Y				16"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-15	16" FLG BUTTERFLY VALVE (BFV-111A)		Y				16"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-16	BOOSTER PUMP #1, NORMALLY OPEN 14" BUTTERFLY VALVE (TYP 5), UPSTREAM		Y				14"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-17	BOOSTER PUMP #1, 12" RUBBER FLAPPER CHECK VALVE W/ LIMIT SWITCH (TYP 4), DOWNSTREAM		Y				12"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-18	BOOSTER PUMP #1, NORMALLY OPEN 12" BUTTERFLY VALVE (TYP 4), DOWNSTREAM		Y				12"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-19	BOOSTER PUMP #2, NORMALLY OPEN 14" BUTTERFLY VALVE (TYP 5), UPSTREAM		Y				14"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-20	BOOSTER PUMP #2, 12" RUBBER FLAPPER CHECK VALVE W/ LIMIT SWITCH (TYP 4), DOWNSTREAM		Y				12"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-21	BOOSTER PUMP #2, NORMALLY OPEN 12" BUTTERFLY VALVE (TYP 4), DOWNSTREAM		Y				12"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-22	BOOSTER PUMP #3, NORMALLY OPEN 14" BUTTERFLY VALVE (TYP 5), UPSTREAM		Y				14"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-23	BOOSTER PUMP #3, 12" RUBBER FLAPPER CHECK VALVE W/ LIMIT SWITCH (TYP 4), DOWNSTREAM		Y				12"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-24	BOOSTER PUMP #3, NORMALLY OPEN 12" BUTTERFLY VALVE (TYP 4),		Y				12"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-25	BOOSTER PUMP #4, NORMALLY OPEN 14" BUTTERFLY VALVE (TYP 5),		Y				14"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-26	BOOSTER PUMP #4, 12" RUBBER FLAPPER CHECK VALVE W/ LIMIT SWITCH (TYP 4), DOWNSTREAM		Y				12"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-27	BOOSTER PUMP #4, NORMALLY OPEN 12" BUTTERFLY VALVE (TYP 4),		Y				12"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-28	20" GATE VALVE W/ 20" RESTRAINED CAP		Y				20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-29	16" GATE VALVE W/ 16" RESTRAINED CAP		Y				16"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-30	20" GATE VALVE W/ 20" MJ PLUG-DI		Y				20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VALVE-31	PUMP OUT VALVE FOR FORCEMAIN	V-621	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-02	INFLUENT PIPE, 20", RESERVIOR 1, TWIN CREEKS REPUMP STATION		Y				20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-03	EEFLUENT PIPE, 24", RESERVIOR 1, TWIN CREEKS REPUMP STATION		Y				24"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-04	DRAIN PIPE, 8", RESERVIOR 1, TWIN CREEKS REPUMP STATION		Y				8"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-05	INFLUENT PIPE, 20", RESERVIOR 2, TWIN CREEKS REPUMP STATION		Y				20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-06	EEFLUENT PIPE, 24", RESERVIOR 2, TWIN CREEKS REPUMP STATION		Y				24"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-07	DRAIN PIPE, 8", RESERVIOR 2, TWIN CREEKS REPUMP STATION		Y				8"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-08	20" GST FILL-CLDI (TANK FILL)		Y				20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-09	30" PUMP SUCTION HEADER-CLDI		Y				30"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-10	24" RE-CLDI (FROM PUMP STATION TO FINISHED WATER ASSEMBLY)		Y				24"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-11	14" CLDI		Y				14"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-12	12" RE-CLDI		Y				12"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-13	14" CLDI		Y				14"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-14	12" RE-CLDI		Y				12"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-15	14" CLDI		Y				14"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-16	12" RE-CLDI		Y				12"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-17	14" CLDI		Y				14"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-18	12" RE-CLDI		Y				12"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-47	18" GST FILL-CLDI		Y				18"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-48	20" RE-CLDI		Y				20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-49	16" RE BYPASS-CLDI		Y				16"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-50	INJECTOR ASSEMBLY, SODIUM HYPOCHLORITE, PIPING, 1" PVC		Y				1"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-01	20" 90 DEG MJ BEND-DI		Y				20"		

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RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-02	20" 90 DEG MJ BEND-DI		Y				20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-03	20"x18" FLG ECC RED-DI		Y				20"x18"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-04	20"x18" FLG ECC RED-DI		Y				20"x18"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-05	20" FLG SPOOL-DI		Y				20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-06	20" 90 DEG MJ BEND-DI		Y				20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-07	20" 90 DEG MJ BEND-DI		Y				20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-08	20" MJ TEE-DI		Y				20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-09	20"x16" MJ TEE-DI		Y				20"x16"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-10	20" 90 DEG MJ BEND-DI		Y				20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-11	20" 90 DEG MJ BEND-DI		Y				20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-12	24" 90 DEG MJ BEND-DI		Y				24"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-13	24" 90 DEG MJ BEND-DI		Y				24"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-14	24"x20" MJ TEE-DI		Y				24"x20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-15	30"x24" MJ RED-DI		Y				30"x24"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-16	30"x24" MJ TEE-DI		Y				30"x24"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-17	30" 11.25 DEG MJ BEND-DI		Y				30"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-18	30" 11.25 DEG MJ BEND-DI		Y				30"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-19	30" 45 DEG MJ BEND-DI		Y				30"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-20	24" 90 DEG MJ BEND-DI		Y				24"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-21	24" 90 DEG MJ BEND-DI		Y				24"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-22	20"x8" MJ TEE-DI		Y				20"x8"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-23	20"x16" MJ TEE-DI		Y				20"x16"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-24	20"x16" MJ TEE-DI		Y				20"x16"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-25	20"x20" MJ TEE-DI		Y				20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-26	24" 90 DEG MJ BEND-DI		Y				24"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-27	24" 90 DEG MJ BEND-DI		Y				24"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-28	24" 90 DEG MJ BEND-DI		Y				24"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-29	24" 90 DEG MJ BEND-DI		Y				24"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-30	24" 90 DEG MJ BEND-DI		Y				24"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-31	24" 90 DEG MJ BEND-DI		Y				24"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-32	20"x14" MJ RED-DI		Y				20"x14"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-33	14" 90 DEG MJ BEND-DI		Y				14"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-34	14" 90 DEG FLG BEND-DI (TYP 5)		Y				14"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-35	14" FLEX HOSE CONNECTION (TYP 4)		Y				14"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-36	14"x6" FLG ECC REDUCER-DI		Y				14"x6"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-37	6" FLG SPOOL-DI		Y				6"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-38	12"x5" FLG ECC REDUCER-DI		Y				12"x5"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-39	16" FLG SPOOL-DI (MIN 8" LONG) (TYP 5)		Y				16"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-40	12" 90 DEG FLG BEND-DI (TYP 5)		Y				12"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-41	12" 90 DEG FLG BASE BEND-DI		Y				12"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-42	20" X 12" FLG RED-DI		Y				20"x12"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-43	24"x20" MJ RED-DI		Y				24"x20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-44	20"x14" MJ TEE-DI		Y				20"x14"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-45	14" 90 DEG FLG BEND-DI (TYP 5)		Y				14"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-46	14" FLEX HOSE CONNECTION (TYP 4)		Y				14"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-47	14"x10" FLG ECC REDUCER-DI		Y				14"x10"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-48	10" FLG SPOOL-DI (TYP 3)		Y				10"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-49	12"x8" FLG ECC REDUCER-DI (TYP 3)		Y				12"x8"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-50	16" FLG SPOOL-DI (MIN 8" LONG) (TYP 5)		Y				16"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-51	12" 90 DEG FLG BEND-DI (TYP 5)		Y				12"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-52	20"x12" FLG TEE-DI		Y				20"x12"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-53	24"x20" FLG RED-DI		Y				24"x20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-54	30"x24" MJ RED-DI		Y				30"x24"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-55	24"x14" MJ TEE-DI		Y				24"x14"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-56	14" 90 DEG FLG BEND-DI (TYP 5)		Y				14"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-57	14" FLEX HOSE CONNECTION (TYP 4)		Y				14"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-58	14"x10" FLG ECC REDUCER-DI		Y				14"x10"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-59	10" FLG SPOOL-DI (TYP 3)		Y				10"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-60	12"x8" FLG ECC REDUCER-DI (TYP 3)		Y				12"x8"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-61	16" FLG SPOOL-DI (MIN 8" LONG) (TYP 5)		Y				16"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-62	12" 90 DEG FLG BEND-DI (TYP 5)		Y				12"		

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RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-63	24"X12" FLG TEE-DI		Y				24"x12"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-64	30"X20" MJ TEE-DI		Y				30"x20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-65	20"X14" MJ RED-DI (TYP 2)		Y				20"x14"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-66	14" 90 DEG FLG BEND-DI (TYP 5)		Y				14"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-67	14" FLEX HOSE CONNECTION (TYP 4)		Y				14"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-68	14"X10" FLG ECC REDUCER-DI		Y				14"x10"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-69	10" FLG SPOOL-DI (TYP 3)		Y				10"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-70	12"X8" FLG ECC REDUCER-DI (TYP 3)		Y				12"x8"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-71	16" FLG SPOOL-DI (MIN 8" LONG) (TYP 5)		Y				16"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-72	12" 90 DEG FLG BEND-DI (TYP 5)		Y				12"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-73	24"X12" FLG TEE-DI		Y				24"x12"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-74	30"X20" MJ TEE-DI		Y				30"x20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-75	20"X14" MJ RED-DI (TYP 2)		Y				20"x14"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-76	14" 90 DEG FLG BEND-DI (TYP 5)		Y				14"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-77	14" BLIND FLANGE-DI		Y				14"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-78	12" BLIND FLANGE-DI		Y				12"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-79	12" 90 DEG FLG BEND-DI (TYP 5)		Y				12"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-80	24"X12" FLG TEE-DI		Y				24"x12"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-81	24" 90 DEG MJ BEND-DI		Y				24"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-82	24" 90 DEG MJ BEND-DI		Y				24"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-83	24"X20" FLG ECC RED-DI		Y				24"x20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-84	24"X20" FLG ECC RED-DI		Y				24"x20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-85	24" 90 DEG FLG BEND-DI		Y				24"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-86	24" 90 DEG MJ BEND-DI		Y				24"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-87	16" 90 DEG MJ BEND-DI		Y				16"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-88	16" 90 DEG MJ BEND-DI		Y				16"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-89	16" FLG SPOOL-DI (MIN 8" LONG)		Y				16"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-90	16" FLG SPOOL-DI		Y				16"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-91	16" FLG SPOOL-DI (MIN 8" LONG)		Y				16"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-92	16" 90 DEG FLG BEND-DI		Y				16"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-93	16" 90 DEG MJ BEND-DI		Y				16"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FTG-94	20" 45 DEG MJ BEND-DI		Y				20"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	HYDRANT-01	FIRE HYDRANT		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SUPPORT-13	CONC PIPE SUPPORT		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SUPPORT-14	CONC PIPE SUPPORT		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SUPPORT-15	CONC PIPE SUPPORT		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SUPPORT-16	CONC PIPE SUPPORT		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SUPPORT-17	CONC PIPE SUPPORT		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SUPPORT-18	CONC PIPE SUPPORT		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SUPPORT-19	CONC PIPE SUPPORT		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SUPPORT-20	CONC PIPE SUPPORT		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SUPPORT-21	CONC PIPE SUPPORT		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SUPPORT-22	CONC PIPE SUPPORT		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SUPPORT-23	CONC PIPE SUPPORT		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SUPPORT-24	CONC PIPE SUPPORT		Y						
3. TOTAL SCHEDULED VALUE: PIPES, FITTINGS AND VALVES \$ -											

4. ELECTRICAL											
New Location	Location Description	Asset Temp #	Asset Description	Tag Number	Capital Asset?	Equipment Purchase Price	Final Installed Cost, Modification Cost or Demo Cost	Install Date	Size	Oracle Project Number	Oracle Work Order Number
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ATS-01	AUTO TRANSFER SWITCH	ATS-1	Y				1600 A		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	CP-01	GENERATOR CONTROL PANEL		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	MCC-01	MCC SWBD-1 ASSEMBLY	SWBD-1	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VFD-01	VFD BOOSTER PUMP #1	VFD 401	Y				125 HP		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VFD-02	VFD BOOSTER PUMP #2	VFD 402	Y				200 HP		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VFD-03	VFD BOOSTER PUMP #3	VFD 403	Y				200 HP		

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RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VFD-04	VFD BOOSTER PUMP #4	VFD 404	Y				200 HP		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	CP-03	GRINDER PUMP STATION, CONTROL PANEL	VCP-630	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	BRKR-X00001	MAIN BREAKER MCC SWBD-1						1600 A		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	BRKR-X00002	BREAKER TO VFD 401, 300 AMP						300 A		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	BRKR-X00003	BREAKER TO VFD 402, 300 AMP						300 A		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	BRKR-X00004	BREAKER TO VFD 403, 300 AMP						300 A		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	BRKR-X00005	BREAKER TO VFD 404, 300 AMP						300 A		
4. TOTAL SCHEDULED VALUE: ELECTRICAL \$ -											

5. INSTRUMENTATION											
New Location	Location Description	Asset Temp #	Asset Description	Tag Number	Capital Asset?	Equipment Purchase Price	Final Installed Cost, Modification Cost or Demo Cost	Install Date	Size	Oracle Project Number	Oracle Work Order Number
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GAUGE-01	LIQUID LEVEL INDICATOR, RESERVOIR 2, TWIN CREEKS REPUMP STATION		N						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GAUGE-02	LIQUID LEVEL INDICATOR, RESERVOIR 2, TWIN CREEKS REPUMP STATION		N						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GAUGE-03	PRESSURE GAUGE AND TRANSMITTER (PIT-101)		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GAUGE-04	18" MAGNETIC FLOW METER (FE-101)		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GAUGE-05	PRESSURE GAUGE (30VAC-100 PSI)		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GAUGE-06	PRESSURE GAUGE (30VAC-100 PSI)		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GAUGE-07	18" MAGNETIC FLOW METER (FE-700)		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GAUGE-08	PRESSURE GAUGE AND TRANSMITTER (PIT-700)		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GAUGE-09	PRESSURE GAUGE AND TRANSMITTER (PIT-701)		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GAUGE-10	16" MAGNETIC FLOW METER (FE-111)		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GAUGE-11	BOOSTER PUMP #1, PRESSURE INDICATING TRANSMITTER, UPSTREAM		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GAUGE-12	BOOSTER PUMP #1, PRESSURE GAUGE (TYP 4) (30VAC-50PSI), UPSTREAM		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GAUGE-13	BOOSTER PUMP #1, PRESSURE GAUGE (TYP 4) (0-150 PSI), DOWNSTREAM		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GAUGE-14	BOOSTER PUMP #2, PRESSURE INDICATING TRANSMITTER, UPSTREAM		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GAUGE-15	BOOSTER PUMP #2, PRESSURE GAUGE (TYP 4) (30VAC-50PSI), UPSTREAM		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GAUGE-16	BOOSTER PUMP #2, PRESSURE GAUGE (TYP 4) (0-150 PSI), DOWNSTREAM		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GAUGE-17	BOOSTER PUMP #3, PRESSURE INDICATING TRANSMITTER, UPSTREAM		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GAUGE-18	BOOSTER PUMP #3, PRESSURE GAUGE (TYP 4) (30VAC-50PSI), UPSTREAM		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GAUGE-19	BOOSTER PUMP #3, PRESSURE GAUGE (TYP 4) (0-150 PSI), DOWNSTREAM		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GAUGE-20	BOOSTER PUMP #4, PRESSURE INDICATING TRANSMITTER, UPSTREAM		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GAUGE-21	BOOSTER PUMP #4, PRESSURE GAUGE (TYP 4) (30VAC-50PSI), UPSTREAM		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GAUGE-22	BOOSTER PUMP #4, PRESSURE GAUGE (TYP 4) (0-150 PSI), DOWNSTREAM		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GAUGE-23	CHLORINE METER/TRANSMITTER		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GAUGE-24	LEVEL METER/TRANSMITTER HYPO TANK		Y						

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RCDS-034-RECS	TWIN CREEKS REPUMP STATION	XDUCER-01	LEVEL METER AND TRANSMITTER, RESERVOIR 1, TWIN CREEKS REPUMP STATION								
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	XDUCER-02	LEVEL METER AND TRANSMITTER, RESERVOIR 2, TWIN CREEKS REPUMP STATION								
5. INSTRUMENTATION \$ -											

6. SCADA											
New Location	Location Description	Asset Temp #	Asset Description	Tag Number	Capital Asset?	Equipment Purchase Price	Final Installed Cost, Modification Cost or Demo Cost	Install Date	Size	Oracle Project Number	Oracle Work Order Number
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	CARD-X00001	A I CARD		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	CARD-X00002	A O CARD		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	CARD-X00003	D I CARD		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	CARD-X00004	D O CARD		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	MODULE-X00001	INTERFACE MODULE 1		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	MODULE-X00002	COMMUNICATION MODULE		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	MODULE-X00003	INTERFACE MODULE O		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	MODULE-X00004	ETHERNET MODULE		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	MODULE-X00005	TELECOMMUNICATION INTERFACE MODULE 1		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PLC-X00001	PLC		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PS-X00001	POWER SUPPLY		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	RACK-X00001	RACK 1		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	RACK-X00002	RACK O		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	OP-X00001	INTERFACE DISPLAY PANEL (OP 270)		Y						
6. TOTAL SCHEDULED VALUE: SCADA \$ -											

7. GENERATOR											
New Location	Location Description	Asset Temp #	Asset Description	Tag Number	Capital Asset?	Equipment Purchase Price	Final Installed Cost, Modification Cost or Demo Cost	Install Date	Size	Oracle Project Number	Oracle Work Order Number
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GEN-01	GENERATOR , 450 KW GENSET		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-03	GENERATOR FUEL TANK		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FOUNDATION-09	GENERATOR FOUNDATION		Y						
7. TOTAL SCHEDULED VALUE: GENERATOR \$ -											

8. SODIUM HYPOCHLORITE FEED SYSTEM											
New Location	Location Description	Asset Temp #	Asset Description	Tag Number	Capital Asset?	Equipment Purchase Price	Final Installed Cost, Modification Cost or Demo Cost	Install Date	Size	Oracle Project Number	Oracle Work Order Number
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-19	HYPOCHORITE STATION PIPING		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-27	INJECTOR ASSEMBLY, SODIUM HYPOCHLORITE, PIPING, 1" PVC		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	VAULT-01	CHEMICAL INJECTION VAULT, SODIUM HYPOCHLORITE		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FOUNDATION-10	FOUNDATION HYPO BUILDING		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	INJECTOR-01	INJECTOR ASSEMBLY, SODIUM HYPOCHLORITE		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	CP-02	SODIUM HYPOCHLORITE FEED PUMP, CONTROL PANEL		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-06	PUMP #1, NaOCl		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-07	PUMP #1, NaOCl		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-04	SINGLE WALL STORAGE TANK, NaOCl, 5100 GALLON	T-501	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	CANOPY-01	CANOPY HYPO BUILDING		Y						
8. SODIUM HYPOCHLORITE FEED SYSTEM \$							-				
9. GRINDER PUMP STATION											
New Location	Location Description	Asset Temp #	Asset Description	Tag Number	Capital Asset?	Equipment Purchase Price	Final Installed Cost, Modification Cost or Demo Cost	Install Date	Size	Oracle Project Number	Oracle Work Order Number
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	WETWELL-01	GRINDER PUMP STATION, WET WELL, 36-INCH		Y				36"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-51	GRINDER PUMP STATION PIPING/VALVES 1 1/2" SCH80 PVC		Y				1-1/2"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-52	FORCEMAIN, 4"		Y				4"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-08	PUMP #1, GRINDER STATION, 2 HP, 1800 RPM	P-631	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-09	PUMP #1, GRINDER STATION, 2 HP, 1800 RPM	P-632	Y						
9. GRINDER PUMP STATION \$							-				

10. PUMP/ELECTRICAL BUILDING											
New Location	Location Description	Asset Temp #	Asset Description	Tag Number	Capital Asset?	Equipment Purchase Price	Final Installed Cost, Modification Cost or Demo Cost	Install Date	Size	Oracle Project Number	Oracle Work Order Number
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PLUMBING-01	PLUMBING		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FIRE-01	FIRE PROTECTION SYSTEM		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	LIGHTING-01	LIGHTING		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	CRANE-01	3 TON MOTORIZED BRIDGE CRANE		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FOUNDATION-01	PUMP PEDESTAL FOUNDATION AND FLOOR, BOOSTER PUMP # 1		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FOUNDATION-02	PUMP PEDESTAL FOUNDATION AND FLOOR, BOOSTER PUMP # 2		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FOUNDATION-03	PUMP PEDESTAL FOUNDATION AND FLOOR, BOOSTER PUMP # 3		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FOUNDATION-04	PUMP PEDESTAL FOUNDATION AND FLOOR, BOOSTER PUMP # 4		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FOUNDATION-05	PUMP PEDESTAL FOUNDATION AND FLOOR, BOOSTER PUMP # 5 (FUTURE)		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SUPPORT-01	PIPE SUPPORT		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SUPPORT-02	PIPE SUPPORT		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SUPPORT-03	PIPE SUPPORT		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SUPPORT-04	PIPE SUPPORT		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SUPPORT-05	PIPE SUPPORT		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SUPPORT-06	PIPE SUPPORT		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SUPPORT-07	PIPE SUPPORT		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SUPPORT-08	PIPE SUPPORT		Y						

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RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SUPPORT-09	PIPE SUPPORT		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SUPPORT-10	PIPE SUPPORT		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SUPPORT-11	PIPE SUPPORT		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SUPPORT-12	PIPE SUPPORT		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ACCU-01	AIR COOLED CONDENSING UNIT, ELECTRICAL ROOM	ACCU-1	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ACCU-02	AIR COOLED CONDENSING UNIT, ELECTRICAL ROOM	ACCU-2	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	AHU-01	AIR HANDLER #1	AC-1	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	EF-01	EXHAUST FAN #1, 17,100 CFM, PUMP ROOM, SIDEWALL	EF-1	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	EF-02	EXHAUST FAN #2, 17,100 CFM, PUMP ROOM, SIDEWALL	EF-2	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	EF-03	EXHAUST FAN #3, 75 CFM, REST ROOM, CEILING	EF-3	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	LOUVER-01	LOUVER - INTAKE LOUVER #1, 17,100 CFM	LV-1	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	LOUVER-02	LOUVER - INTAKE LOUVER #2, 17,100 CFM	LV-2	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	MOTOR-05	EXHAUST FAN #1, MOTOR	EF-1	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	MOTOR-06	EXHAUST FAN #2, MOTOR	EF-2	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	MOTOR-07	EXHAUST FAN #3, MOTOR	EF-3	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-10	SUMP PUMP WITH 1.25" PIPE AND FITTINGS	P-621	Y						
10. PUMP/ELECTRICAL BUILDING \$ -											

11. RESERVOIR											
New Location	Location Description	Asset Temp #	Asset Description	Tag Number	Capital Asset?	Equipment Purchase Price	Final Installed Cost, Modification Cost or Demo Cost	Install Date	Size	Oracle Project Number	Oracle Work Order Number
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-01	RESERVOIR 1, TWIN CREEKS REPUMP STATION		Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-02	RESERVOIR 2, TWIN CREEKS REPUMP STATION		Y					8004340	
11. RESERVOIR \$ -											

12. SITE WORK											
New Location	Location Description	Asset Temp #	Asset Description	Tag Number	Capital Asset?	Equipment Purchase Price	Final Installed Cost, Modification Cost or Demo Cost	Install Date	Size	Oracle Project Number	Oracle Work Order Number
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	LANDSCAPING	LANDSCAPING		N						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DMH-01	FDOT TYPE F INLET W/ 4'X4' TYPE J BOTTOM	S-1	Y				4'x4'		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DMH-02	FDOT TYPE P-8 MANHOLE	S-2	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DMH-03	FDOT TYPE F INLET W/ 4'X4' TYPE J BOTTOM	S-3	Y				4'x4'		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DMH-04	FDOT TYPE F INLET	S-4	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DMH-05	FDOT TYPE P-8 MANHOLE	S-5	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DMH-06	FDOT TYPE F INLET	S-6	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DMH-07	FDOT TYPE P-8 MANHOLE	S-7	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DMH-08	FDOT TYPE P-8 MANHOLE	S-8	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DMH-09	FDOT TYPE F INLET	S-9	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DMH-10	FDOT TYPE F INLET	S-10	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DMH-11	FDOT TYPE P-8 MANHOLE	S-11	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DMH-12	FDOT TYPE F INLET	S-12	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DMH-13	FDOT TYPE F INLET	S-13	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DMH-14	FDOT TYPE F INLET	S-14	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DMH-15	FDOT TYPE P-8 MANHOLE	S-15	Y						
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-20	30" RCP DRAINGAGE PIPE	P-1	Y				30"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-21	30" RCP DRAINGAGE PIPE	P-2	Y				30"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-22	30" RCP DRAINGAGE PIPE	P-3	Y				30"		

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RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-23	24" RCP DRAINAGE PIPE	P-4	Y				24"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-24	18" RCP DRAINAGE PIPE	P-5	Y				18"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-25	18" RCP DRAINAGE PIPE	P-6	Y				18"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-26	18" RCP DRAINAGE PIPE	P-7	Y				18"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-27	18" RCP DRAINAGE PIPE	P-8	Y				18"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-28	18" RCP DRAINAGE PIPE	P-9	Y				18"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-29	18" RCP DRAINAGE PIPE	P-10	Y				18"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-30	18" RCP DRAINAGE PIPE	P-11	Y				18"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-31	18" RCP DRAINAGE PIPE	P-12	Y				18"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-32	18" RCP DRAINAGE PIPE	P-13	Y				18"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-33	18" RCP DRAINAGE PIPE	P-14	Y				18"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-34	6" ADS-N-12WT PERFORATED DRAINAGE PIPE	P-15	Y				6"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-35	6" ADS-N-12WT PERFORATED DRAINAGE PIPE	P-16	Y				6"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-36	6" ADS-N-12WT PERFORATED DRAINAGE PIPE	P-17	Y				6"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-37	6" ADS-N-12WT PERFORATED DRAINAGE PIPE	P-18	Y				6"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-38	6" ADS-N-12WT PERFORATED DRAINAGE PIPE	P-19	Y				6"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-39	6" ADS-N-12WT PERFORATED DRAINAGE PIPE	P-20	Y				6"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-40	6" ADS-N-12WT PERFORATED DRAINAGE PIPE	P-21	Y				6"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-41	6" ADS-N-12WT PERFORATED DRAINAGE PIPE	P-22	Y				6"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-42	6" ADS-N-12WT PERFORATED DRAINAGE PIPE	P-23	Y				6"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-43	6" ADS-N-12WT PERFORATED DRAINAGE PIPE	P-24	Y				6"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-44	6" ADS-N-12WT PERFORATED DRAINAGE PIPE	P-25	Y				6"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-45	6" ADS-N-12WT PERFORATED DRAINAGE PIPE	P-26	Y				6"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PIPE-46	6" ADS-N-12WT PERFORATED DRAINAGE PIPE	P-27	Y				6"		
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FENCE-01	FENCE AND GATE		Y						
12. SITEWORK \$ -											

13. DEMOLITION											
New Location	Location Description	Asset Temp #	Asset Description	Tag Number	Capital Asset?	Equipment Purchase Price	Final Installed Cost, Modification Cost or Demo Cost	Install Date	Size	Oracle Project Number	Oracle Work Order Number
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DEMO-01	DEMOLITION OF EXISTING FACILITIES		N						
13. DEMOLITION \$ -											

TOTAL COST TWIN CREEKS RECLAIMED WATER RE-PUMP STATION IMPROVEMENTS \$ - This amount must total the complete contract amount											
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ASSET INFORMATION								REQUIRED ON ALL ASSETS			NAME PLATE DATA								ADDITIONAL ATTRIBUTES																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
LOCATION	LOCATION DESCRIPTION	PARENT ASSET	PARENT ASSET DESCRIPTION	CHILD ASSET	CHILD ASSET DESCRIPTION	TAG	CAPITAL Y/N	COMMISSION DATE / SUBSTANTIAL COMPLETION DATE	WARRANTY END DATE	FINAL INSTALLED COST	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	MANUF PART	PURCHASE COST	VENDOR	DATE MANUFACTURED	DATE PURCHASED	GAUGE TYPE	GAUGE SIZE	DISPLAY RANGE	OUTPUT RANGE																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					

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LOCATION	LOCATION DESCRIPTION	PARENT ASSET	PARENT ASSET DESCRIPTION	CHILD ASSET	CHILD ASSET DESCRIPTION	TAG	CAPITAL Y/N	COMMISSION DATE / SUBSTANTIAL COMPLETION DATE	WARRANTY END DATE	FINAL INSTALLED COST	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	MANUF PART	PURCHASE COST	VENDOR	DATE MANUFACTURED	DATE PURCHASED	PIPE SIZE	PIPE TYPE	LENGTH	PIPE LINED	LINER TYPE																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												</
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ASSET INFORMATION						REQUIRED ON ALL ASSETS	NAME PLATE DATA					ADDITIONAL ATTRIBUTES									
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD-PIPING	FTG-16	30"X24" MJ TEE-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD-PIPING	FTG-17	30" 11.25 DEG MJ BEND-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD-PIPING	FTG-18	30" 11.25 DEG MJ BEND-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD-PIPING	FTG-19	30" 45 DEG MJ BEND-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD-PIPING	FTG-20	24" 90 DEG MJ BEND-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD-PIPING	FTG-21	24" 90 DEG MJ BEND-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD-PIPING	FTG-22	20"X8" MJ TEE-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD-PIPING	FTG-23	20"X16" MJ TEE-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD-PIPING	FTG-24	20"X16" MJ TEE-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD-PIPING	FTG-25	20"X20" MJ TEE-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-01	1.66 MG (1.5 MG USABLE VOLUME) TANK NO. 1	FTG-26	24" 90 DEG MJ BEND-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-01	1.66 MG (1.5 MG USABLE VOLUME) TANK NO. 1	FTG-27	24" 90 DEG MJ BEND-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-01	1.66 MG (1.5 MG USABLE VOLUME) TANK NO. 1	FTG-28	24" 90 DEG MJ BEND-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-02	1.66 MG (1.5 MG USABLE VOLUME) TANK NO. 2	FTG-29	24" 90 DEG MJ BEND-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-02	1.66 MG (1.5 MG USABLE VOLUME) TANK NO. 2	FTG-30	24" 90 DEG MJ BEND-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-02	1.66 MG (1.5 MG USABLE VOLUME) TANK NO. 2	FTG-31	24" 90 DEG MJ BEND-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	FTG-32	20"X14" MJ RED-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	FTG-33	14" 90 DEG MJ BEND-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	FTG-34	14" 90 DEG FLG BEND-DI (TYP 5)	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	FTG-35	14" FLEX HOSE CONNECTION (TYP 4)	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	FTG-36	14"X6" FLG ECC REDUCER-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	FTG-37	6" FLG SPOOL-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	FTG-38	12"X5" FLG ECC REDUCER-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	FTG-39	16" FLG SPOOL-DI (MIN 8" LONG) (TYP 5)	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	FTG-40	12" 90 DEG FLG BEND-DI (TYP 5)	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	FTG-41	12" 90 DEG FLG BASE BEND-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	FTG-42	20" X 12" FLG RED-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	FTG-43	24"X20" MJ RED-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	FTG-44	20"X14" MJ TEE-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	FTG-45	14" 90 DEG FLG BEND-DI (TYP 5)	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	FTG-46	14" FLEX HOSE CONNECTION (TYP 4)	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	FTG-47	14"X10" FLG ECC REDUCER-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	FTG-48	10" FLG SPOOL-DI (TYP 3)	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	FTG-49	12"X8" FLG ECC REDUCER-DI (TYP 3)	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	FTG-50	16" FLG SPOOL-DI (MIN 8" LONG) (TYP 5)	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	FTG-51	12" 90 DEG FLG BEND-DI (TYP 5)	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	FTG-52	20"X12" FLG TEE-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	FTG-53	24"X20" FLG RED-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	FTG-54	30"X24" MJ RED-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	FTG-55	24"X14" MJ TEE-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	FTG-56	14" 90 DEG FLG BEND-DI (TYP 5)	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	FTG-57	14" FLEX HOSE CONNECTION (TYP 4)	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	FTG-58	14"X10" FLG ECC REDUCER-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	FTG-59	10" FLG SPOOL-DI (TYP 3)	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	FTG-60	12"X8" FLG ECC REDUCER-DI (TYP 3)	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	FTG-61	16" FLG SPOOL-DI (MIN 8" LONG) (TYP 5)	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	FTG-62	12" 90 DEG FLG BEND-DI (TYP 5)	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	FTG-63	24"X12" FLG TEE-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	FTG-64	30"X20" MJ TEE-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	FTG-65	20"X14" MJ RED-DI (TYP 2)	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	FTG-66	14" 90 DEG FLG BEND-DI (TYP 5)	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	FTG-67	14" FLEX HOSE CONNECTION (TYP 4)	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	FTG-68	14"X10" FLG ECC REDUCER-DI	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	FTG-69	10" FLG SPOOL-DI (TYP 3)	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	FTG-70	12"X8" FLG ECC REDUCER-DI (TYP 3)	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	FTG-71	16" FLG SPOOL-DI (MIN 8" LONG) (TYP 5)	Y															
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	FTG-72	12" 90 DEG FLG BEND-DI (TYP 5)	Y															

ASSET INFORMATION									REQUIRED ON ALL ASSETS			NAME PLATE DATA								ADDITIONAL ATTRIBUTES																		
CANOPY	LOCATION	LOCATION DESCRIPTION	PARENT ASSET	PARENT ASSET DESCRIPTION	CHILD ASSET	CHILD ASSET DESCRIPTION	TAG	CAPITAL Y/N	COMMISSION DATE / SUBSTANTIAL COMPLETION DATE	WARRANTY END DATE	FINAL INSTALLED COST	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	MANUF PART #	ORACLE PROJECT #	PURCHASE COST	VENDOR	GLOBAL ID	BARCODE	DATE MANUFACTURED	DATE PURCHASED	MANUFACTURER	MODEL NUMBER														
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	CJ-01	CHEMICAL INJECTION SYSTEM	CANOPY-01	CANOPY HYPO BUILDING		Y																														
MOTORS	LOCATION	LOCATION DESCRIPTION	PARENT ASSET	PARENT ASSET DESCRIPTION	CHILD ASSET	CHILD ASSET DESCRIPTION	TAG	CAPITAL Y/N	COMMISSION DATE / SUBSTANTIAL COMPLETION DATE	WARRANTY END DATE	FINAL INSTALLED COST	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	MANUF PART #	ORACLE PROJECT #	PURCHASE COST	VENDOR	GLOBAL ID	BARCODE	DATE MANUFACTURED	DATE PURCHASED	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	VOLTAGE	PHASE	FULL LOAD AMPS	HP	DUTY	RPM	TYPE	LUBE OIL-GREASE					
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	MOTOR-01	MOTOR, BOOSTER PUMP #1 (P-401)	P-401	Y																					125 HP									
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	MOTOR-02	MOTOR, BOOSTER PUMP #2 (P-402)	P-402	Y																					200 HP									
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	MOTOR-03	MOTOR, BOOSTER PUMP #3 (P-403)	P-403	Y																					200 HP									
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	MOTOR-04	MOTOR, BOOSTER PUMP #4 (P-404)	P-404	Y																					200 HP									
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	HVAC-01	HVAC SYSTEMS FOR BOOSTER PUMP BUILDING	MOTOR-05	EXHAUST FAN #1, MOTOR	EF-1	Y																					5 HP									
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	HVAC-01	HVAC SYSTEMS FOR BOOSTER PUMP BUILDING	MOTOR-06	EXHAUST FAN #2, MOTOR	EF-2	Y																					5 HP									
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	HVAC-01	HVAC SYSTEMS FOR BOOSTER PUMP BUILDING	MOTOR-07	EXHAUST FAN #3, MOTOR	EF-3	Y																					120w									
PLUMBING	LOCATION	LOCATION DESCRIPTION	PARENT ASSET	PARENT ASSET DESCRIPTION	CHILD ASSET	CHILD ASSET DESCRIPTION	TAG	CAPITAL Y/N																														
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PLUMBING-01	PLUMBING																																		
PUMPS	LOCATION	LOCATION DESCRIPTION	PARENT ASSET	PARENT ASSET DESCRIPTION	CHILD ASSET	CHILD ASSET DESCRIPTION	TAG	CAPITAL Y/N	COMMISSION DATE / SUBSTANTIAL COMPLETION DATE	WARRANTY END DATE	FINAL INSTALLED COST	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	MANUF PART #	ORACLE PROJECT #	PURCHASE COST	VENDOR	GLOBAL ID	BARCODE	DATE MANUFACTURED	DATE PURCHASED	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	TYPE	HP	RPM	IMPELLER	IMPELLER DIAMETER	SUCTION HEAD	SUCTION SIZE	TDH	GPM	DISCHARGE SIZE			
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	PUMP-01	BOOSTER PUMP #1 (P-401), 1375 GPM @ 203 FT	P-401	Y																				125 HP										
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	PUMP-02	BOOSTER PUMP #2 (P-402), 2750 GPM @ 203 FT	P-402	Y																				200 HP										
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	PUMP-03	BOOSTER PUMP #3 (P-402), 2750 GPM @ 203 FT	P-403	Y																					200 HP									
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	PUMP-04	BOOSTER PUMP #4 (P-402), 2750 GPM @ 203 FT	P-404	Y																					200 HP									
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	CJ-01	CHEMICAL INJECTION SYSTEM	PUMP-06	PUMP #1, NaOCl		Y																														
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	CJ-01	CHEMICAL INJECTION SYSTEM	PUMP-07	PUMP #1, NaOCl		Y																														
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	LS-01	GRINDER STATION	PUMP-08	PUMP #1, GRINDER STATION, 2 HP, 1800 RPM	P-631	Y																				2 HP										
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	LS-01	GRINDER STATION	PUMP-09	PUMP #1, GRINDER STATION, 2 HP, 1800 RPM	P-632	Y																					2 HP									
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SUMP-01	SUMP PUMP ASSEMBLY	PUMP-10	SUMP PUMP WITH 1.25" PIPE AND FITTINGS	P-621	Y																					1/10 HP									
ROTATE EL	LOCATION	LOCATION DESCRIPTION	PARENT ASSET	PARENT ASSET DESCRIPTION	CHILD ASSET	CHILD ASSET DESCRIPTION	TAG	CAPITAL Y/N																														
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	ROTEL-01	ROTATING ELEMENT, BOOSTER PUMP #1 (P-401)	P-401	Y																														
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	ROTEL-02	ROTATING ELEMENT, BOOSTER PUMP #2 (P-402)	P-402	Y																														
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	ROTEL-03	ROTATING ELEMENT, BOOSTER PUMP #3 (P-403)	P-403	Y																														
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	ROTEL-04	ROTATING ELEMENT, BOOSTER PUMP #4 (P-404)	P-404	Y																														
SCADA	LOCATION	LOCATION DESCRIPTION	PARENT ASSET	PARENT ASSET DESCRIPTION	CHILD ASSET	CHILD ASSET DESCRIPTION	TAG	CAPITAL Y/N	COMMISSION DATE / SUBSTANTIAL COMPLETION DATE	WARRANTY END DATE	FINAL INSTALLED COST	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	MANUF PART #	ORACLE PROJECT #	PURCHASE COST	VENDOR	GLOBAL ID	BARCODE	DATE MANUFACTURED	DATE PURCHASED	MANUFACTURER	PART NUMBER	TYPE	USE OF MODULE	COMMENTS											
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY				N																														
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY	CARD-X00001	A I CARD		Y																														
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY	CARD-X00002	A O CARD		Y																														
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY	CARD-X00003	D I CARD		Y																														
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY	CARD-X00004	D O CARD		Y																														
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY	MODULE-X00001	INTERFACE MODULE 1		Y																														
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY	MODULE-X00002	COMMUNICATION MODULE		Y																														
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY	MODULE-X00003	INTERFACE MODULE O		Y																														
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY	MODULE-X00004	ETHERNET MODULE		Y																														
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY	MODULE-X00005	TELECOMMUNICATION INTERFACE MODULE 1		Y																														
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY	PLC-X00001	PLC		Y																														
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY	PS-X00001	POWER SUPPLY		Y																														
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY	RACK-X00001	RACK 1		Y																														
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY	RACK-X00002	RACK 0		Y																														
VFD	LOCATION	LOCATION DESCRIPTION	PARENT ASSET	PARENT ASSET DESCRIPTION	CHILD ASSET	CHILD ASSET DESCRIPTION	TAG	CAPITAL Y/N	COMMISSION DATE / SUBSTANTIAL COMPLETION DATE	WARRANTY END DATE	FINAL INSTALLED COST	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	MANUF PART #	ORACLE PROJECT #	PURCHASE COST	VENDOR	GLOBAL ID	BARCODE	DATE MANUFACTURED	DATE PURCHASED	Amp Rating	HP	Manufacturer	Model Number	Serial Number	Size	Voltage									
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	MCC-01	MCC SWBD-1 ASSEMBLY	VFD-01	VFD BOOSTER PUMP #1	VFD 401	Y																		125 HP												
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	MCC-01	MCC SWBD-1 ASSEMBLY	VFD-02	VFD BOOSTER PUMP #2	VFD 402	Y																		200 HP												
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	MCC-01	MCC SWBD-1 ASSEMBLY	VFD-03	VFD BOOSTER PUMP #3	VFD 403	Y																			200 HP											
	RCDS-034-RECS	TWIN CREEKS REPUMP STATION	MCC-01	MCC SWBD-1 ASSEMBLY	VFD-04	VFD BOOSTER PUMP #4	VFD 404	Y																			200 HP											
WET WELL	LOCATION	LOCATION DESCRIPTION	PARENT ASSET	PARENT ASSET DESCRIPTION	CHILD ASSET	CHILD ASSET DESCRIPTION	TAG	CAPITAL Y/N	COMMISSION DATE / SUBSTANTIAL COMPLETION DATE	WARRANTY END DATE	FINAL INSTALLED COST	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	MANUF PART #	ORACLE PROJECT #	PURCHASE COST	VENDOR	GLOBAL ID	BARCODE	DATE MANUFACTURED	DATE PURCHASED	DIAMETER	SHAPE	TOP ELEVATION	WET WELL BASE ELEVATION	INVERT ELEVATION	WET WELL BASE LEVEL	DEPTH	INVERT LEVEL	INVERT SIZE	WELL LINED	LINER TYPE	MATERIAL	PUMP OUT SIZE			
		RCDS-034-RECS	TWIN CREEKS REPUMP STATION	LS-01	GRINDER STATION	WETWELL-01	GRINDER PUMP STATION, WET WELL, 36-INCH		Y														36"	Cylinder												FIBERGLASS		
FENCE	LOCATION	LOCATION DESCRIPTION	PARENT ASSET	PARENT ASSET DESCRIPTION	CHILD ASSET	CHILD ASSET DESCRIPTION	TAG	CAPITAL Y/N	COMMISSION DATE / SUBSTANTIAL COMPLETION DATE	WARRANTY END DATE	FINAL INSTALLED COST	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	MANUF PART #	ORACLE PROJECT #	PURCHASE COST	VENDOR	GLOBAL ID	BARCODE	DATE MANUFACTURED	DATE PURCHASED	MANUFACTURER	HEIGHT	MATERIAL	INSERTS												
		RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FENCE-01	FENCE AND GATE																																	

Location	Location Description	Parent Asset ID	Parent Asset Description	Child Asset ID	Child Asset Description	Tag	Capital?
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-01	FILL LINE ASSEMBLY	GAUGE-03	PRESSURE GAUGE AND TRANSMITTER (PIT-101)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-01	FILL LINE ASSEMBLY	GAUGE-04	18" MAGNETIC FLOW METER (FE-101)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-01	FILL LINE ASSEMBLY	GAUGE-05	PRESSURE GAUGE (30VAC-100 PSI)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-01	FILL LINE ASSEMBLY	GAUGE-06	PRESSURE GAUGE (30VAC-100 PSI)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-01	FILL LINE ASSEMBLY	PIPE-47	18" GST FILL-CLDI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-01	FILL LINE ASSEMBLY	VALVE-07	18" FLG BUTTERFLY VALVE (BFV-101)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-01	FILL LINE ASSEMBLY	VALVE-08	20" PROPORTIONAL PRESSURE REDUCING VALVE (PRV-101)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-01	FILL LINE ASSEMBLY	VALVE-09	20" PRESSURE SUSTAINING VALVE (PSV-101)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-01	FILL LINE ASSEMBLY	VALVE-10	20" FLG BUTTERLY VALVE (BFV-102)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-01	FILL LINE ASSEMBLY	ARV-01	2" SS ARV; 2" 316 SS BV AND 2" SCH 40; SS PIPE AND FITTINGS TO SUIT		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-01	FILL LINE ASSEMBLY	FTG-01	20" 90 DEG MJ BEND-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-01	FILL LINE ASSEMBLY	FTG-02	20" 90 DEG MJ BEND-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-01	FILL LINE ASSEMBLY	FTG-03	20"X18" FLG ECC RED-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-01	FILL LINE ASSEMBLY	FTG-04	20"X18" FLG ECC RED-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-01	FILL LINE ASSEMBLY	FTG-05	20" FLG SPOOL-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-01	FILL LINE ASSEMBLY	FTG-06	20" 90 DEG MJ BEND-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-01	FILL LINE ASSEMBLY	FTG-07	20" 90 DEG MJ BEND-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-01	FILL LINE ASSEMBLY	FOUNDATION-06	HOUSEKEEPING PAD, FILL LINE ASSEMBLY		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-01	FILL LINE ASSEMBLY	SUPPORT-16	PIPE SUPPORT		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-01	FILL LINE ASSEMBLY	SUPPORT-17	PIPE SUPPORT		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-01	FILL LINE ASSEMBLY	SUPPORT-18	PIPE SUPPORT		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-01	FILL LINE ASSEMBLY	SUPPORT-19	PIPE SUPPORT		Y

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-02	FINISHED WATER ASSEMBLY LINE	GAUGE-07	18" MAGNETIC FLOW METER (FE-700)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-02	FINISHED WATER ASSEMBLY LINE	GAUGE-08	PRESSURE GAUGE AND TRANSMITTER (PIT-700)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-02	FINISHED WATER ASSEMBLY LINE	GAUGE-09	PRESSURE GAUGE AND TRANSMITTER (PIT-701)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-02	FINISHED WATER ASSEMBLY LINE	GAUGE-23	CHLORINE METER/TRANSMITTER		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-02	FINISHED WATER ASSEMBLY LINE	PIPE-48	20" RE-CLDI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-02	FINISHED WATER ASSEMBLY LINE	VALVE-11	20" FLG BUTTERFLY VALVE (BFV-702)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-02	FINISHED WATER ASSEMBLY LINE	VALVE-12	20" FLG BUTTERFLY VALVE (BFV-701)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-02	FINISHED WATER ASSEMBLY	ARV-06	2" SS ARV; 2" 316 SS BV AND 2" SCH 40; SS PIPE AND FITTINGS TO SUIT		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-02	FINISHED WATER ASSEMBLY LINE	FTG-81	24" 90 DEG MJ BEND-DI		Y

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-02	FINISHED WATER ASSEMBLY LINE	FTG-82	24" 90 DEG MJ BEND-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-02	FINISHED WATER ASSEMBLY LINE	FTG-83	24"X20" FLG ECC RED-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-02	FINISHED WATER ASSEMBLY LINE	FTG-84	24"X20" FLG ECC RED-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-02	FINISHED WATER ASSEMBLY LINE	FTG-85	24" 90 DEG FLG BEND-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-02	FINISHED WATER ASSEMBLY LINE	FTG-86	24" 90 DEG MJ BEND-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-02	FINISHED WATER ASSEMBLY LINE	FOUNDATION-07	HOUSEKEEPING PAD, FINISHED WATER ASSEMBLY		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-02	FINISHED WATER ASSEMBLY LINE	SUPPORT-20	PIPE SUPPORT		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-02	FINISHED WATER ASSEMBLY LINE	SUPPORT-21	PIPE SUPPORT		Y

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-03	BYPASS ASSEMBLY LINE	GAUGE-10	16" MAGNETIC FLOW METER (FE-111)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-03	BYPASS ASSEMBLY LINE	PIPE-49	16" RE BYPASS-CLDI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-03	BYPASS ASSEMBLY LINE	VALVE-13	16" FLG BUTTERFLY VALVE (BFV-1112B)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-03	BYPASS ASSEMBLY LINE	VALVE-14	16" FLG RUBBER FLAPPER CHECK VALVE WITH LIMIT SWITCH (CV-111)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-03	BYPASS ASSEMBLY LINE	VALVE-15	16" FLG BUTTERFLY VALVE (BFV-111A)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-03	BYPASSS ASSEMBLY	ARV-07	2" SS ARV; 2" 316 SS BV AND 2" SCH 40; SS PIPE AND FITTINGS TO SUIT		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-03	FINISHED WATER ASSEMBLY LINE	SAMPLE-01	TOTAL RESIDUAL CHLORINE ANALYZER		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-03	BYPASS ASSEMBLY LINE	FTG-87	16" 90 DEG MJ BEND-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-03	BYPASS ASSEMBLY LINE	FTG-88	16" 90 DEG MJ BEND-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-03	BYPASS ASSEMBLY LINE	FTG-89	16" FLG SPOOL-DI (MIN 8" LONG)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-03	BYPASS ASSEMBLY LINE	FTG-90	16" FLG SPOOL-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-03	BYPASS ASSEMBLY LINE	FTG-91	16" FLG SPOOL-DI (MIN 8" LONG)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-03	BYPASS ASSEMBLY LINE	FTG-92	16" 90 DEG FLG BEND-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-03	BYPASS ASSEMBLY LINE	FTG-93	16" 90 DEG MJ BEND-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-03	BYPASS ASSEMBLY LINE	FOUNDATION-08	HOUSEKEEPING PAD, FINISHED WATER ASSEMBLY		Y

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-03	BYPASS ASSEMBLY LINE	SUPPORT-22	PIPE SUPPORT		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-03	BYPASS ASSEMBLY LINE	SUPPORT-23	PIPE SUPPORT		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-03	BYPASS ASSEMBLY LINE	SUPPORT-24	PIPE SUPPORT		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-03	FINISHED WATER ASSEMBLY LINE	HYDRANT-01	RECLAIMED WATER FIRE HYDRANT		Y

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD PIPING	PIPE-08	20" GST FILL-CLDI (TANK FILL)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD PIPING	PIPE-09	30" PUMP SUCTION HEADER-CLDI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD PIPING	PIPE-10	24" RE-CLDI (FROM PUMP STATION TO FINISHED WATER ASSEMBLY)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD PIPING	VALVE-28	20" GATE VALVE W/ 20" RESTRAINED CAP		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD PIPING	VALVE-29	16" GATE VALVE W/ 16" RESTRAINED CAP		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD PIPING	VALVE-30	20" GATE VALVE W/ 20" MJ PLUG-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD-PIPING	FTG-08	20" MJ TEE-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD-PIPING	FTG-09	20"X16" MJ TEE-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD-PIPING	FTG-14	24"X20" MJ TEE-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD-PIPING	FTG-15	30"X24" MJ RED-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD-PIPING	FTG-16	30"X24" MJ TEE-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD-PIPING	FTG-17	30" 11.25 DEG MJ BEND-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD-PIPING	FTG-18	30" 11.25 DEG MJ BEND-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD-PIPING	FTG-19	30" 45 DEG MJ BEND-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD-PIPING	FTG-20	24" 90 DEG MJ BEND-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD-PIPING	FTG-21	24" 90 DEG MJ BEND-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD-PIPING	FTG-22	20"X8" MJ TEE-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD-PIPING	FTG-23	20"X16" MJ TEE-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD-PIPING	FTG-24	20"X16" MJ TEE-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD-PIPING	FTG-25	20"X20" MJ TEE-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD-PIPING	FTG-94	20" 45 DEG MJ BEND-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	ASBLY-04	YARD PIPING	HYDRANT-01	FIRE HYDRANT		Y

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	CIJ-01	CHEMICAL INJECTION SYSTEM				Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	CIJ-01	CHEMICAL INJECTION SYSTEM	PIPE-19	HYPOCHORITE STATION PIPING		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	CIJ-01	CHEMICAL INJECTION SYSTEM	PIPE-50	INJECTOR ASSEMBLY, SODIUM HYPOCHLORITE, PIPING, 1" PVC		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	CIJ-01	CHEMICAL INJECTION SYSTEM	VAULT-01	CHEMICAL INJECTION VAULT, SODIUM HYPOCHLORITE		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	CIJ-01	CHEMICAL INJECTION SYSTEM	FOUNDATION-10	FOUNDATION HYPO BUILDING		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	CIJ-01	CHEMICAL INJECTION SYSTEM	INJECTOR-01	INJECTOR ASSEMBLY, SODIUM HYPOCHLORITE		

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	CIJ-01	CHEMICAL INJECTION SYSTEM	CP-02	SODIUM HYPOCHLORITE FEED PUMP, CONTROL PANEL		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	CIJ-01	CHEMICAL INJECTION SYSTEM	GAUGE-24	LEVEL METER/TRANSMITTER HYPO TANK		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	CIJ-01	CHEMICAL INJECTION SYSTEM	PUMP-06	PUMP #1, NaOCI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	CIJ-01	CHEMICAL INJECTION SYSTEM	PUMP-07	PUMP #1, NaOCI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	CIJ-01	CHEMICAL INJECTION SYSTEM	TANK-04	SINGLE WALL STORAGE TANK, NaOCI, 5100 GALLON	T-501	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	CIJ-01	CHEMICAL INJECTION SYSTEM	CANOPY-01	CANOPY HYPO BUILDING		Y

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	CRANE-01	3 TON MOTORIZED BRIDGE CRANE				
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RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINGE PIPING AND STRUCTURES	PIPE-20	30" RCP DRAINGAGE PIPE	P-1	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINGE PIPING AND STRUCTURES	PIPE-21	30" RCP DRAINGAGE PIPE	P-2	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINGE PIPING AND STRUCTURES	PIPE-22	30" RCP DRAINGAGE PIPE	P-3	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINGE PIPING AND STRUCTURES	PIPE-23	24" RCP DRAINGAGE PIPE	P-4	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINGE PIPING AND STRUCTURES	PIPE-24	18" RCP DRAINGAGE PIPE	P-5	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINGE PIPING AND STRUCTURES	PIPE-25	18" RCP DRAINGAGE PIPE	P-6	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINGE PIPING AND STRUCTURES	PIPE-26	18" RCP DRAINGAGE PIPE	P-7	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINGE PIPING AND STRUCTURES	PIPE-27	18" RCP DRAINGAGE PIPE	P-8	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINGE PIPING AND STRUCTURES	PIPE-28	18" RCP DRAINGAGE PIPE	P-9	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINGE PIPING AND STRUCTURES	PIPE-29	18" RCP DRAINGAGE PIPE	P-10	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINGE PIPING AND STRUCTURES	PIPE-30	18" RCP DRAINGAGE PIPE	P-11	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINGE PIPING AND STRUCTURES	PIPE-31	18" RCP DRAINGAGE PIPE	P-12	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINGE PIPING AND STRUCTURES	PIPE-32	18" RCP DRAINGAGE PIPE	P-13	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINGE PIPING AND STRUCTURES	PIPE-33	18" RCP DRAINGAGE PIPE	P-14	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINGE PIPING AND STRUCTURES	PIPE-34	6" ADS-N-12WT PERFORATED DRAINAGE PIPE	P-15	Y

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINAGE PIPING AND STRUCTURES	PIPE-35	6" ADS-N-12WT PERFORATED DRAINAGE PIPE	P-16	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINAGE PIPING AND STRUCTURES	PIPE-36	6" ADS-N-12WT PERFORATED DRAINAGE PIPE	P-17	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINAGE PIPING AND STRUCTURES	PIPE-37	6" ADS-N-12WT PERFORATED DRAINAGE PIPE	P-18	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINAGE PIPING AND STRUCTURES	PIPE-38	6" ADS-N-12WT PERFORATED DRAINAGE PIPE	P-19	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINAGE PIPING AND STRUCTURES	PIPE-39	6" ADS-N-12WT PERFORATED DRAINAGE PIPE	P-20	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINAGE PIPING AND STRUCTURES	PIPE-40	6" ADS-N-12WT PERFORATED DRAINAGE PIPE	P-21	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINAGE PIPING AND STRUCTURES	PIPE-41	6" ADS-N-12WT PERFORATED DRAINAGE PIPE	P-22	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINAGE PIPING AND STRUCTURES	PIPE-42	6" ADS-N-12WT PERFORATED DRAINAGE PIPE	P-23	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINAGE PIPING AND STRUCTURES	PIPE-43	6" ADS-N-12WT PERFORATED DRAINAGE PIPE	P-24	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINAGE PIPING AND STRUCTURES	PIPE-44	6" ADS-N-12WT PERFORATED DRAINAGE PIPE	P-25	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINAGE PIPING AND STRUCTURES	PIPE-45	6" ADS-N-12WT PERFORATED DRAINAGE PIPE	P-26	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINAGE PIPING AND STRUCTURES	PIPE-46	6" ADS-N-12WT PERFORATED DRAINAGE PIPE	P-27	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINAGE PIPING AND STRUCTURES	DMH-01	FDOT TYPE F INLET W/ 4'X4' TYPE J BOTTOM	S-1	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINAGE PIPING AND STRUCTURES	DMH-02	FDOT TYPE P-8 MANHOLE	S-2	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINAGE PIPING AND STRUCTURES	DMH-03	FDOT TYPE F INLET W/ 4'X4' TYPE J BOTTOM	S-3	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINAGE PIPING AND STRUCTURES	DMH-04	FDOT TYPE F INLET	S-4	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINAGE PIPING AND STRUCTURES	DMH-05	FDOT TYPE P-8 MANHOLE	S-5	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINAGE PIPING AND STRUCTURES	DMH-06	FDOT TYPE F INLET	S-6	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINAGE PIPING AND STRUCTURES	DMH-07	FDOT TYPE P-8 MANHOLE	S-7	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINAGE PIPING AND STRUCTURES	DMH-08	FDOT TYPE P-8 MANHOLE	S-8	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINAGE PIPING AND STRUCTURES	DMH-09	FDOT TYPE F INLET	S-9	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINAGE PIPING AND STRUCTURES	DMH-10	FDOT TYPE F INLET	S-10	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINAGE PIPING AND STRUCTURES	DMH-11	FDOT TYPE P-8 MANHOLE	S-11	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINAGE PIPING AND STRUCTURES	DMH-12	FDOT TYPE F INLET	S-12	Y

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINAGE PIPING AND STRUCTURES	DMH-13	FDOT TYPE F INLET	S-13	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINAGE PIPING AND STRUCTURES	DMH-14	FDOT TYPE F INLET	S-14	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	DRAIN-01	DRAINAGE PIPING AND STRUCTURES	DMH-15	FDOT TYPE P-8 MANHOLE	S-15	Y

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FENCE-01	FENCE AND GATE				Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	FIRE-01	FIRE PROTECTION SYSTEM				Y

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	HVAC-01	HVAC SYSTEMS FOR BOOSTER PUMP BUILDING				
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	HVAC-01	HVAC SYSTEMS FOR BOOSTER PUMP BUILDING	ACCU-01	AIR COOLED CONDENSING UNIT, ELECTRICAL ROOM	ACCU-1	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	HVAC-01	HVAC SYSTEMS FOR BOOSTER PUMP BUILDING	ACCU-02	AIR COOLED CONDENSING UNIT, ELECTRICAL ROOM	ACCU-2	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	HVAC-01	HVAC SYSTEMS FOR BOOSTER PUMP BUILDING	AHU-01	AIR HANDLER #1	AC-1	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	HVAC-01	HVAC SYSTEMS FOR BOOSTER PUMP BUILDING	EF-01	EXHAUST FAN #1, 17,100 CFM, PUMP ROOM, SIDEWALL	EF-1	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	HVAC-01	HVAC SYSTEMS FOR BOOSTER PUMP BUILDING	EF-02	EXHAUST FAN #2, 17,100 CFM, PUMP ROOM, SIDEWALL	EF-2	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	HVAC-01	HVAC SYSTEMS FOR BOOSTER PUMP BUILDING	EF-03	EXHAUST FAN #3, 75 CFM, REST ROOM, CEILING	EF-3	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	HVAC-01	HVAC SYSTEMS FOR BOOSTER PUMP BUILDING	LOUVER-01	LOUVER - INTAKE LOUVER #1, 17,100 CFM	LV-1	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	HVAC-01	HVAC SYSTEMS FOR BOOSTER PUMP BUILDING	LOUVER-02	LOUVER - INTAKE LOUVER #2, 17,100 CFM	LV-2	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	HVAC-01	HVAC SYSTEMS FOR BOOSTER PUMP BUILDING	MOTOR-05	EXHAUST FAN #1, MOTOR	EF-1	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	HVAC-01	HVAC SYSTEMS FOR BOOSTER PUMP BUILDING	MOTOR-06	EXHAUST FAN #2, MOTOR	EF-2	Y

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	HVAC-01	HVAC SYSTEMS FOR BOOSTER PUMP BUILDING	MOTOR-07	EXHAUST FAN #3, MOTOR	EF-3	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GEN-01	GENERATOR , 450 KW GENSET				Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GEN-01	GENERATOR	FOUNDATION-09	GENERATOR FOUNDATION		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GEN-01	GENERATOR	ATS-01	AUTO TRANSFER SWITCH	ATS-1	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GEN-01	GENERATOR	CP-01	GENERATOR CONTROL PANEL		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	GEN-01	GENERATOR	TANK-03	GENERATOR FUEL TANK		Y

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	LS-01	GRINDER STATION				Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	LS-01	GRINDER STATION	WETWELL-01	GRINDER PUMP STATION, WET WELL, 36-INCH		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	LS-01	GRINDER STATION	CP-03	GRINDER PUMP STATION, CONTROL PANEL	VCP-630	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	LS-01	GRINDER STATION	PIPE-51	GRINDER PUMP STATION PIPING/VALVES 1 1/2" SCH80 PVC		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	LS-01	GRINDER STATION	PIPE-52	FORCEMAIN, 4"		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	LS-01	GRINDER STATION	PUMP-08	PUMP #1, GRINDER STATION, 2 HP, 1800 RPM	P-631	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	LS-01	GRINDER STATION	PUMP-09	PUMP #1, GRINDER STATION, 2 HP, 1800 RPM	P-632	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	LS-01	GRINDER STATION	VALVE-31	PUMP OUT VALVE FOR FORCEMAIN	V-621	Y

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	MCC-01	MCC SWBD-1 ASSEMBLY			SWBD-1	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	MCC-01	MCC SWBD-1 ASSEMBLY	VFD-01	VFD BOOSTER PUMP #1	VFD 401	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	MCC-01	MCC SWBD-1 ASSEMBLY	VFD-02	VFD BOOSTER PUMP #2	VFD 402	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	MCC-01	MCC SWBD-1 ASSEMBLY	VFD-03	VFD BOOSTER PUMP #3	VFD 403	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	MCC-01	MCC SWBD-1 ASSEMBLY	VFD-04	VFD BOOSTER PUMP #4	VFD 404	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	MCC-01	MCC SWBD-1 ASSEMBLY	BRKR-X00001	MAIN BREAKER MCC SWBD-1		N
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	MCC-01	MCC SWBD-1 ASSEMBLY	BRKR-X00002	BREAKER TO VFD 401, 300 AMP		N
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	MCC-01	MCC SWBD-1 ASSEMBLY	BRKR-X00003	BREAKER TO VFD 402, 300 AMP		N
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	MCC-01	MCC SWBD-1 ASSEMBLY	BRKR-X00004	BREAKER TO VFD 403, 300 AMP		N
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	MCC-01	MCC SWBD-1 ASSEMBLY	BRKR-X00005	BREAKER TO VFD 404, 300 AMP		N

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	LIGHTING-01	LIGHTING				
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RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PLUMBING-01	PLUMBING				
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RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	GAUGE-11	BOOSTER PUMP #1, PRESSURE INDICATING TRANSMITTER, UPSTREAM		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	GAUGE-12	BOOSTER PUMP #1, PRESSURE GAUGE (TYP 4) (30VAC-50PSI), UPSTREAM		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	GAUGE-13	BOOSTER PUMP #1, PRESSURE GAUGE (TYP 4) (0-150 PSI), DOWNSTREAM		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	PIPE-11	14" CLDI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	PIPE-12	12" RE-CLDI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	VALVE-16	BOOSTER PUMP #1, NORMALLY OPEN 14" BUTTERFLY VALVE (TYP 5), UPSTREAM		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	VALVE-17	BOOSTER PUMP #1, 12" RUBBER FLAPPER CHECK VALVE W/ LIMIT SWITCH (TYP 4), DOWNSTREAM		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	VALVE-18	BOOSTER PUMP #1, NORMALLY OPEN 12" BUTTERFLY VALVE (TYP 4), DOWNSTREAM		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	ARV-02	1" SST AIR RELEASE VALVE; 1" PVC BV AND 1" SCH 80 PVC PIPE AND FITTINGS TO SUIT DISCHARGE TO TRENCH (TYP EA PUMP)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	FTG-32	20"X14" MJ RED-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	FTG-33	14" 90 DEG MJ BEND-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	FTG-34	14" 90 DEG FLG BEND-DI (TYP 5)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	FTG-35	14" FLEX HOSE CONNECTION (TYP 4)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	FTG-36	14"X6" FLG ECC REDUCER-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	FTG-37	6" FLG SPOOL-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	FTG-38	12"X5" FLG ECC REDUCER-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	FTG-39	16" FLG SPOOL-DI (MIN 8" LONG) (TYP 5)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	FTG-40	12" 90 DEG FLG BEND-DI (TYP 5)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	FTG-41	12" 90 DEG FLG BASE BEND-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	FTG-42	20" X 12" FLG RED-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	FOUNDATION-01	PUMP PEDESTAL FOUNDATION AND FLOOR, BOOSTER PUMP # 1		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	SUPPORT-01	PIPE SUPPORT		Y

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	SUPPORT-02	PIPE SUPPORT		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	SUPPORT-03	PIPE SUPPORT		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	MOTOR-01	MOTOR, BOOSTER PUMP #1 (P-401)	P-401	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	PUMP-01	BOOSTER PUMP #1 (P-401), 1375 GPM @ 203 FT	P-401	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-01	BOOSTER PUMP ASSEMBLY #1	ROTEL-01	ROTATING ELEMENT, BOOSTER PUMP #1 (P-401)	P-401	Y

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	GAUGE-14	BOOSTER PUMP #2, PRESSURE INDICATING TRANSMITTER, UPSTREAM		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	GAUGE-15	BOOSTER PUMP #2, PRESSURE GAUGE (TYP 4) (30VAC-50PSI), UPSTREAM		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	GAUGE-16	BOOSTER PUMP #2, PRESSURE GAUGE (TYP 4) (0-150 PSI), DOWNSTREAM		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	PIPE-13	14" CLDI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	PIPE-14	12" RE-CLDI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	VALVE-19	BOOSTER PUMP #2, NORMALLY OPEN 14" BUTTERFLY VALVE (TYP 5), UPSTREAM		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	VALVE-20	BOOSTER PUMP #2, 12" RUBBER FLAPPER CHECK VALVE W/ LIMIT SWITCH (TYP 4), DOWNSTREAM		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	VALVE-21	BOOSTER PUMP #2, NORMALLY OPEN 12" BUTTERFLY VALVE (TYP 4), DOWNSTREAM		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	ARV-03	1" SST AIR RELEASE VALVE; 1" PVC BV AND 1" SCH 80 PVC PIPE AND FITTINGS TO SUIT DISCHARGE TO TRENCH (TYP EA PUMP)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	FTG-43	24"X20" MJ RED-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	FTG-44	20"X14" MJ TEE-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	FTG-45	14" 90 DEG FLG BEND-DI (TYP 5)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	FTG-46	14" FLEX HOSE CONNECTION (TYP 4)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	FTG-47	14"X10" FLG ECC REDUCER-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	FTG-48	10" FLG SPOOL-DI (TYP 3)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	FTG-49	12"X8" FLG ECC REDUCER-DI (TYP 3)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	FTG-50	16" FLG SPOOL-DI (MIN 8" LONG) (TYP 5)		Y

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	FTG-51	12" 90 DEG FLG BEND-DI (TYP 5)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	FTG-52	20"X12" FLG TEE-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	FTG-53	24"X20" FLG RED-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSE	FOUNDATION-02	PUMP PEDESTAL FOUNDATION AND FLOOR, BOOSTER PUMP # 2		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	SUPPORT-04	PIPE SUPPORT		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	SUPPORT-05	PIPE SUPPORT		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	SUPPORT-06	PIPE SUPPORT		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	MOTOR-02	MOTOR, BOOSTER PUMP #2 (P-402)	P-402	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	PUMP-02	BOOSTER PUMP #2 (P-402), 2750 GPM @ 203 FT	P-402	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-02	BOOSTER PUMP ASSEMBLY #2	ROTEL-02	ROTATING ELEMENT, BOOSTER PUMP #2 (P-402)	P-402	Y

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	GAUGE-17	BOOSTER PUMP #3, PRESSURE INDICATING TRANSMITTER, UPSTREAM		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	GAUGE-18	BOOSTER PUMP #3, PRESSURE GAUGE (TYP 4) (30VAC-50PSI), UPSTREAM		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	GAUGE-19	BOOSTER PUMP #3, PRESSURE GAUGE (TYP 4) (0-150 PSI), DOWNSTREAM		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	PIPE-15	14" CLDI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	PIPE-16	12" RE-CLDI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	VALVE-22	BOOSTER PUMP #3, NORMALLY OPEN 14" BUTTERFLY VALVE (TYP 5), UPSTREAM		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	VALVE-23	BOOSTER PUMP #3, 12" RUBBER FLAPPER CHECK VALVE W/ LIMIT SWITCH (TYP 4), DOWNSTREAM		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	VALVE-24	BOOSTER PUMP #3, NORMALLY OPEN 12" BUTTERFLY VALVE (TYP 4), DOWNSTREAM		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	ARV-04	1" SST AIR RELEASE VALVE; 1" PVC BV AND 1" SCH 80 PVC PIPE AND FITTINGS TO SUIT DISCHARGE TO TRENCH (TYP EA PUMP)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	FTG-54	30"X24" MJ RED-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	FTG-55	24"X14" MJ TEE-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	FTG-56	14" 90 DEG FLG BEND-DI (TYP 5)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	FTG-57	14" FLEX HOSE CONNECTION (TYP 4)		Y

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	FTG-58	14"X10" FLG ECC REDUCER-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	FTG-59	10" FLG SPOOL-DI (TYP 3)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	FTG-60	12"X8" FLG ECC REDUCER-DI (TYP 3)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	FTG-61	16" FLG SPOOL-DI (MIN 8" LONG) (TYP 5)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	FTG-62	12" 90 DEG FLG BEND-DI (TYP 5)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	FTG-63	24"X12" FLG TEE-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	FOUNDATION-03	PUMP PEDESTAL FOUNDATION AND FLOOR, BOOSTER PUMP # 3		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	SUPPORT-07	PIPE SUPPORT		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	SUPPORT-08	PIPE SUPPORT		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	SUPPORT-09	PIPE SUPPORT		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	MOTOR-03	MOTOR, BOOSTER PUMP #3 (P-403)	P-403	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	PUMP-03	BOOSTER PUMP #3 (P-402), 2750 GPM @ 203 FT	P-403	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-03	BOOSTER PUMP ASSEMBLY #3	ROTEL-03	ROTATING ELEMENT, BOOSTER PUMP #3 (P-403)	P-403	Y

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	GAUGE-20	BOOSTER PUMP #4, PRESSURE INDICATING TRANSMITTER, UPSTREAM		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	GAUGE-21	BOOSTER PUMP #4, PRESSURE GAUGE (TYP 4) (30VAC-50PSI), UPSTREAM		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	GAUGE-22	BOOSTER PUMP #4, PRESSURE GAUGE (TYP 4) (0-150 PSI), DOWNSTREAM		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	PIPE-17	14" CLDI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	PIPE-18	12" RE-CLDI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	VALVE-25	BOOSTER PUMP #4, NORMALLY OPEN 14" BUTTERFLY VALVE (TYP 5), UPSTREAM		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	VALVE-26	BOOSTER PUMP #4, 12" RUBBER FLAPPER CHECK VALVE W/ LIMIT SWITCH (TYP 4), DOWNSTREAM		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	VALVE-27	BOOSTER PUMP #4, NORMALLY OPEN 12" BUTTERFLY VALVE (TYP 4), DOWNSTREAM		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	ARV-05	1" SST AIR RELEASE VALVE; 1" PVC BV AND 1" SCH 80 PVC PIPE AND FITTINGS TO SUIT DISCHARGE TO TRENCH (TYP EA PUMP)		Y

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	FTG-64	30"X20" MJ TEE-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	FTG-65	20"X14" MJ RED-DI (TYP 2)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	FTG-66	14" 90 DEG FLG BEND-DI (TYP 5)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	FTG-67	14" FLEX HOSE CONNECTION (TYP 4)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	FTG-68	14"X10" FLG ECC REDUCER-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	FTG-69	10" FLG SPOOL-DI (TYP 3)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	FTG-70	12"X8" FLG ECC REDUCER-DI (TYP 3)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	FTG-71	16" FLG SPOOL-DI (MIN 8" LONG) (TYP 5)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	FTG-72	12" 90 DEG FLG BEND-DI (TYP 5)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	FTG-73	24"X12" FLG TEE-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	FOUNDATION-04	PUMP PEDESTAL FOUNDATION AND FLOOR, BOOSTER PUMP # 4		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	SUPPORT-10	PIPE SUPPORT		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	SUPPORT-11	PIPE SUPPORT		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	SUPPORT-12	PIPE SUPPORT		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	MOTOR-04	MOTOR, BOOSTER PUMP #4 (P-404)	P-404	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	PUMP-04	BOOSTER PUMP #4 (P-402), 2750 GPM @ 203 FT	P-404	Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-04	BOOSTER PUMP ASSEMBLY #4	ROTEL-04	ROTATING ELEMENT, BOOSTER PUMP #4 (P-404)	P-404	Y

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-05	BOOSTER PUMP ASSEMBLY #5 (FUTURE)	FTG-74	30"X20" MJ TEE-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-05	BOOSTER PUMP ASSEMBLY #5 (FUTURE)	FTG-75	20"X14" MJ RED-DI (TYP 2)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-05	BOOSTER PUMP ASSEMBLY #5 (FUTURE)	FTG-76	14" 90 DEG FLG BEND-DI (TYP 5)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-05	BOOSTER PUMP ASSEMBLY #5 (FUTURE)	FTG-77	14" BLIND FLANGE-DI		Y

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-05	BOOSTER PUMP ASSEMBLY #5 (FUTURE)	FTG-78	12" BLIND FLANGE-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-05	BOOSTER PUMP ASSEMBLY #5 (FUTURE)	FTG-79	12" 90 DEG FLG BEND-DI (TYP 5)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-05	BOOSTER PUMP ASSEMBLY #5 (FUTURE)	FTG-80	24"X12" FLG TEE-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-05	BOOSTER PUMP ASSEMBLY #5	FOUNDATION-05	PUMP PEDESTAL FOUNDATION AND FLOOR, BOOSTER PUMP # 5 (FUTURE)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-05	BOOSTER PUMP ASSEMBLY #5 (FUTURE)	SUPPORT-13	PIPE SUPPORT		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-05	BOOSTER PUMP ASSEMBLY #5 (FUTURE)	SUPPORT-14	PIPE SUPPORT		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	PUMP-05	BOOSTER PUMP ASSEMBLY #5 (FUTURE)	SUPPORT-15	PIPE SUPPORT		Y

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY				N
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY	CARD-X00001	A I CARD		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY	CARD-X00002	A O CARD		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY	CARD-X00003	D I CARD		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY	CARD-X00004	D O CARD		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY	MODULE-X00001	INTERFACE MODULE 1		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY	MODULE-X00002	COMMUNICATION MODULE		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY	MODULE-X00003	INTERFACE MODULE O		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY	MODULE-X00004	ETHERNET MODULE		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY	MODULE-X00005	TELECOMMUNICATION INTERFACE MODULE 1		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY	PLC-X00001	PLC		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY	PS-X00001	POWER SUPPLY		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY	RACK-X00001	RACK 1		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY	RACK-X00002	RACK O		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SCADA-01	SCADA ASSEMBLY	OP-X00001	INTERFACE DISPLAY PANEL (OP 270)		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	SUMP-01	SUMP PUMP ASSEMBLY	PUMP-10	SUMP PUMP WITH 1.25" PIPE AND FITTINGS	P-621	Y

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-01	RESERVOIR 1, TWIN CREEKS REPUMP STATION	GAUGE-01	LIQUID LEVEL INDICATOR, RESERVOIR 2, TWIN CREEKS REPUMP STATION		N
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RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-01	RESERVOIR 1, TWIN CREEKS REPUMP STATION	PIPE-02	INFLUENT PIPE, 20", RESERVIOR 1, TWIN CREEKS REPUMP STATION		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-01	RESERVOIR 1, TWIN CREEKS REPUMP STATION	PIPE-03	EEFLUENT PIPE, 24", RESERVIOR 1, TWIN CREEKS REPUMP STATION		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-01	RESERVOIR 1, TWIN CREEKS REPUMP STATION	PIPE-04	DRAIN PIPE, 8", RESERVIOR 1, TWIN CREEKS REPUMP STATION		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-01	1.66 MG (1.5 MG USABLE VOLUME) TANK NO. 1	TANK-01	RESERVOIR 1, TWIN CREEKS REPUMP STATION		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-01	RESERVOIR 2, TWIN CREEKS REPUMP STATION	VALVE-01	20" INFLUENT VALVE , RESERVIOR 1, TWIN CREEKS REPUMP STATION		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-01	RESERVOIR 2, TWIN CREEKS REPUMP STATION	VALVE-02	24" EFFLUENT VALVE , RESERVIOR 1, TWIN CREEKS REPUMP STATION		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-01	RESERVOIR 2, TWIN CREEKS REPUMP STATION	VALVE-03	6" DRAIN VALVE, RESERVIOR 1, TWIN CREEKS REPUMP		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-01	RESERVOIR 2, TWIN CREEKS REPUMP STATION	XDUCER-01	LEVEL METER AND TRANSMITTER, RESERVOIR 1, TWIN CREEKS REPUMP STATION		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-01	1.66 MG (1.5 MG USABLE VOLUME) TANK NO. 1	FTG-10	20" 90 DEG MJ BEND-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-01	1.66 MG (1.5 MG USABLE VOLUME) TANK NO. 1	FTG-12	24" 90 DEG MJ BEND-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-01	1.66 MG (1.5 MG USABLE VOLUME) TANK NO. 1	FTG-26	24" 90 DEG MJ BEND-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-01	1.66 MG (1.5 MG USABLE VOLUME) TANK NO. 1	FTG-27	24" 90 DEG MJ BEND-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-01	1.66 MG (1.5 MG USABLE VOLUME) TANK NO. 1	FTG-28	24" 90 DEG MJ BEND-DI		Y

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-02	RESERVOIR 2, TWIN CREEKS REPUMP STATION	GAUGE-02	LIQUID LEVEL INDICATOR, RESERVOIR 2, TWIN CREEKS REPUMP STATION		N
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-02	RESERVOIR 2, TWIN CREEKS REPUMP STATION	PIPE-05	INFLUENT PIPE, 20", RESERVIOR 2, TWIN CREEKS REPUMP STATION		Y

RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-02	RESERVOIR 2, TWIN CREEKS REPUMP STATION	PIPE-06	EFFLUENT PIPE, 24", RESERVOIR 2, TWIN CREEKS REPUMP STATION		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-02	RESERVOIR 2, TWIN CREEKS REPUMP STATION	PIPE-07	DRAIN PIPE, 8", RESERVOIR 2, TWIN CREEKS REPUMP STATION		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-02	1.66 MG (1.5 MG USABLE VOLUME) TANK NO. 2	TANK-02	RESERVOIR 2, TWIN CREEKS REPUMP STATION		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-02	RESERVOIR 2, TWIN CREEKS REPUMP STATION	VALVE-04	20" INFLUENT VALVE , RESERVOIR 2, TWIN CREEKS REPUMP STATION		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-02	RESERVOIR 2, TWIN CREEKS REPUMP STATION	VALVE-05	24" EFFLUENT VALVE , RESERVOIR 2, TWIN CREEKS REPUMP STATION		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-02	RESERVOIR 2, TWIN CREEKS REPUMP STATION	VALVE-06	6" DRAIN VALVE, RESERVOIR 2, TWIN CREEKS REPUMP		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-02	RESERVOIR 2, TWIN CREEKS REPUMP STATION	XDUCER-02	LEVEL METER AND TRANSMITTER, RESERVOIR 2, TWIN CREEKS REPUMP STATION		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-02	1.66 MG (1.5 MG USABLE VOLUME) TANK NO. 2	FTG-11	20" 90 DEG MJ BEND-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-02	1.66 MG (1.5 MG USABLE VOLUME) TANK NO. 2	FTG-13	24" 90 DEG MJ BEND-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-02	1.66 MG (1.5 MG USABLE VOLUME) TANK NO. 2	FTG-29	24" 90 DEG MJ BEND-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-02	1.66 MG (1.5 MG USABLE VOLUME) TANK NO. 2	FTG-30	24" 90 DEG MJ BEND-DI		Y
RCDS-034-RECS	TWIN CREEKS REPUMP STATION	TANK-02	1.66 MG (1.5 MG USABLE VOLUME) TANK NO. 2	FTG-31	24" 90 DEG MJ BEND-DI		Y

Main St WTP - Well #13

WELL ADDRESS	
ASSOCIATED WTP	
CASING DEPTH (ft)	
CASING TOTAL DEPTH (ft)	
GALLONS PER MINUTE	
DATE WELL DRILLED	
LAT / LONG COORDINATES	
WELL CASING DIAMETER (inch)	

Vendor and Manufacturer Data

[illegible]

Local Representative Data

[illegible]

Spare Part Data

[illegible]

Spare Part Data

[illegible]

Preventive Maintenance Header

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Preventive Maintenance Tasks

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Appendix D

Wire Wrapped Prestressed Concrete Tank Contractor's Scope of Work

SECTION 13216

WIRE WRAPPED PRESTRESSED CONCRETE TANK

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. The tanks and all accessories described herein will be bid as part of the Phase I improvements for the Twin Creeks Re-Pump Station Improvements project. It will be the responsibility of the tank MANUFACTURER to coordinate construction of the tank with the re-pump station CONTRACTOR and other work associated with the tanks. All costs associated with such shall be included in the bid price.
- B. Furnish all labor, materials, and incidentals required to design, construct, and test two (2) circular, 120-foot inside diameter, 1.66 MG (**nominal volume**) wire wrapped pre-stressed concrete reclaimed water storage tanks including a gravity ventilator, hatches, guardrails, rainfall capture system, stair tower assembly and other accessories as shown on the Drawings and described herein.
- C. The soils beneath and up to 5 feet around the perimeter of the proposed ground storage tank (GST) shall be excavated 6 inches from existing grade. The excavated material shall be removed, hauled and disposed of in an approved landfill or State of Florida approved disposal facility. The cost for this dewatering, excavation, removal, hauling and disposal, shall be included in the tank MANUFACTURER's base bid. No additional payment for this work will be considered. The tank MANUFACTURER shall refer to the geotechnical report for the water table and seasonal high ground water table levels. **An AVERAGE seasonal high water table beneath BOTH tanks shall be considered at elevation 50.87 feet.** Any additional fill required for the tank foundation shall be provided in the tank MANUFACTURER'S base bid per Section 02220 and 02221.
- D. The reclaimed water storage tanks will require post-loading of the area with water for four weeks after construction and prior to making any piping connections as described in the geotechnical report. The geotechnical report is included in **Appendix A.**

1.02 RELATED WORK

- A. Excavation, dewatering, and backfill are included in Division 2.
- B. Concrete is included in Division 3.
- C. Pipes, valves, and fittings are included in Division 15.

SECTION 13216

WIRE WRAPPED PRESTRESSED CONCRETE TANK

1.03 SUBMITTALS

- A. Submit shop drawings, design calculations, and product data, showing materials of construction and details of installation for construction of the new reclaimed water storage tanks and all related appurtenances as shown on the design drawings and in this specification in accordance with Section 01300:
1. Product Data: Manufacturer's information, specifications, and installation instructions for the tank appurtenances. This submittal will be reviewed for operational requirements only. The locations of all appurtenances shall be identified and dimensioned. Appurtenances may include the following:
 - a. Inlet, outlet, drain, and level tap pipes
 - b. Ladders, stairs, walkways, platforms, guardrails, sump, hatches, vortex breakers, and pipe sleeves
 - c. Wall manways and dome sleeves
 - d. Settlement monuments
 - e. Liquid level indicators
 - f. Perimeter concrete overflows
 - g. Roof ventilator and curbs
 - h. Rainfall capture system
 - i. All other appurtenances
 2. Shop Drawings: Detailed erection shop drawings and construction procedures stamped by a professional ENGINEER licensed in the State of Florida. Provide complete details for the foundation, floor slab, walls, dome, piping, and all other details and accessories necessary to construct the tanks. The submittal shall include thicknesses and dimensions of all structure components and the prestressing schedule showing number and placement of prestressing wires. The submittal shall include the size, location and number of all reinforcing bars. The submittal will be reviewed for operational requirements only and will be used in the field by the OWNER's representative during construction.
 3. Submit concrete design mixes including ingredient proportions, minimum cementitious content, and water/cementitious ratio in accordance with Paragraph 2.02 and 2.03 of this specification.
 4. Interior and exterior coating data:
 - a. Product data sheets for each coating product used to coat the interior and exterior concrete surfaces and interior metallic surfaces.
 - b. Coating profile including recommended surface preparation, prime coat MDFT and finish coat MDFT for the interior and exterior coatings.
 - c. Qualifications and record of experience of the tank contractor's crew performing the work.
 - d. Submit a statement from the coatings manufacturer that they will monitor the coatings work and testing during construction to ensure the 10-year warranty is enforceable.

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- e. Documentation for cure time based on temperature.
 - f. Color chart
 - 5. Submit concrete and shotcrete strength reports for 7-day and 28-day breaks taken in accordance with the requirements of Paragraph 3.04 of this specification.
 - 6. Submit warranty document in Owner's name in accordance with Paragraph 1.08 of this specification.
 - 7. Submit a cleaning plan which complies Paragraph 3.05 of this specification.
- B. Design Data
- 1. Submit design calculations of the tanks stamped by a professional ENGINEER licensed in the State of Florida for the project records. These calculations shall be provided at the time of initial shop drawing review. If changes occur during construction, the tank MANUFACTURER will also provide the "as-built tank" design calculations for re-submittal upon completion of construction.
 - 2. Rainfall capture system calculations shall be provided with the initial shop drawing.
 - 3. Tank manufacturer shall provide weir calculations showing that the concrete dome overflows are sized to accommodate the maximum fill rate.
- C. Certification
- 1. The tank MANUFACTURER shall be responsible for the design and construction of the prestressed concrete tanks. The tank MANUFACTURER shall submit written certification prepared, sealed, and signed by a professional ENGINEER licensed State of Florida that the design, details, and construction conform to the requirements of AWWA D110, this Section, and applicable city and state building codes.
 - 2. The tank CONTRACTOR shall submit results of the concrete and shotcrete strength test following 28 days of curing.
 - 3. Tank MANUFACTURER shall submit field tests demonstrating the interior and exterior coatings were accepted by the coatings' manufacturer.
- D. Statement of Qualification
- 1. Submit experience record in the design and construction of wire wrapped prestressed concrete tanks as specified herein.
 - 2. Submit ACI CP-60 certification for each nozzleman and foreman to be employed on the project as specified herein.
- E. Project Record Documents
- 1. Record actual location layout and final configuration of tanks and accessories and appurtenances on the shop drawings and submit to ENGINEER after construction of the tanks are complete.

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1.04 DEFINITIONS

- A. Prestressed Tank System: Consists of AWWA D110 wire-wound, circular prestressed concrete tanks with Type II core wall, concrete dome roof storage tanks with GALVANIZED steel diaphragm, concrete base mat, reinforcing, concrete work, accessories, appurtenances and testing directly related to the tanks.
- B. Shotcrete: Mortar projected directly upon intended surface.

1.05 REFERENCE STANDARDS AND DOCUMENTS

- A. JEA WTP Standards Manual Section V - Ground Storage Tank
- B. American Society for Testing and Materials (ASTM)
 - 1. ASTM A416/A416M - Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.
 - 2. ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - 3. ASTM A653, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot Dip Process.
 - 4. ASTM A821/A821M – Standard Specification for Steel Wire, Hard Drawn for Prestressing Concrete Tanks.
 - 5. ASTM A884/A884M – Standard Specification for Epoxy Coated Steel Wire and Welded Wire Reinforcement.
 - 6. ASTM A1064/A1064M Standard Specification for Carbon Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
 - 7. ASTM C31/C31M – Test Methods for Making and Curing Concrete Test Specimens in the Field.
 - 8. ASTM C33/C33M – Specification for Concrete Aggregates.
 - 9. ASTM C39/C39M – Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - 10. ASTM C42, Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
 - 11. ASTM C143 – Standard Test Method for Slump of Hydraulic-Cement.
 - 12. ASTM C172 – Standard Practice for Sampling Freshly Mixed Concrete.
 - 13. ASTM C231 – Standard Test Method for Air Content of Freshly Mixed Concrete by Pressure Method.
 - 14. ASTM C881/C881M – Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
 - 15. ASTM C1140/C1140M – 11 – Standard Practice for Preparing and Testing Specimens from Shotcrete Test Panels.

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16. ASTM D1056 – Standard Specification for Flexible Cellular Materials-
Sponge or Expanded Rubber.
 17. ASTM D1557, Standard Test Method for Laboratory Compaction
Characteristics of Soil Using Modified Effort.
 18. ASTM E1745 – Standard Specifications for Plastic Water Vapor Retarders
Used in Contact with Soil or Granular Fill Under Concrete Slabs.
 19. ASTM F593, Standard Specification for Stainless Steel Bolts, Hex Cap
Screws, and Studs.
- C. American Concrete Institute (ACI)
1. ACI 117 – Specification for Tolerances for Concrete Construction and
Materials.
 2. ACI 301 – Specifications for Structural Concrete for Buildings.
 3. ACI 305R – Hot Weather Concreting.
 4. ACI 306R – Cold Weather Concreting.
 5. ACI 318 – Building Code Requirements for Structural Concrete.
 6. ACI 347 – Guide to Formwork for Concrete.
 7. ACI 350/350R – Environmental Engineering Concrete Structures.
 8. ACI 350.1-10 – Specification for Tightness Testing of Environmental
Engineering Concrete Containment Structures & Commentary.
 9. ACI 372R-13 – Design and Construction of Circular Wire and Strand
Wrapped Prestressed Concrete Structures.
 10. ACI 506R.2 – Guide to Shotcrete.
 11. ACI CP-60 – Shotcrete Nozzlemen Certification Publication.
 12. ACI SP4 – Formwork for Concrete.
- D. American Society of Civil Engineers (ASCE): 7 – Minimum Design Loads for
Buildings and Other Structures.
- E. American Water Works Association (AWWA)
1. AWWA D110 – Wire- and Strand- Wound Circular-Prestressed Concrete
Water Tanks
- F. U.S. Army Corps of ENGINEERs Spec. CRD-C572 - Specification for PVC
Waterstop
- G. Florida Building Code, 2017, 6th edition
- H. Occupational Safety and Health Administration (OSHA)
- I. Concrete Reinforcing Steel Institute (CRSI) – Code of Standard Practice
- J. Where reference is made to one of the above standards, the revision in effect at
the time of bid opening shall apply.

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1.06 QUALITY ASSURANCE

- A. The tank shall be wire wrapped prestressed concrete tank with a Type II core wall as manufactured by Crom Corp. Gainesville, Florida, Precon Corporation of Newberry, Florida or ENGINEER pre-approved equal that meet or exceed all quality assurance prequalification requirements. Approved equals will be added by addendum only.
- B. The tank design and construction shall be performed by an established manufacturer of recognized ability, having at least 10 years of experience in the design and construction of wire wrapped circular prestressed concrete tanks as specified herein. The design and construction of all aspects of the floor slab, walls, dome, prestressing, and shotcrete of the wire wound circular prestressed concrete tank shall be performed by the tank MANUFACTURER and shall not be subcontracted or otherwise assigned.
 - 1. The MANUFACTURER shall have designed and constructed at least 20 wire wrapped prestressed concrete tanks conforming to ANSI/AWWA D110 with Type II core wall(s) that have been put into service within the last 5 years. The tanks shall be of equal or greater size than that required for this proposed tank.
 - 2. The tank manufacturer shall have provided tank coatings on more than 20 domed, circular prestressed concrete tanks.
 - 3. The MANUFACTURER's staff shall include a full-time professional engineer registered in the state of Florida, having no less than five years of experience in the design and field construction of circular prestressed composite tanks. All working drawings and design calculations shall carry the seal of such registered professional engineer.
- C. All concrete work including the foundation, base slab/floor, walls, and roof shall be performed by the tank MANUFACTURER, including all tank coatings, using its own trained personnel and equipment.
- D. Foreman supervising the placing of the shotcrete shall have a minimum of five (5) years' experience as a nozzleman. Each shotcrete nozzleman shall have a minimum of five (5) years' experience on similar applications and shall be able to demonstrate by tests, if required, his/her ability to satisfactorily gun shotcrete of the required quality. All shotcrete nozzleman shall be certified by the American Concrete Institute (ACI) as outlined in the ACI certification publication CP-60.
- E. All interior and exterior coatings shall be included in the scope of the tank MANUFACTURER. The exterior coating shall carry a 5-year warranty and the interior coating shall carry a 10-year warranty. All coating work shall be completed by the tank MANUFACTURER. Subcontracting of this work is not allowed.

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F. Prequalification

1. All tank construction companies must be prequalified and meet the criteria stated in Paragraph 1.06 of this specification to be considered an acceptable tank builder.
2. A complete prequalification package shall be submitted to the ENGINEER for consideration 21 days prior to the date set for receipt of bids. The prequalification submittal shall include the following items:
 - a. Complete construction drawings showing the principal sizes, thicknesses, reinforcing size and spacing for all structural members including: floor, wall, dome shell, and dome edge.
 - b. Complete details of other structural appurtenances as required by the project drawings showing principal sizes, thickness, and reinforcing sizes and spacing.
 - c. Complete design calculations which address applicable loads provided in Paragraph 1.07 B of this specification.
 - d. Complete experience record for the tanks used to meet the experience requirement of Paragraph 1.06 B of this specification that have been designed and built in the tank construction company's own name and shall include only those tanks that are under the company's warranty. The record shall include the size of the tank; name, address and telephone number of the Owner; the year of construction; and the name and telephone number of the Engineer for the project.
 - e. Experience in prestressed concrete tanks of the type specified herein for the construction superintendent, foreman, and three most experienced tank builders. Experience shall be with the bidder during the three previous years.
 - f. Construction schedule which details the duration for tank construction.

1.07 DESIGN CRITERIA

- A. Tank construction for the two (2) circular wire wrapped prestressed concrete, domed, AWWA D110 Type II, reclaimed water tanks.
 1. Inside diameter: 120 feet
 2. Tank finished floor elevation: 52.28 feet (NAVD 88)
 3. Finished grade around tank exterior perimeter: varies as per contract drawings
 4. Usable Liquid Capacity – 1,500,000 gallons
 - a. Maximum water elevation at overflow through frog eyes: 71.91 feet
 - b. Minimum low water elevation: 53.93 feet
 - c. Maintenance water elevation (empty): 52.28 feet
 5. Maximum Influent Flow Rate – 11,250 gpm
 6. Maximum Effluent Flow Rate – 16,250 gpm
 7. Connections to each tank and piping requirements including tank penetrations, watertight appurtenances, and concrete encasement below tank for the following:
 - a. 20-inch diameter influent ductile iron pipe

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- b. 30-inch diameter effluent ductile iron pipe that reduces to a 24-inch diameter effluent ductile iron pipe under the tank
 - 1) Provide vortex suppression plate
 - c. 8-inch diameter drain pipe with one inlet
 - d. Flanged pipe sleeve for conduit/instrumentation
- 8. Tank accessories furnished and installed to include:
 - a. Tank access hatch curbs and covers for each tank
 - b. Exterior aluminum stairs
 - c. Interior fiberglass ladders with safety climbing devices
 - d. Two wall manholes per tank
 - e. Fiberglass liquid level indicator for each tank
 - f. Provisions for mounting conduit for electrical equipment including conduit mounting brackets and a dome probe openings/curbs as well as any necessary side wall pipe connections.
 - g. Provide thickened bosses for the full height of the wall as shown on the Drawings for mounting materials such as exterior lightning protection down conductor conduit, exterior electrical conduits, and internal ladder on each tank.
 - h. One (1) 4-inch 316 SS schedule 40 pipe for the pressure transmitter floor penetration and valves for each tank as shown on the Drawings.
- 9. Tank MANUFACTURER shall provide light pole support brackets as shown on the Drawings. The light poles and light switches located on the stair tower shall be provided by the re-pump station CONTRACTOR.
- 10. Precast concrete overflows in the dome of the roof on each tank as shown on the Drawings.
- 11. Guardrail around entire dome of tanks.
- 12. Gravity dome ventilator for each tank.
- 13. Rain capture system with parapet wall and sloped edge of dome with grout so that runoff from dome drains to the ground storage tanks. The 25 year, 24-hour storm event of 9.5-inches should be used for the design of the rain capture system.
- 14. A tank placard shall be installed on the exterior of each of the tanks. Information shall include tank contractor, year of construction, job number, dates of warranty, depth, diameter, and type of interior coating.
- 15. All interior surfaces of tank, including walls, floor, and dome, shall be coated with an epoxy approved for contact with reclaimed water as per Paragraph 2.02 K.
- 16. Subbase - A granular base material shall be used beneath the membrane slab when the subgrade materials do not allow free drainage.
 - a. The base material should consist of a minimum 6-inch thick clean, well-compacted, and angular or sub-angular material.
 - b. The gradation of the base material should be selected to permit free drainage without the loss of fines or intermixing with the subgrade material.
 - c. The maximum particle size of the base material should be limited to provide a relatively level working surface without potential intrusion of the base materials into the membrane floor slab concrete.

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- d. Base material should be structural fill compacted to 98 percent of the maximum laboratory density determined by ASTM D1557.
- 17. Floor – Non-prestressed cast-in-place reinforced concrete
 - a. A Class A polyethylene moisture barrier of at least 6 mils thick shall be installed under concrete floor slabs.
 - b. The minimum thickness of the floor slab is 4-inch.
 - c. Each of the floor systems shall have a thickened edge for the exterior wall footing and where additional loadings are expected or reinforcement is needed. Slabs greater than 12-inch shall have top and bottom reinforcement in each direction.
 - d. The transition from the bottom of the footings and pipe encasements to the underside of the floor slab shall not be steeper than 2 horizontal to 1 vertical. The concrete floor above all pipe encasement(s) and sump(s) shall not be less than 8 inches thick. All pipe encasements shall be flared at tank wall. The clearance in all directions shall not be less than 12 inches.
 - e. A minimum percentage of 0.625 percent reinforcing steel shall be used in the membrane floors. The minimum percentage shall apply to all thickened sections and shall extend a minimum of 2 feet into the adjacent membrane floor.
 - f. The floors shall be cast monolithically with no cold joints.
- 18. Hydrostatic Floor/Wall Joint – Fixed, non-hydrostatic, rotating, or translating. Translating joints shall include plastic waterstop.
- 19. Horizontal prestressing shall be continuous. Discontinuous prestressing tendons or strands will not be allowed.
- 20. All vertical and horizontal joints shall be designed to minimize leakage. Joints with gaps shall not be allowed.
- 21. Equipment /Structural Dead and Dynamic Loads
 - a. Gravity ventilators and rainfall capture systems
 - b. Miscellaneous: walkways, piping, valves, etc. See Drawings for details.
- 22. Core Walls
 - a. Shotcrete core wall with continuous internal galvanized steel diaphragm, vertical joint seals, and shotcrete coverings. Walls placed on elastomeric bearing pads, free to move radially, shall have plastic water stop connection between wall and footing.
 - b. The wire-wound, prestressed concrete tank core wall shall be designed as a thin shell cylindrical element using shotcrete and an embedded, mechanically bonded, galvanized steel shell diaphragm.
 - c. Bonded wire-prestressed wall consisting of Type II shotcrete core wall encasing a mechanically bonded, continuous, galvanized steel diaphragm.

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- d. The design of the core wall shall take into account appropriate edge restraint. To compensate for bending moments, shrinkage, differential drying, and temperature stresses, the top two feet of core wall and the bottom three feet of core wall shall have not less than one percent circumferential reinforcing.
 - 1) Inside Face:
 - (a) The inside face of the core wall shall utilize the diaphragm as effective reinforcing.
 - (b) Additional vertical and horizontal reinforcing steel bars shall be used as required by design computations.
 - 2) Outside Face:
 - (a) Vertical reinforcing steel in the outside face of the core wall shall be: minimum of No. 4 bars at 12-inch center to center.
 - (b) Additional vertical and horizontal reinforcing steel bars shall be used as required by design computations.
 - e. The minimum core wall thickness shall be 3½-inch.
 - f. Reinforcing steel used in the core wall shall be designed using a maximum allowable design tensile stress, f_s , of 18,000 psi.
 - g. Allowable compressive stress in the core wall due to initial prestressing force, f_{gi} , shall be:
 - 1) 1250 psi + 75t psi/in. with 0.5 f_{gi} maximum (where f_{gi} is defined as compressive strength required for final prestressing force and t is the thickness of the core wall in inches).
 - 2) Maximum of 2000 psi.
 - h. Allowable compressive stress in the core wall due to final prestressing force, f_g , shall be:
 - 1) 1250 psi + 75t psi/in. with 0.45 f_g maximum (where f_g is defined as compressive strength required for final prestressing force and t is the thickness of the core wall in inches).
 - 2) Maximum of 1800 psi.
23. Roof - Concrete domes
- a. Roof shall be a circumferentially prestressed cast-in-place concrete dome with a minimum thickness of 3-inch except at the edge, where it shall be at least 7.5-inch.
 - b. Dome shell reinforcement shall consist of reinforcing bars or welded wire fabric meeting ASTM A185, not galvanized. Bolsters for wire fabric and reinforcing bars shall be plastic. Steel reinforcement shall

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meet the requirements of AWWA D110-04. Wire ties shall be galvanized.

- c. The dome ring girder shall be prestressed with sufficient wire to withstand the dome dead load and design live loads. The ring girder shall have cross section suitable to accept the applied prestressing forces.
- d. The high-water level in the tank shall be permitted to encroach on the dome shell no higher than the upper horizontal plane of the dome ring girder so that the tank may overflow out of the dedicated dome overflows. Should the water level continue to rise, it shall flow out of the precast concrete overflows. The precast overflow outlets shall provide a cross-sectional area no less than three times the influent pipe area. Tank manufacturer shall provide weir calculations showing that the width of the concrete dome overflows shall be sized to accommodate the maximum fill rate.
- e. The dome shall be designed as a free-span, spherical thin shell with one-tenth rise.
- f. The dome edge and upper wall shall be designed to resist the moments, thrusts, and shears that occur in this region due to dome and wall prestressing and loading conditions.

1) Dome Edge Thickness:

- (a) A determination of the buckle diameter shall be made, as defined by:

$$d_b = 2.5 \cdot \sqrt{r_d \cdot t_d} \text{ rounded up to the next foot}$$

Where: d_b = buckle diameter in feet

r_d = dome radius in feet

t_d = typical dome thickness in feet

- (b) Dome edge thickening shall begin at a radial location on the dome, defined as which is at least one buckle diameter away from the tank wall.
- (c) A springline haunch shall be provided, which extends radially from the inside face of the tank wall to radial location which is defined as:

$$s_1 = 0.6 \cdot \sqrt{1.5 \cdot r_d \cdot t_d} \text{ rounded up to the next foot}$$

Where: s_1 = distance from inside face of wall to haunch in feet

s_2 = distance from inside face of wall to typical dome thickness in feet.

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This springline haunch shall begin at the inside face of the tank wall with a springline thickness as required by paragraph (f) below and shall end at radial location with the following thickness:

$$t_{d1} = 1.33 \cdot t_d$$

Where: t_{d1} = minimum thickness at in feet

t_d = typical dome thickness in feet at one buckle diameter from tank wall

- (d) Beginning at s_1 and continuing to s_2 the dome shell shall have a uniform straight line taper.
 - (e) Parameters (b), (c), and (d) above are not required for domes where the calculated typical dome thickness is less than 75% of the actual typical dome thickness.
 - (f) Sufficient concrete thickness at the springline of the dome shall be provided so that no more than 2 ft of the springline haunch is considered in calculating the effective dome edge ring cross sectional area. Compressive stress in this area shall not exceed 1000 psi when subjected to initial prestressing, offset by dead load only.
- 2) Dome Edge Steel Reinforcement:
- (a) Throughout the dome edge, the percentage of steel reinforcement, both radially and circumferentially, shall be no less than 0.25% of the gross cross sectional area of concrete.
 - (b) Along the dome edge, steel reinforcement shall be distributed between the upper and lower layers unless finite element analysis calculations indicate that tensile stress does not exist in the concrete along the bottom face of the dome edge. In that case, only top bars are required radially and circumferentially. In addition, radial and circumferential reinforcing bars will not be required along the bottom face of the dome edge where the calculated typical dome thickness is less than 75% of the actual typical dome thickness.
 - (c) Where reinforcing bars are required in the bottom layer, they shall be placed near the tank wall to insure adequate development at the intersection between dome and wall.

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- (d) In all cases, the percentage of circumferential steel reinforcement in the effective dome ring shall be no less than one percent of the gross cross sectional area of concrete. The effective dome ring is defined as $\frac{1}{4}$ of the haunch length not to exceed 2 ft.
 - (e) Where bottom dome edge steel reinforcement is required, vertical steel reinforcement along the inside face of the tank wall shall be no less than 0.5% of the cross sectional area of wall shotcrete.
 - g. The dome shall be designed to support all accessories that will be included such as probe curbs, access hatches, ventilators, precast concrete overflows, rainfall capture system, and guardrail.
 - h. The tank shall incorporate a rainfall capture system. The system shall include a 1-foot tall parapet wall which extends above the top of wall at tank dome edge. The low point of the rainfall capture system shall coincide with one of the #675 precast concrete overflows to allow captured rainfall to flow into the tank. The high point shall be located equidistant between adjacent precast overflows. Rainfall shall be captured through the overflows as depicted on the Drawings. Downcomers with grates will not be accepted. The parapet wall shall be reinforced using drilled and epoxied anchors OR cast-in-place reinforcing in the perimeter of the tank wall. Parapet wall shall be chamfered on each side.
 - i. Aluminum dome guardrail around the tank perimeter shall be constructed of 6061-T6 aluminum to meet applicable OSHA standards.
24. Prestressing
- a. Circumferential prestressing of the tank shall be achieved by the application of cold-drawn, high-carbon steel wire placed under high tension.
 - b. A substantial allowance shall be made for prestressing losses due to shrinkage and plastic flow in the shotcrete and due to relaxation in the prestressing steel.
 - c. The prestressing design shall conform to the following minimum requirements:
 - 1) Working stress for the tank wall and dome ring shall be a maximum of 115,000 psi and 120,000 psi, respectively.
 - 2) The allowable design tensile stress in the prestressing wire before losses, fsi shall be 145,600 psi or no greater than 0.63 times the ultimate strength of the wire.
 - 3) Areas to be prestressed will contain no fewer than 10 wires per foot of wall for 8-gauge and 8 wires per foot of wall for 6-gauge.

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- 4) A maximum of 24 wires per layer per foot for 8-gauge and 20 wires per layer per foot for 6-gauge will be allowed.

25. Wall Openings

- a. When it is necessary for a pipe to pass through the tank wall, the invert of such pipe or sleeve shall be no less than 18 inches above the floor slab. The prestressing wires required at the pipe elevation shall be distributed into circumferential bands immediately above and below the opening to maintain the required prestressing force while leaving an unbanded strip around the entire tank.
- b. Unbanded strips shall have a vertical dimension of no more than 36 inches unless an axi-symmetric shell analysis is performed to account for compressive forces plus shear and moments caused by displacement of the prestressing wires into adjacent bands.
- c. All wall pipes, sleeves, and manholes passing through the wall shall be sealed to the diaphragm by epoxy injection

B. The tank MANUFACTURER shall use the following minimum information in the design of the tank and tank appurtenances:

1. Construct the tank from prestressed concrete.
2. Design, fabricate, erect, inspect, and test the structures in accordance with ACI 318, ACI 350, ACI 350.1, and ACI 372.
3. The tanks shall be free of abrupt changes in the meridional profile throughout the operating liquid depth.
4. Include the effects of localized stresses in the design of the tank and structural attachments and connections.
5. Design each prestressed concrete tank in accordance with ACI 372 and AWWA D-110 and follow the recommendations for environmental engineering concrete structures in ACI 350.
6. Maximum initial prestress shall not exceed 0.55 of the concrete compressive strength at time of tensioning.
7. Provide a minimum 200 psi compressive residual stress under operating conditions circumferentially at any point in the tank wall if the standard design approach is utilized in the tank wall design. (Design References ACI 372R-13 Sections 3.3.5.2 and 3.3.5.3) & (ANSI/AWWA D110-13 Section 3.5.2.1). The 25,000 psi prestressing loss in the standard design approach will require the additional 200 psi residual compressive stress to be accounted for in the wall design. If the Alternative Design is utilized as illustrated in (ANSI/AWWA D110-13 Sections 3.4.4 and 3.5.2.2), the 200 psi residual compressive stress is already taken into account due the long term prestressing loss of 30,600 psi and the 200 psi residual compressive stress will not be required. On the design plans and calculations, please indicate which design option was utilized in the design of the tank.

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8. Tank design shall include the following basic loads that act upon the structure:
 - a. Full hydrostatic load.
 - b. Partial hydrostatic load.
 - c. No hydrostatic load.
 - d. Loads from access platforms and walkways.
 - e. Wind load.
 - f. Wind vortex shedding.
 - g. Pressure loads.
 - h. Unbalanced backfill loads.
 - i. Vehicle load GVWR 12,000 on the backfill.
 - j. Construction loads.
 - k. Buoyancy loads, **IF REQUIRED** due to seasonal high groundwater conditions as specified herein and the geotechnical report.
 - l. Minimum roof live load or snowload.
 - m. Gravity ventilator load and winds/seismic loads induced by gravity ventilator.
 - n. Connection load from catwalk to and from each tank.
9. Unit Weights:
 - a. Concrete and Shotcrete - 150 pcf
 - b. Soil - 120 pcf
 - c. Water – 62.4 pcf
 - d. Steel – 490 pcf
10. Live Load:
 - a. Floor – 62.4 pcf times the height of water to overflow plus 6-inch
 - b. Roof – 20 psf horizontal projection to tank roof but the roof live load is reducible as allowed by the current ASCE 7 and the latest Florida Building Code.
 - 1) Live load shall include the load of the appurtenances on the tank dome.
11. Wind Load:
 - a. Shall be calculated using ASCE 7-10 based on an ultimate wind load of 142 mph.
 - b. Building Risk Category III
 - c. Exposure C
12. Lateral Earth Pressure Criteria:
 - a. Equivalent fluid pressure above groundwater level - 60 pcf
 - b. Equivalent fluid pressure below groundwater level - 90 pcf
 - c. Live load lateral surcharge loading: Resultant applied live load surcharge multiplied by a 0.5 coefficient.
13. Seismic Load:

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- a. Importance Factor: 1.25
- b. Spectral Response Accelerations:(Ss,S1):0.105, 0.055
- c. Site Class: D
- d. Spectral Response Coeffecients:(Sds,Sd1):0.112, 0.087
- e. Seismic Design Category: B
- f. Seismic Force Resisting System: Flat Bottom Ground Supported Tanks Reinforced or Prestressed Concrete Reinforced Anchored Flexible Base
- g. Seismic Response Modification Factor: 2
- h. Seismic Response Coefficient: 0.0725
- 14. Flood Criteria:
 - a. Flood Zone: Zone X, outside of the annual 0.2% chance floodplain
- 15. Allowable Bearing Pressure: 1,500 psf
- 16. Applied Bearing Pressure: Refer to geotechnical report for expected applied bearing pressures with correlating settlements.
- 17. Dead load of any permanent ancillary roof dome components
- 18. Overflow weir width required to accommodate maximum infill capacity of 11,250 gpm
- 19. Consider loads listed herein to act in combinations, whichever produces the most unfavorable effects.
- 20. It is not necessary to combine wind and earthquake loads but the maximum stress produced by either condition with other applicable loads shall be considered.
- 21. Any stairs, ladders, or platforms connecting to or on the tank shall be coordinated with the tank MANUFACTURER for support and connection details. Loads resulting from these appurtenances shall be taken into account in the tank's design.

1.08 WARRANTY

- A. The tank MANUFACTURER shall warrant the tank structure against any defective materials or workmanship for a period of 5 years from the date of tank acceptance. If any materials or workmanship proves to be defective within that period, they shall be replaced or repaired by the tank MANUFACTURER at no additional cost to the OWNER.
- B. If any leakage or other defects appear within the warranty period, the Tank MANUFACTURER shall promptly repair the tank at its own expense upon written notification by the Owner that such defects have been found. This warranty shall not apply to any accessory, equipment or other product that is not a structural part of the tank or manufactured by a company other than the tank construction company. Leakage is liquid appearing on the exterior of the tank, the source of which is from inside the tank.

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- C. All interior and exterior coatings shall be included in the scope of the tank MANUFACTURER. The exterior coating shall carry a 5-year warranty and the interior coating shall carry a 10-year warranty. All coating work shall be completed by the tank MANUFACTURER. Subcontracting of this work is not allowed. Any requirement of inspection to guarantee the warranty shall be at no cost to the OWNER.
1. Coating system failure is defined as either (1) delamination of the coating, (2) a breach of the coating exposing the substrate below, or (3) chipping and peeling of the coating system not caused by physical damage or abrasion to the tank. Changes in color shall not be deemed a coating failure.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Materials shall be new and shall conform to the material specified in AWWA D110 and the following material standards.
- B. Products listed in this section shall be applicable to locations shown in drawings or otherwise specified in the design criteria of this specification. Substitutions to the materials in this specification shall be submitted in writing to the ENGINEER for approval.

2.02 MATERIALS

- A. Concrete and reinforcing steel for the tank core wall and roof dome shall conform to the requirements of AWWA D110. Concrete and reinforcing steel for all other structural elements shall conform to the requirements of Division 3. A 3/8-inch maximum size aggregate may be used for dome concrete if designed for strength and maximum density. Admixtures causing accelerated or retarded set of the concrete shall not be used unless approved in writing by the ENGINEER.
1. Concrete Strength: Minimum concrete strength at 28 days.
 - a. Pipe encasement $f'c = 3000$ psi
 - b. Footing and floors $f'c = 4000$ psi
 - c. Shotcrete $f'c = 4000$ psi
 - d. Dome roof $f'c = 4000$ psi
- B. Shotcrete
1. Shotcrete shall be in accordance with AWWA D110.
 2. Shotcrete shall conform to the requirements of ACI 506.2 except as modified herein.
 3. All shotcrete mixes shall utilize Type I/II cement.
 4. A maximum of 25 percent cementitious material may be flyash.
 - a. $f'c = 4000$ psi

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- b. Maximum w/c ratio = 0.42
 - c. Slump = 4" \pm 1"
- 5. All shotcrete in contact with galvanized diaphragm or prestressing wire shall be proportioned to consist of not more than three parts sand to one part Portland cement by weight. All other shotcrete shall be proportioned to consist of not more than four parts sand to one part Portland cement by weight.
- 6. Admixtures shall not contain more than trace amounts of chlorides, fluorides, sulfides, or nitrates.
- 7. Shotcrete mixes used in the tank construction shall conform to the following.
 - a. f'_c = 4000 psi
 - b. Maximum w/c ratio = 0.42
 - c. Slump = 4" \pm 1"
- C. Fine Aggregates (Sand)
 - 1. Saturated, surface dry, hard, dense, uncoated rock fragments free from injurious amounts of foreign or deleterious substances
 - 2. Fineness Modulus for Sand: Range from 2.70 to 3.00 with maximum particle size of 1/4-inch.
 - 3. Maintain sand at 3 to 6 percent moisture content; dampen or dry with sand dryers if necessary.
 - 4. Screen sand for finish coat to produce uniform dense surface in texture and appearance.
 - 5. Gradation:

Sieve Size	Percent Passing by Weight
No. 4	97 - 100
No. 8	90 - 98
No. 16	70 - 85
No. 30	35 - 55
No. 50	12 - 25
No. 100	2 - 8
 - 6. Mix proportions:
 - a. Adjacent to steel diaphragm and over prestressing wire shall be proportioned to consist of not more than three parts sand to one part Portland cement by weight.
 - b. All other areas shall be proportioned to consist of not more than four parts sand to one part Portland cement by weight.
- D. Non-prestressed Reinforcement
 - 1. Shall meet the requirements of ACI 318.

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2. Shall have a maximum allowable tensile stress of 18,000 psi, exclusive of shrinkage and temperature effects.
3. Shall not be credited for resisting any portion of primary circumferential tension resulting from fluid pressure.
4. Non-prestressed mild reinforcing steel shall be new billet steel meeting the requirements of ASTM A615/A615M with a minimum yield strength, f_y , of 60,000 psi.
5. Welded wire reinforcing shall be plain wire conforming to the requirements of ASTM A1064/A1064M with a minimum yield strength, f_y , of 65,000 psi.

E. Prestressed Wire

1. Unless otherwise approved in writing by the ENGINEER, prestressed wire shall conform to ASTM A821, suitable for redrawing and having a minimum ultimate strength of 231,000 psi.
2. The prestressing wire shall conform to the requirements of ASTM A821/A821M, Type B.
3. The prestressing wire size shall be 0.162-inch (8 gauge), 0.192-inch (6 gauge) or larger, but no larger than 0.250-inch.
4. The ultimate tensile strength shall be 231,000 psi or greater for 8 gauge wire, and 222,000 psi or greater for 6 gauge.
5. Splices for horizontal prestressed reinforcement shall be ferrous material compatible with the prestressing reinforcement and shall develop the full strength of the wire.

F. Galvanized Steel Diaphragm

1. Tank diaphragm in accordance with ASTM A653 for commercial quality cold-rolled steel sheet. Minimum of 26-gauge sheet and form corrugations of a pattern to form a continuous positive watertight seal and a strong mechanical key between shotcrete and steel. Furnish steel sheets in one continuous length to full height of wall. Vertical joints between sheets. Weight of zinc coating shall be not less than G90 or a minimum coating weight of 0.9 oz/ft² total for both sides with a minimum average coating weight per side of 0.32 oz/ft². Testing of the galvanic coating shall be completed at three locations on the surfaces of the diaphragm as per the ASTM standards.
2. The diaphragm shall be continuous to within 3 inches of the top of slab on grade encased in epoxy at the waterstop.
3. All vertical joints in the diaphragm shall be rolled seamed, crimped, and sealed watertight using epoxy injection.
4. At the floor/wall joint, the steel shell diaphragm shall be epoxy bonded to the waterstop.
5. In all tanks designed to use a waterstop at the floor/wall joint, the steel shell diaphragm shall be epoxy bonded to the waterstop.

G. Elastomeric Materials

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1. Waterstops
 - a. Waterstops shall be extruded from an elastomeric plastic compound with virgin polyvinyl chloride as the basic resins. The waterstop shall meet the performance criteria in the Corps of Engineers Specifications CRD-C572.
 - b. The profile and size of the waterstop shall be suitable for the hydrostatic pressure and movements to which it is exposed.
 2. Elastomeric Bearing Pad
 - a. Elastomeric Bearings Pads shall be a neoprene or natural rubber pad conforming to ASTM D2000, line call-outs 2BC415A14B14 and 4AA420AB respectively.
 3. Sponge filler at the floor/wall joint shall be closed-cell neoprene.
- H. Moisture Barrier
1. The moisture barrier shall be polyethylene Class A conforming to ASTM D4397. The thickness shall not be less than 6 mil.
- I. Epoxy
1. Epoxy Sealants
 - a. Epoxy used for sealing the steel shell shall conform to the requirements of ASTM C881/C881M.
 - b. Epoxy used for sealing the steel shall be Type III, Grade 1, and shall be a 100 percent solids, moisture insensitive, low modulus epoxy system.
 - c. Epoxy used for placing the waterstop shall be Type II, Grade 2, and shall be 100 percent solids, moisture insensitive, low exotherm epoxy.
 - d. When pumped, maximum viscosity of the epoxy shall be 10 poises at 77-degree F.
 - e. The epoxy sealants used in the tank construction shall be suitable for bonding to concrete, shotcrete, PVC, and steel.
 2. Bonding Epoxy
 - a. Epoxy resins used for enhancing the bond between fresh concrete and hardened concrete shall conform to the requirements of ASTM C 881/C 881M.
 - b. Epoxy resins shall be a two-component, 100% solids, moisture-insensitive epoxy and shall be Type II, Grade 2.
 3. Seismic Resistant Cables
 - a. Seismic restraint cables shall be seven-wire strand conforming to ASTM A416/A416M.
 - b. The strand shall be protected with a fusion-bonded, grit-impregnated epoxy coating conforming to ASTM A882/A882M.

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- c. The minimum yield strength of the seven-wire strand shall be 270,000 psi.

J. Appurtenances

1. Wall Manway

- a. For each tank, the tank MANUFACTURER shall provide two rectangular opening access manways 3-foot high by 4-foot-10-inches wide for access to the interior of the tank. Frame, cover, and anchor bolts shall be type 316 stainless steel. The removable watertight wall manhole shall be designed to resist hydraulic loading without excessive deflection.
- b. See Drawings for locations and centerlines of manways. Manway locations shall be coordinated with the Owner during the shop drawing submittal.
- c. Provide FRP manhole rungs cast into the tank wall by the tank MANUFACTURER for each manway to provide safe access into the tank per OSHA standards if centerline of the manhole is greater than 24 inches from the tank floor. Rungs shall be completely inert and rated for installation within a reclaimed water tank.

2. Roof hatch

- a. Provide fiberglass roof hatch cover with Type 316 stainless steel fasteners for each tank. The hatch opening in the tank dome shall be a 6-foot by 6-foot opening with a fiberglass cover. The fiberglass cover shall have a minimum 3-foot by 3-foot 8-inch clear opening with a lockable hinged access door. Hatch shall be furnished with 316 stainless steel hardware throughout. A suitable stainless steel anchor system for attachment to concrete curb on roof shall be provided. Provide continuous 1/4-inch thick, 60 durometer neoprene sheet gasket under hatch flange and fasten flange through gasket. Hatch shall be watertight.
- b. Roof hatch shall be installed at locations shown on the Drawings. The hatch shall be installed on a concrete curb with a minimum finished height of 4 inches above dome and a minimum of 3 inches wide.

3. Concrete Overflows

- a. For each tank, provide six (6) No. 675 precast concrete emergency overflows on the dome at the locations shown in the Drawings. The total cross-sectional areas of emergency overflows shall be a minimum three times the area of the inlet pipe. Emergency overflows shall be provided with stainless steel insect screens (24-inch by 24-inch mesh). The screen shall meet the following requirements.
 - 1. Fiber: stainless steel.

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2. Mesh Opening: 800 microns.
 3. Thread Count: 24 by 24 per inch.
 4. Thread Diameter: 254 microns.
 5. Open Area Percent: 58 percent.
 6. Overflow and screens shall be provided by tank MANUFACTURER.
4. Guardrail
- a. Guardrail shall be of 6061-T6 anodized aluminum conforming to OSHA requirements. Guardrail shall be installed as shown on the Drawings and shall conform to the requirements of OSHA. Railing shall be around the entire perimeter of the tank and as shown on the Drawings. The guardrail shall be as detailed on the structural Drawings.
 - b. Aluminum guardrail shall be shop fabricated and fully welded. All welding shall be in accordance with American Welding Society (AWS) standards using gas tungsten arc welding (GTAW) to fuse materials without distortion of the material. Mechanical splices are permitted for use at field splice locations spaced no more than 20 feet center-to-center.
 - c. Anodizing shall conform with AA DAF45 designation AA-M32-C22-A41.
 - d. The guardrail shall consist of vertical posts, mid rail, and a top rail 42-inches above the top of the parapet wall. Schedule 40 posts shall be spaced as required as per the delegated guardrail specialty engineer design.
 - e. Platform supports shall be either by stainless steel expansion bolts or cast-in-place threaded inserts. Prior to installing expansion bolts, the reinforcing bars shall be located with a "rebar locator". The location of the reinforcing bars shall be marked on the concrete surface indicating the spacing and direction of the bars.
 - f. Where interference occurs, adjust anchor locations to clear reinforcing bars and alter supports at no additional cost to the OWNER.
5. Ladders
- a. Interior ladders shall be fiberglass. Ladders shall be installed at locations shown on the Drawings. Ladder, ladder accessories, and ladder clearances shall conform to the requirements of OSHA.
 - b. Provide 316 stainless steel hardware and fasteners, accessories, and all other materials required for the complete installation.
 - c. The ladders shall be fitted with a fall prevention device and removable extension conforming to OSHA requirements. Two climbing belts shall be provided to the OWNER.

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- d. Ladders shall be installed at locations shown on the Drawings. The ladder shall have a safety climbing device and extension manufactured from Type 316 stainless steel to meet applicable OSHA standards.
 - e. Ladder supports shall be installed by stainless steel expansion bolts or stainless steel bolts with cast-in-place threaded inserts. Prior to installing expansion bolts, the reinforcing bars shall be located with a "rebar locator" supplied by the tank manufacturer. The location of the reinforcing bars shall be marked on the concrete surface indicating the spacing and direction of the bars.
 - f. Where interference occurs, adjust anchor locations to clear reinforcing bars and alter supports at no additional cost to the Owner.
6. Stairs
- a. Exterior stairs, landings and concrete foundation shall be installed by the tank MANUFACTURER.
 - b. Exterior stair and landings shall be fabricated from 6061-T6 aluminum and shall conform to all applicable OSHA standards and be fabricated and installed by tank MANUFACTURER unless approved by others via addendum only.
7. Corbel Supporting Walkway Between Tanks
- a. The engineer of record delegates the corbel design that supports the walkway between the tanks to the tank specialty engineer. The corbel shall be a minimum of 6'-0" wide x 1'-0" long in the direction of the walkway and 1'-6" deep. The applied unfactored vertical (downward) load applied to the top of the corbel is 8,000 pounds and the unfactored lateral load applied to the top of the corbel perpendicular to the walkway longitudinal axis is 3,600 pounds. The tank wall design and wall thickness shall consider the resulting forces and stresses caused by the corbel and associated walkway. A minimum of (2) 3/4" diameter cast-in-place 316 stainless anchor bolts with a minimum of 12" embedment and minimum 4" projection shall be cast into corbel. Drilled and epoxied anchor bolts will not be allowed or approved. Signed and sealed corbel calculations shall be supplied with the signed and sealed tank drawings.
8. Liquid Level Indicator and Transmitter
- a. The liquid level indicator shall have a half travel gauge with an interior float. The glass shall be fiberglass with 4-inch black numbers on a white board. The level indicator shall be a red fiberglass target. The zero mark shall be set even with the top of the tank wall. The interior float shall be fiberglass or PVC and shall be guided vertically true.

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- b. Two 10-inch dome probe curbs, one for mounting of level switch(es) and one for spare penetration shall be included.
 - c. One 4-inch through-the floor 316 Sch 40 SS pipe with, piping and valves and flange for mounting the pressure transmitter assembly.
 - d. Liquid level indicators and transmitters shall be installed at locations shown on the Drawings.
 - 9. One 3/8-inch thick 316 SS vortex baffle plate on the tank discharge with 316 SS mounting hardware shall be provided for each tank.
 - 10. Any required through-wall pipe sleeves and pipe brackets shall be Type 316 stainless steel.
 - 11. Settlement monuments shall be the tank manufacturer's standard settlement monuments.
 - 12. Accessory hardware, unless otherwise noted, shall be Type 316 stainless steel conforming to ASTM F593.
- K. Coatings
- 1. Provide interior coating and exterior coating on the tanks as per this section. The coatings shall be applied after hydrostatic watertightness testing.
 - 2. Two options are presented below (Option A and Option B) for the interior coatings of the tank. The tank MANUFACTURER may provide either of these coating options.
 - 3. The interior coatings of the tank, (concrete surfaces and all metallic surfaces) shall be coated by the tank MANUFACTURER and the tank MANUFACTURER shall have system responsibility for all interior coatings.
 - 4. Coatings shall be applied by the tank MANUFACTURER. Subcontracting the coatings is prohibited.
 - 5. Internal and external tank colors shall be selected by Owner during the shop drawing process.
 - 6. Tank manufacturer shall issue a 10-year warranty on internal and a 5-year warranty on the external coating system directly to the Owner from date of substantial completion. The coating manufacturer shall provide a warranty letter naming the Owner as beneficiary and documenting that coatings were applied in accordance to the coating manufacturer's recommendations and the beginning and end dates for the warranty period.
 - 7. Interior Coatings – Option A:
 - a. Underside of dome and interior walls (full height)
 - i. Surface Preparation: Sweep blast to CSP5.
 - ii. Apply surfacer across the entire interior surface to fill all bug holes and coat all peaks: Sherwin Williams Duraplate 2300 at 1/16-inch to 1/8-inch above the peaks.
 - iii. Prime Coat: Sherwin Williams Macropoxy 5500 OAP Blue at 8.04 to 10.0 mils DFT.

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- iv. Top Coat: Sherwin Williams Duraplate UHS White at 16.0 to 20.0 mils DFT.
 - b. Interior floor
 - i. Surface preparation: Sweep blast to ICRI CSP3.
 - ii. Prime Coat: Sherwin Williams Macropoxy 5500 OAP Blue at 4.0 to 6.0 mils DFT.
 - iii. Top Coat: Sherwin Williams Duraplate UHS White at 16.0 to 20.0 mils DFT.
 - c. All interior metal surfaces (including but not limited to pipes and pipe supports).
 - i. Surface Preparation: Pressure wash at 4,000 psi and abrade primer with sandpaper to develop a surface profile.
 - ii. Prime Coat: Sherwin Williams Macropoxy 5500 OAP Blue at 8.0 to 10.0 mils DFT.
 - iii. Stripe Coat: All edges and sharp points shall be coated with a brush or roller to within 3 inches of the edge with Sherwin Williams Macropoxy 5500 at 4.0 to 6.0 mils DFT.
 - iv. Top Coat: Sherwin Williams Dura plate UHS White at 16.0 to 20.0 mils DFT.
- 8. Interior Coatings (underside of dome, interior walls (full height), and floor) – Option B:
 - a. Underside of dome and interior walls (full height)
 - i. Surface Preparation: Sweep blast to CSP5.
 - ii. Apply surfacer across the entire interior surface to fill all bug holes and coat all peaks: Tnemec Series 218 at 1/16-inch to 1/8-inch above the peaks.
 - iii. Prime Coat: Tnemec Series 20 HS at 8.04 to 10.0 mils DFT.
 - iv. Top Coat: Tnemec Series 22 at 16.0 to 20.0 mils DFT.
 - b. Interior floor
 - i. Surface preparation: Sweep blast to ICRI CSP3.
 - ii. Prime Coat: Tnemec Series FC20 at 4.0 to 6.0 mils DFT.
 - iii. Top Coat: Tnemec Series 22 at 16.0 to 20.0 mils DFT.
 - c. All interior metal surfaces (including but not limited to pipes and pipe supports).
 - i. Surface Preparation: Pressure wash at 4,000 psi and abrade primer with sandpaper to develop a surface profile.
 - ii. Prime Coat: Tnemec Series 20 HS at 8.0 to 10.0 mils DFT.
 - iii. Stripe Coat: All edges and sharp points shall be coated with a brush or roller to within 3 inches of the edge with Tnemec Series 20 HS at 4.0 to 6.0 mils DFT.
 - iv. Top Coat: Tnemec Series 22 at 16.0 to 20.0 mils DFT.
- 9. Exterior Coating

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- a. Provide an elastomeric breathable coating for the exterior of the new prestressed concrete tank (walls and dome). Exterior coating shall be a modified waterborne acrylate applied to two coats.
 - i. Surface preparation: remove all contaminants by powerwashing per SSPC-SP1.
 - ii. First Coat
 1. Tnemec Series 156 Enviro-crete – 5 mils DFT
 2. Sherwin-Williams, Loxon XP (smooth) – 6 mils DFT
 - iii. Second Coat
 1. Tnemec Series 156 Enviro-crete – 5 mils DFT
 2. Sherwin-Williams, Loxon XP (smooth) – 6 mils DFT

2.03 STRUCTURAL DESIGN

- A. In addition to these loads, the design shall provide for the effects on the structure from the following stresses:
 1. Losses from shrinkage, plastic flow, wire creep, anchorage loss, maximum friction loss, and allowance for residual compression in concrete.
 2. In no case shall the losses used for design (exclusive of residual compression requirements) be less than 25,000 psi, regardless of calculations.
 3. Support stresses at the junction with the vessel support structure.
 4. Prestressing during and after tensioning.
 5. Calculate differential drying stresses and the required reinforcement.
- B. The stresses for concrete shall not exceed ACI 318 except as recommended in ACI 372 and unless otherwise specified herein.
- C. Under no combination of conditions due to specified load conditions, prestressing, backfilling, and temperature or dryness differential shall maximum extreme fiber tensile stresses under severe load conditions in the wall exceed $3f'_c$ during construction or after the tanks are in service.
- D. The maximum effective steel prestress, after deducting losses due to shrinkage, plastic flow, reinforcement creep, and an allowance for residual compression, shall not exceed 63 percent of the ultimate strength of the prestressed reinforcement.
- E. The maximum initial prestress, in any single wire or strand, shall not exceed 75 percent of the minimum ultimate strength of the prestressed reinforcement.
- F. Nonprestressed Reinforcement
 1. Shall meet the requirements of ACI 318.
 2. Shall have a maximum allowable tensile stress of 18,000 psi, exclusive of shrinkage and temperature effects.

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3. Shall not be credited for resisting any portion of primary circumferential tension resulting from fluid pressure.
4. Non-prestressed mild reinforcing steel shall be new billet steel meeting the requirements of ASTM A615/A615M with a minimum yield strength, f_y , of 60,000 psi.
5. Welded wire reinforcing shall be plain wire conforming to the requirements of ASTM A1064/A1064M with a minimum yield strength, f_y , of 65,000 psi.

PART 3 – EXECUTION

3.01 ENVIRONMENTAL INSTALLATION REQUIREMENTS

- A. Delay of work under the following conditions:
 1. During high winds causing sand to separate at the nozzle.
 2. When weather approaches freezing defined as below 40 degrees F when temperature is falling, or until temperature is 35 degrees F when temperature is rising.
 3. During rains of high intensity to wash cement out of fresh material.
- B. Cold Weather: Take precautions to avoid low temperatures detrimental to epoxy grout or the ability to pump. If grouting procedure cannot be postponed, keep wall temperatures within the required temperature range.
- C. Hot Weather: When temperatures exceed 90 degrees F, obtain approval for method used to protect shotcrete from excessive heat and drying.
- D. Do not expose circumferential prestressing on walls to weather for more than 72 hours. Exercise precautions during adverse weather conditions.

3.02 INSTALLATION

- A. All subgrade elevations shall be verified prior to starting tank construction.
- B. Reinforcing Steel
 1. Reinforcing steel shall be installed in accordance with the CRSI, Code of Standard Practice.
- C. Placing Concrete
 1. General Placement
 - a. Cast-in-place concrete floor and dome roof shall be installed in accordance with ACI 318 and ACI 350 except as specified herein.
 - b. No concrete shall be mixed or placed during freezing weather without explicit permission. When placing concrete when air temperature is below 40 degrees F, the water, sand and gravel shall be heated so that the temperature of the concrete will be at least 50

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degrees F. This temperature shall be maintained for 72 hours after placing. No concrete shall be placed on frozen ground.

- c. In hot weather, concrete, when deposited, shall have a placing temperature that will not cause difficulty from loss of slump, flash set, or formation of cold joints. In no case shall the temperature of concrete being placed exceed 95 degrees F.
- d. All concrete shall be consolidated by means of a vibrator for proper encasement of reinforcing steel and welded wire fabric.

2. Floor Slab

- a. The subgrade shall be prepared by fine grading to ensure proper placement of reinforcing steel with proper bottom cover.
- b. Prior to placement of the floor slab, a 6 mil vapor- barrier per ASTM D 4397, Below grade vapor retarders shall be placed over the subbase.
- c. Form and screed boards shall be of proper thickness and sufficiently braced to ensure that the floor is constructed within proper thickness tolerances.
- d. Plate bolsters shall be used to support reinforcing steel supported directly on the subgrade to ensure positive control of placement of reinforcing steel.
- e. The floor shall be vibratory screeded to effect consolidation of concrete and proper encasement of floor reinforcing steel.
- f. The floor slab including the thickened portion for the wall footing shall be placed in one continuous concrete placement. Construction joints between the floor slab and footings shall not be allowed. Where a construction joint is approved in writing by the ENGINEER, the joint shall have 6-inch wide, 3/8-inch thick PVC waterstop conforming to the same requirements as the wall - base slab waterstop.
- g. The tank floor shall be wood/bull float finished first followed by a finish matching the finish requirements of the interior floor coating. No water shall be added to the slab during finishing. Curing of the tank floor shall be accomplished by ponding the entire area within the waterstops with 2-inch minimum of water within 24 hours after concrete placement. The floor shall be kept ponded for a minimum of 7 days.
- h. Provide four settlement monuments on the perimeter of the tank at 90-deg increments, four at 30 feet from the center of tank at the same 90-deg increments as those on the perimeter, and one at the center of the tank to survey and monitor total, differential, and angular settlement for compliance with ACI 372R and settlement estimates.

3. Concrete Dome

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- a. The roof shall be wood/bull float finished and then receive a surface finish matching the exterior dome coating requirements. No water shall be added during the finishing of the roof. Precast dome panels, if used, shall have a surface designed to receive a cementitious coating.

D. Core Walls

1. Prestressed Core wall(s)

- a. Exterior wall details including the steel diaphragm, PVC waterstops, elastomeric bearing pads, sponge rubber fillers, prestressing steel, prestressing earthquake cables, and shotcrete shall conform to the requirements of AWWA D110.
 1. Seismic Resistant Cables
 - a. Seismic restraint cables shall be seven-wire strand conforming to ASTM A416/A416M.
 - b. The strand shall be protected with a fusion-bonded, grit-impregnated epoxy coating conforming to ASTM A882/A882M.
 - c. The minimum yield strength of the seven-wire strand shall be 270,000 psi.
- b. A PVC waterstop shall be installed in the wall to base joint for translating floor-wall joints. Field splices shall be in accordance with the MANUFACTURER's specifications. The waterstops shall be installed so as to form a continuous watertight dam. Adequate provisions shall be made to support and protect the waterstop during the progress of the work. Where the waterstop is placed in a concrete cove attached to the inner face of the wall, the cove shall attain 60 percent of its 28-day strength prior to the start of prestressing the wall.
- c. Circumferential Prestressing
 1. Stress readings on a calibrated stressometer, furnished by the tank MANUFACTURER, shall be made on each prestressing wire. The stress measuring equipment shall include: electronic direct reading stressometer accurate to within 2%, calibrated dynamometers and a test stand to verify the accuracy of the equipment. A running log shall be maintained by the tank manufacturer of the stress readings and used to determine the final number of wires required.
 2. The initial tension in each wire shall be read and recorded to verify that the total aggregate force is no less than that required by the design. Averaging or estimating the force of the wire on the wall shall not be considered satisfactory evidence of correct placement of prestressing wires.

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3. In computing the final tension in the wires, an allowance for prestress loss due to creep, shrinkage, elastic deformation, and residual compression shall be provided for. The tank manufacturer shall submit an "as-built" revision to the design diagram showing the location and number of wires actually used for the project records only.
 4. Placement of the prestressing steel wire shall be in a continuous and uniform helix of such pitch as to provide in each lineal foot of core wall height an initial force and unit compressive force equal to that shown on the design drawings. Horizontal prestressing shall be continuous. Discontinuous prestressing tendons or strands will not be allowed. Splicing of the wire shall be permitted only when completing the application of a full coil of wire or when removing a defective section of wire.
 5. Shotcrete shall be used to completely encase each individual wire and to protect it from corrosion. To facilitate this encasement, the clear space between adjacent wires is to be no less than one wire diameter.
 6. Prestressing shall be accomplished by a machine capable of continuously inducing a uniform initial tension in the wire before it is positioned on the tank wall. Tension in the wire shall be generated by methods not dependent on cold working or re-drawing of the wire. In determining compliance with design requirements, the aggregate force of all tensioned wires per foot of wall shall be considered rather than the force per individual wire, and such aggregate force shall be no less than that required by the design and as shown on approved drawings.
 7. After circumferential prestressing wires have been placed, they shall be protected by encasement in shotcrete. This encasement shall completely encapsulate each wire and permanently bond the wire to the tank wall. A shotcrete cover having a thickness of no less than 1" shall be placed over the prestressing wires
- d. The diaphragm shall be protected against damage before, during, and after erection. Nail or other holes shall not be made in the diaphragm for erection except in the top 3 inches. Holes shall not be made in the diaphragm except for inserting wall pipes or sleeves, reinforcing steel, bolts, or other special appurtenances. Such penetrations shall be sealed with an epoxy sealant which complies with Paragraph 2.02.I. Epoxy.

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e. Shotcreting

1. Each shotcrete layer shall be broomed prior to final set to effect satisfactory bonding of subsequent layers.
2. No shotcrete shall be applied to reinforcing steel or diaphragm which is encrusted with shotcrete overspray.
3. A minimum of 1/8-inch thick shotcrete shall separate reinforcing steel and prestressing wire. When multiple layers of wire are required, shotcrete cover between layers shall be no less than 1/8-inch thick.
4. No prestressing wire shall remain exposed during inclement weather over a holiday or weekend; it shall be covered with shotcrete and subsequently wet cure.
5. Vertical shooting wires shall be installed to establish uniform and correct thickness of shotcrete. Shooting wires shall be at 2-ft on center around the circumference of the tank. The final coat shall be applied true to shooting wires so as to form a cylindrical surface.
6. At the end of the day's work, or similar stoppage period, the shotcrete shall be sloped off at an angle of approximately 45 degrees. Before placing adjacent sections, the sloped portions shall be thoroughly cleaned and wetted by means of air and water blast. Shotcrete with a strength lower than specified due to cold weather shall be removed and replaced with sound material.
7. The shotcrete shall be cured by keeping the shotcrete continuously wet for 7 days. No natural curing allowed.
8. Shotcrete on the inside of the tank shall receive a light broom finish, and shotcrete on the exterior shall receive a sponge float finish.
9. Keep shotcrete between layers of wire and cover damp by hand watering or fine mist spray.
10. Remove laitance from wall prior to placing successive layers of shotcrete.
11. Do not use curing compounds.
12. Horizontal sections of the wall shall form true circles without flat areas, excessive bumps or hollows. The covercoat shall receive a sliced trowel or sponge float finish.
13. All rebound concrete shall be completely removed after construction.

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E. Finishing of Shotcrete

1. Underlayers or Exposed Surfaces:
 - a. On completing surfaces, bring shotcrete to an even plane and to well-formed corners by working up to ground wires or other thickness or alignment guides, using lower placing velocity than normal.
 - b. Screed exposed surfaces or underlayers by working upward against gravity with thin-edged screed using a slicing motion to trim off high spots and expose low spots.
 - c. Avoid pulling and breaking surface with subsequent checking.
2. Finish Coat:
 - a. After all circumferential prestressing wires have been placed, a shotcrete cover having a thickness of no less than 1 inch shall be placed over the prestressing wires.
 - b. Carefully screen sand for finish coat to remove oversize particles which rebound and mar surfaces.
 - c. Surface of finish coat shall be; of natural texture and coloration; free from spotting, cement or dust streaking, lap lines, uneven surfaces, and rebounded material.
 - d. Do not hand-patch.
 - e. Check coatings for bond by tapping lightly to test for hollow sounding spots.
 - f. Cut out areas where bond is not fully developed and repair.

F. Curing

1. Dome Concrete:
 - a. The dome shall be water cured for a minimum 7 days after casting or until dome band prestressing is complete.
 - b. Schedule wire wrapping and application of shotcrete so curing shall not be interrupted, and water from curing shall not wash or damage shotcrete wire coats.
 - c. Begin curing after initial concrete set has occurred.
2. Shotcrete:
 - a. Keep shotcrete between layers of wire and cover damp by hand watering or fine mist spray.
 - b. Continuously water cure completed shotcrete surfaces for period of 7 days after application, or until subsequent shotcrete coats are applied prior to end of the 7-day curing period.
 - c. Remove laitance from wall by light abrasive blasting after curing period.
 - d. Do not use curing compounds.

G. Epoxy Injection

1. Epoxy injection shall be carried out from bottom to top of wall using a pressure pumping procedure.

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2. Epoxy injection shall proceed only after the diaphragm has been fully encased, inside and outside, with shotcrete.
- H. Dome
1. All concrete shall be consolidated by means of a vibrator for proper encasement of reinforcing steel and welded wire fabric.
 2. All surfaces at the joint between the wall and the dome shall be coated with bonding epoxy which complies with PART 2 – Products: Epoxy.
 3. Plastic bolsters shall be used to support reinforcing steel and welded wire reinforcement to ensure positive control on placement of steel.
 4. The exterior surface of the dome shall receive a light broom finish.
 5. New plywood shall be used for dome scheduled to receive interior protective coatings.
 6. Dome wall interface shall be formed as such the minimum tolerance should be 1/16-inch.
 7. All form board gaps greater than 1/16-inch shall be sealed with tape prior to dome pour.
- I. Accessory hardware, unless otherwise noted, shall be Type 316 stainless steel conforming to ASTM F593.

3.03 TANK SETTLEMENT BY OPERATIONAL-LEVEL POST-LOADING

- A. The tank must be allowed to settle following satisfactory testing and prior to attaching pipes or application of tank coatings. The settlement will be achieved by loading the tank to operating level. The hydraulic watertightness test may be conducted concurrently with the operational-level tank settlement. Any required flowable fill to be installed at the pipe excavation after pipe to pipe connection on the exterior of the tank shall be supplied by the tank MANUFACTURER.
- B. Tank MANUFACTURER shall provide a detailed plan for monitoring total and differential tank settlement, including the settlement monuments, means and frequency of monitoring both total and differential tank settlement, and log of settlement at each monument and cumulative settlement, as shown in total settlement and differential settlement. Submit a proposed monitoring plan for review and approval by the ENGINEER.
- C. The tank settlement must last at least four weeks and will continue until the majority of expected settlement has occurred, as determined by ENGINEER.
- D. During operational-level loading of the tank, the changes in elevation to the outside edge of the tank foundation of the tank must be surveyed weekly to monitor differential and total tank settlement. A registered land surveyor certified in the

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State of Florida shall perform the tank settlement monitoring plan or submit alternative monitoring plan for approval. A survey of the tank center and interior midpoint settlement monuments shall be taken immediately prior to and after the post-loading has been completed and the tank has been drained.

- E. Results from monitoring tank settlement data shall be submitted every week to the ENGINEER.
- F. At the end of the minimum four-week tank settlement period, ENGINEER shall review final monitoring data to determine whether majority of expected settlement has occurred. More time shall be allowed for tank settlement if deemed necessary by ENGINEER.
- G. Review report of geotechnical exploration for the anticipated post loading settlement and settlement after post loading. Refer to geotechnical report for required post loading requirements. Refer to geotechnical report for required waiting time period before piping connections are completed after the post loading sequence of construction.

Estimated Settlement	
Post Loading Settlement	Differential Settlement between Center of Tank and Perimeter of Tank
< 1"	<1/2"

- H. If operational settlement testing is successful and after the results are approved by the ENGINEER, Re-Pump Station CONTRACTOR can proceed with connecting the inlet and outlet piping.

3.04 TESTING

- A. Compression Tests
 - 1. Compression test specimens shall be taken during construction from the first placement of shotcrete. At least one set of test specimens shall be made for each 50 cubic yards of shotcrete placed. Additional tests shall be made if deemed necessary by the ENGINEER to ensure continued compliance with these Specifications. Each set of specimens shall be a minimum of 5 cylinders.
 - 2. Compression test specimens for shotcrete shall conform to ASTM C172/C172M for sampling and ASTM C31/C31M for making and curing test cylinders. Test specimens shall be 6-inch diameter by 12-inch high or 4-inch diameter by 8-inch high cylinders.

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3. Compression test shall be performed in accordance with ASTM C39/C39M. Two test cylinders will be tested at 7 days and two at 28 days. The remaining cylinder will be held to verify test results, if needed.
- B. Air Content Tests (concrete only)
1. Air content tests shall conform to ASTM C231/C231M (Pressure Method for Air Content).
 2. Test for air content shall be made prior to concrete placement and whenever compression test specimens are made.
- C. Slump Test (concrete only)
1. Slump tests shall be made in accordance with ASTM C143/C143M.
 2. Slump tests shall be made whenever compression test specimens are made.
- D. Tank MANUFACTURER shall perform shotcrete testing and testing shall follow ASTM C1140/C1140M – 11.
- E. Hydraulic Watertightness Testing
1. After the tank has been completed, but before any backfill is placed or coatings have been applied, the tank shall be filled slowly in the presence of the ENGINEER. Careful observation for leaks shall be made and any leaks that occur shall be immediately repaired. The tanks shall not be filled any higher than 8 feet over a 24-hour period.
 2. The tanks shall be kept full of water until the ENGINEER is satisfied that all defects have been discovered and repaired. There shall be no flowing water allowed through the walls or floor slab. Damp spots that glisten on the surface of the tank and spots where moisture can be picked up on a dry hand, the source of which is from inside the tank, will not be allowed. Damp spots on the top of footing projections that are not from flowing water shall not be considered to be leakage.
 3. Allowable tank leakage shall be zero.
 4. The water required for leakage tests shall be provided by the OWNER at no cost. The tank MANUFACTURER shall provide and install any piping, valves, or pumps that are needed to supply the water for the testing.
 5. Water tightness testing shall be performed prior to application of any coatings.
 6. After completion of the watertightness testing, continue to fill the tank to verify the overflow function of the frog eyes.

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3.05 CLEANING

- A. The interior of the tank shall be cleaned to remove debris, construction items, and equipment prior to testing.

END OF SECTION 13216