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IFB NO. Y15-742-PH **ISSUED: December 11, 2014**

INVITATION FOR BIDS

FOR

SOUTH WATER RECLAMATION FACILITY PRETREATMENT STRUCTURE ODOR CONTROL SYSTEM

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PART H
TECHNICAL SPECIFICATIONS

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PART H

NEW BID BOND REQUIREMENT – See Part C, Instructions to Bidders, Paragraph 19 e.

Issued for Bid

SWRF Preliminary Treatment Odor Control System

Sequence No. 70987
CAP No. 1555-14

Orange County Utilities

October 2014

Prepared For:

Orange County Utilities
Engineering Division
9150 Curry Ford Road
Orlando, FL 32825

ORANGE COUNTY UTILITIES
PRELIMINARY TREATMENT STRUCTURE ODOR CONTROL
Technical Specifications

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SECTION 01001
GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE AND INTENT

A. Description:

This Project will provide engineering services associated with implementing a biotower odor control system at the Orange County South Water Reclamation Facility's (SWRF's) Preliminary Treatment Structure to treat odorous air. The Project replaces an existing biotower odor control system that receives odorous air from the covered channels, the covered outlet weir boxes, and the dumpster room. A biotower odor control unit will be specified and implemented on a competitively bid basis. The design includes installation of a two-stage in one vessel odor control unit, FRP fan, nutrient storage and feed pump, the respective above ground ductwork, exhaust fan, grit bagging system, demolition of portions of the existing odor control system, demolition of portions of the existing ductwork, paving and grading, repairs to the existing 30-inch FRP pipe, and structural repairs and tie-in to the south side of the PTS.

Work Included:

1. The Contractor shall furnish all supervision, labor, materials, power, light, heat, fuel, water, tools, appliances, equipment, supplies, and means of construction necessary for proper performance and completion of the work. The Contractor shall obtain and pay for all required permits. The Contractor shall perform and complete the work in the manner best calculated to promote rapid construction consistent with safety of life and property and to the satisfaction of the Owner, and in strict accordance with the Contract Documents. The Contractor shall clean up the work and maintain it during and after construction, until accepted, and shall do all work and pay all costs incidental thereto. The Contractor shall repair or restore all structures and property that may be damaged or disturbed during performance of the work.
2. The cost of incidental work described in these General Work Requirements, for which there are no specific Contract Items, shall be considered as part of the general cost of doing the work and shall be included in the prices for the various Contract Items. No additional payment will be made therefore.
3. The Contractor shall provide and maintain such modern materials, tools, and equipment as may be necessary, in the opinion of the Engineer, to perform in a satisfactory and acceptable manner all the work required by this Contract. Only equipment of established reputation and proven efficiency shall be used.

The Contractor shall be solely responsible for the adequacy of his/her workmanship, materials and equipment, prior approval of the Engineer notwithstanding.

B. Utility Installations and Structures:

1. Utility installations and structures shall be understood to include all poles, tracks, pipes, ductwork, wires, conduits, vaults, drains and all other appurtenances and facilities pertaining thereto whether owned or controlled by the Owner, other governmental bodies or privately owned by individuals, firms or corporations, used to serve the public with transportation, traffic control, gas, electricity, telephone, sewerage, drainage, water or other public or private property which may be affected by the work shall be deemed included hereunder.

2. The Contract Documents contain data relative to existing utility installations and structures above and below the ground surface. These data are not guaranteed as to their completeness or accuracy and it is the responsibility of the Contractor to make his/her own investigations to inform himself fully of the character, condition and extent of all such installations and structures as may be encountered and as may affect the construction operations.

3. The Contractor shall protect all utility installations and structures from damage during the work. The Contractor shall so arrange his/her operations as to avoid any damage to these facilities. All required protective devices and construction shall be provided by the Contractor at his/her expense. All existing utilities damaged by the Contractor shall be repaired by the Contractor, at his/her expense. No separate payment shall be made for such protection or repairs to utility installations or structures.

4. Public utility installations or structures owned or controlled by the Owner or other governmental body which are shown on the Drawings to be removed, relocated, replaced or rebuilt by the Contractor shall be considered as a part of the general cost of doing the work and shall be included in the price bid for the various contract items. No separate payment shall be made therefore.

5. Where public utility installations of structures owned or controlled by the Owner or other governmental body are encountered during the course of the work, and are not indicated on the Drawings or in the Specifications, and when, in the opinion of the Engineer, removal, relocation, replacement or rebuilding is necessary to complete the work under this Contract, such work shall be accomplished by the utility having jurisdiction, or such work may be ordered, in writing by the Engineer, for the Contractor to accomplish. If such work is accomplished by the utility having jurisdiction it will be carried out expeditiously and the Contractor shall give full cooperation to permit the utility to complete the removal, relocation, replacement or rebuilding as required. If such work is accomplished by the Contractor, it will be paid for as

extra work as provided in the Agreement. The Contractor shall obtain approval in writing from the Owner prior to performing such work.

6. The Contractor shall, at all times in performance of the work, employ approved methods and exercise reasonable care and skill so as to avoid unnecessary delay, injury, damage or destruction of public utility installations and structures; and shall, at all times in the performance of the work, avoid unnecessary interference with, or interruption of, public utility services, and shall cooperate fully with the owners thereof to that end.

7. The Contractor shall give written notice to Owner, other governmental utility departments and other owners of public utilities of the location of his/her proposed construction operations, at least forty-eight (48) hours in advance of breaking ground in any area or on any unit of the work.

8. The maintenance, repair, removal, relocation or rebuilding of public utility installations and structures, when accomplished by the Contractor as herein provided, shall be done by methods approved by the Owners of such utilities.

1.02 DRAWINGS AND PROJECT MANUAL

A. Drawings: When obtaining data and information from the Drawings, figures shall be used in preference to scaled dimensions, and large scale drawings in preference to small scale drawings.

B. Copies Furnished to Contractor:

1. After the Contract has been executed, the Contractor will be furnished one (1) complete set of reproducible full size drawings (24 inches by 36 inches) on bond paper and one (1) copy of the Project Manual (Contract Requirements and Specifications) and all addenda.

2. The Contractor shall furnish each of the subcontractors, manufacturers, and material suppliers such copies of the Contract Documents as may be required for their work. All copies of the Contract Documents shall be printed from the reproducible sets furnished to the Contractor. All costs of reproduction and printing shall be borne by the Contractor.

C. Supplementary Drawings:

1. When, in the opinion of the Engineer, it becomes necessary to explain more fully the work to be done or to illustrate the work further or to show any changes which may be required, drawings known as Supplementary Drawings, with specifications pertaining thereto, will be prepared by the Engineer and the Contractor will be furnished one (1) complete set of drawings (24 inches by 36 inches) and one (1) copy of the Project Manual.

2. The Supplementary Drawings shall be binding upon the Contractor with the same force as the Drawings. Where such Supplementary Drawings require

either less or more than the estimated quantities of work, credit to the Owner or compensation therefore to the Contractor shall be subject to the terms of the Agreement.

D. Contractor to Check Drawings and Data:

1. The Contractor shall verify all dimensions, quantities and details shown on the Drawings, Supplementary Drawings, schedules, Specifications or other data received from the Engineer, and shall notify him of all errors, omissions, conflicts, and discrepancies found therein. Failure to discover or correct errors, conflicts or discrepancies shall not relieve the Contractor of full responsibility for unsatisfactory work, faulty construction or improper operation resulting there from nor from rectifying such conditions at his/her own expense. The Contractor will not be allowed to take advantage of any errors or omissions, as full instructions will be furnished by the Engineer, should such errors or omissions be discovered.

2. All schedules are given for the convenience of the Engineer and the Contractor and are not guaranteed to be complete. The contractor shall assume all responsibility for the making of estimates of the size, kind, and quality of materials and equipment included in work to be done under the Contract.

E. Specifications: The Technical Specifications consist of three parts: General, Products and Execution. The General Section contains General Requirements which govern the work. Products and Execution modify and supplement these by detailed requirements for the work and shall always govern whenever there appears to be a conflict.

F. Intent:

1. All work called for in the Specifications applicable to this Contract, but not shown on the Drawings in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. Work not specified in either the Drawings or in the Specifications, but involved in carrying out their intent or in the complete and proper execution of the work, is required and shall be performed by the Contractor as though it were specifically delineated or described.

2. The apparent silence of the Specifications as to any detail, or the apparent omission from them of a detailed description concerning any work to be done and materials to be furnished, shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used, and interpretation of these Specifications shall be made upon that basis.

1.03 MATERIALS AND EQUIPMENT

A. Manufacturer:

1. The names of proposed manufacturers, material suppliers, and dealers who are to furnish materials, fixtures, equipment, appliances or other fittings shall be submitted to the Engineer for approval, as early as possible, to afford proper investigation and checking. Such approval must be obtained before Shop Drawings will be reviewed. No manufacturer will be approved for any materials to be furnished under this Contract unless shall be of good reputation and have a plant of ample capacity. The Contractor shall, upon the request of the Engineer, be required to submit evidence that he/she has manufactured a similar product to the one specified and that it has been previously used for a like purpose for a sufficient length of time to demonstrate its satisfactory performance.

2. All transactions with the manufacturers or subcontractors shall be through the Contractor, unless the Contractor shall request, in writing to the Engineer, that the manufacturer or subcontractor deal directly with the Engineer. Any such transactions shall not in any way release the Contractor from his/her full responsibility under this Contract.

3. Any two or more pieces of material or equipment of the same kind, type or classification, and being used for identical types of service, shall be made by the same manufacturer.

B. Delivery:

1. The Contractor shall deliver materials to the site in ample quantities to insure the most speedy and uninterrupted progress of the work so as to complete the work within the allotted time. However, the Contractor shall not store materials on site for more than thirty (30) days before installation.

2. The Contractor shall also coordinate deliveries in order to avoid delay in, or impediment of, the progress of the work of any related Contractor.

3. All materials and equipment shall be properly stored on site in accordance with these specifications and the manufacturer's recommendations.

C. Tools and Accessories:

1. The Contractor shall, unless otherwise stated in the Contract Documents, furnish with each type, kind or size of equipment, one complete set of suitably marked high grade special tools and appliances which may be needed to adjust, operate, maintain or repair the equipment. Such tools and appliances shall be furnished in approved painted steel cases, properly labeled and equipped with good grade cylinder locks and duplicate keys.

2. Spare parts shall be furnished as specified.

3. Each piece of equipment shall be provided with a substantial nameplate, securely fastened in place and clearly inscribed with the manufacturer's name, year of manufacture, serial number, weight and principal rate data.

D. Service of Manufacturer's Engineer:

1. The Contract prices for equipment shall include the cost of furnishing a competent and experienced Engineer or superintendent who shall represent the manufacturer and shall assist the Contractor, when required, to install, adjust, test and place in operation, the equipment in conformity with the Contract Documents.

2. After the equipment is placed in permanent operation by the Owner, such engineer or superintendent shall make all adjustments and tests required by the Engineer to prove that such equipment is in proper and satisfactory operating condition, and shall instruct such personnel as may be designated by the Owner in the proper operation and maintenance of such equipment.

1.04 INSPECTION AND TESTING

A. General:

1. Inspection and testing of materials will be provided by the Contractor unless otherwise specified.

2. For tests specified to be made by the Contractor, the testing personnel shall make the necessary inspections and tests and the reports thereof shall be in such form as will facilitate checking to determine compliance with the Contract Documents. Five copies of the reports shall be submitted and authoritative certification thereof must be furnished to the Engineer as a prerequisite for the acceptance of any material or equipment.

3. If, in the making of any test of any material or equipment, it is ascertained by the Engineer that the material or equipment does not comply with the Contract Documents, the Contractor will be notified thereof and he/she will be directed to refrain from delivering said material or equipment, or to remove it promptly from the site or from the work and replace it with acceptable material, without cost to the Owner.

4. Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with recognized test codes of the ANSI, ASME, or the IEEE, except as may otherwise be stated herein.

5. The Contractor shall be fully responsible for the proper operation of equipment during tests and instruction periods and shall neither have nor make any claim for damage which may occur to equipment prior to the time when the Owner normally takes over the operation thereof.

B. Costs:

1. Inspection and testing of materials furnished under this Contract will be provided by the Owner, unless otherwise specified.

2. The cost of shop and field tests of equipment and certain other tests specifically called for in the Contract Documents shall be borne by the

Contractor and such costs shall be deemed to be included in the Contract price.

3. Materials and equipment submitted by the Contractor as the equivalent to those specifically named in the Contract may be tested by the Owner for compliance. The Contractor shall reimburse the Owner for the expenditures incurred in making such tests of materials and equipment which are rejected for non-compliance.

C. Inspection of Materials:

1. The Contractor shall give notice in writing to the Engineer, sufficiently in advance of his/her intention to commence the manufacture or preparation of materials especially manufactured or prepared for use in or as part of the permanent construction. Such notice shall contain a request for inspection, the date of commencement and the expected date of completion of the manufacture or preparation of materials. Upon receipt of such notice, the Engineer will arrange to have a representative present at such times during the manufacture as may be necessary to inspect the materials or he/she will notify the Contractor that the inspection will be made at a point other than the point of manufacture.

2. The Contractor must comply with these provisions before shipping any material. Such inspection shall not release the Contractor from the responsibility for furnishing materials meeting the requirements of the Contract Documents.

D. Certificate of Manufacture:

1. When inspection is waived or when the Engineer so requires, the Contractor shall furnish to him authoritative evidence in the form of Certificate of Manufacture that the materials to be used in the work have been manufactured and tested in conformity with the Contract Documents.

2. These certificates shall be notarized and shall include copies of the results of physical tests and chemical analyses, where necessary, that have been made directly on the product or on similar products of the manufacturer.

E. Shop Tests:

1. Testing for pressure, duty, capacity, rating, efficiency, performance, function or special requirements which are specified shall be tested in the shop of the maker in a manner which shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents.

2. No such equipment or materials shall be shipped to the work site until the Engineer notifies the Contractor, in writing, that the results of such tests are acceptable.

3. Five (5) copies of the manufacturers' actual test data and interpreted results thereof, accompanied by a certificate of authenticity sworn to be a responsible official of the manufacturing company and/or independent laboratory, shall be forwarded to the Engineer for approval.

4. The cost of shop tests and of furnishing manufacturer's preliminary and shop test data of operating equipment shall be borne by the Contractor.

F. Final Field Tests:

1. Upon completion of the work and prior to final payment, all equipment and piping installed under this Contract shall be subjected to acceptance tests as specified or required to provide compliance with the Contract Documents.

2. The Contractor shall furnish labor, fuel, energy, water and all other materials, equipment and instruments necessary for all acceptance tests, at no additional cost to the Owner. The furnishing Contractor shall assist in the final field tests as applicable.

G. Final Inspection: During such final inspections, the work shall be clean and functional. In no case will the final estimate be prepared until the Contractor has complied with all requirements set forth and the Engineer and Owner have made their final inspection of the entire work and are satisfied that the entire work is properly and satisfactorily constructed in accordance with the requirements of the Contract Documents.

1.05 TEMPORARY STRUCTURES

A. Temporary Fences: If, during the course of the work, it is necessary to remove or disturb any fence or part thereof, the Contractor shall provide a suitable temporary fence at his/her own expense.

B. Responsibility for Temporary Structures: In accepting the Contract, the Contractor assumes full responsibility for the sufficiency and safety of all temporary structures or work and for any damage which may result from their failure or their improper construction, maintenance or operation and will indemnify and hold harmless the Owner and Engineer from all claims, suits or actions and damages or costs of every description arising by reason of failure to comply with the above provisions.

1.06 ACCIDENT PREVENTION

A. Precautions shall be exercised at all times for the protection of person and property. The safety provisions of applicable laws, building and construction codes shall be observed.

B. The Contractor shall comply with the U.S. Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of 1970 (PL 91-596), and under Hours and Safety Standards Act Section 107 of

the contract Work. Hours and Safety Standards Act (PL 91-54), except where state and local safety standards exceed the federal requirements and except where state safety standards have been approved by the Secretary of Labor in accordance with provisions of the Occupational Safety and Health Act, shall be complied with.

C. First Aid: The Contractor shall keep upon the site, at each location where work is in progress, a completely equipped first aid kit and shall provide ready access thereto at all times when men are employed on the work.

1.07 LINES AND GRADES

A. Grade:

1. All work under this Contract shall be constructed in accordance with the lines and grades shown on the Drawings, or as given by the Engineer. The full responsibility for keeping alignment and grade shall rest upon the Contractor.

2. 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 also 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.

B. Surveys:

1. The Contractor shall furnish and maintain, at his/her own expense, stakes and other such materials, and give assistance, including qualified helpers, for setting reference marks to the satisfaction of Utilities and the Engineer.

2. The Contractor shall check such reference marks by such means as he/she may deem necessary and, before using this, shall call the Utilities' attention to any inaccuracies.

3. The Contractor shall, at his/her 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. However, the Contractor shall be subject to the check and review by Utilities. Field engineering shall be in accordance with Section 01050.

4. The Contractor shall, at his/her own expense, provide a surveyor to survey and monument all easements or proposed easements on private property prior to the start of Utilities Work. Monuments shall be preserved throughout the Work.

5. The Contractor shall, at his/her own expense, provide a Surveyor to survey stake or monument the proposed Right-of-Way of property to be turned over to the Public prior to the start of Utilities Work. Monuments shall be preserved throughout the Work.

C. Safeguarding Marks:

1. The Contractor shall safeguard all points, stakes, grade marks, monuments and bench marks made or established on the work, bear the cost of reestablishing them if disturbed, and bear the entire expense of rectifying work improperly installed due to not maintaining or protecting or to removing without authorization such established points, stakes and marks.

2. The Contractor shall safeguard all existing and known property corners, monuments and marks adjacent to but not related to the work and, if required, shall bear the cost of reestablishing them if disturbed or destroyed.

1.08 ADJACENT STRUCTURES AND LANDSCAPING

A. Responsibility:

1. The Contractor shall also be entirely responsible and liable for all damage or injury as a result of his/her operations to all other adjacent public and private property, structures of any kind and appurtenances thereto met with during the progress of the work.

2. The cost of protection, replacement in their original locations and conditions or payment of damages for injuries to such adjacent public and private property and structures affected by the work, whether or not shown on the Drawings, and the removal, relocation and reconstruction of such items called for on the Drawings or specified shall be included in the various Contract Items and no separate payments will be made therefore.

3. Contractor is expressly advised that the protection of buildings, structures, tanks, pipelines, etc. and related work adjacent and in the vicinity of his/her operations, wherever they may be, is solely his/her responsibility.

4. Conditional inspection of buildings or structures in the immediate vicinity of the project which may reasonably be expected to be affected by the Work shall be performed by and be the responsibility of the Contractor.

5. Contractor shall, before starting operations, make an examination of the adjacent structures, buildings, facilities, etc., and record by notes, measurements, photographs, etc., conditions which might be aggravated by open excavation and construction. Repairs or replacement of all conditions disturbed by the construction shall be made to the satisfaction of the Owner and to the satisfaction of the Owner. This does not preclude conforming to the requirements of the insurance underwriters. Copies of surveys, photographs, reports, etc., shall be given to the Owner.

6. Prior to the beginning of any excavations the Contractor shall advise the Owner of all structures on which he/she intends to perform work or which performance of the project work will affect.

B. Protection of Trees and Shrubs: The Contractor at his/her expense, shall protect all trees and shrubs not shown to be removed on the Plans, in accordance with "Article VIII, 'Tree Protection and Removal', Chapter 15, Orange County Code". No excavated materials shall be placed so as to injure such trees or shrubs. Trees or shrubs destroyed by negligence of the Contractor or his/her employees shall be replaced in accordance with "Article VIII, 'Tree Protection and Removal', Chapter 15, Orange County Code" at the sole expense of the Contractor.

C. Protection of Lawn Areas: Lawn areas shall be left in as good or better condition as before starting of the Work. Where sod is to be removed, it shall be carefully restored with new sod of the same type.

D. Restoration of Fences:

1. 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 or replaced and the materials used shall be subject to the approval of Utilities.

2. The cost of all labor, materials, equipment, and work for the replacement or repair of any fence shall be deemed included in the appropriate Contract Item or items, or if no specific item is provided therefore, as part of the overhead cost of the work, and no additional payment will be made therefore.

1.09 PROTECTION OF WORK AND PUBLIC

A. Barricades, Guards and Safety Provisions:

1. The Contractor shall be solely responsible for adhering to the rules and regulations of OSHA and appropriate authorities regarding safety provisions. To protect persons from injury and to avoid property damage, adequate barricades, construction signs, lights and guards as required shall be placed and maintained by the Contractor at his/her expense during the progress of the Work and until it is safe for traffic to use the roads and streets. Material piles, equipment and pipe which may serve as obstructions for traffic shall be enclosed by fences or barricades and shall be protected by proper lights when the visibility is poor.

2. Signage and barricades shall be in accordance with applicable FDOT manuals.

B. Noise:

1. The Contractor shall eliminate noise to as great an extent as practicable at all times. Air compressing equipment shall be equipped with silencers and the exhaust of all gasoline motors or other power equipment shall be provided with mufflers. The Contractor shall construct sound barriers as necessary to eliminate noise.

2. Work shall be performed during normal working hours and normal working days unless written authorization has been granted by Owner and overtime pay for inspection shall apply per the current Fee Directory prepared by Orange County OMB. Work shall not be performed outside the hours of 7:00 a.m. to 7:00 p.m. Prior to performing any Work, written notification shall be provided to Utilities a minimum of two normal working days.

C. Access to Public Services: Neither the materials excavated nor the materials or equipment used in the construction of the work shall be so placed as to prevent free access to public services. All excavated material shall be piled in a safe manner that will not endanger the Work and that will avoid obstructing streets, sidewalks and driveways. Excavated material suitable for backfilling shall be stockpiled separately on the site. No material shall be placed closer than two feet from the edge of an excavation. Fire hydrants, valve pit covers, valve boxes, curb stop boxes or other utility controls shall be left unobstructed and accessible. Gutters shall be kept clear or other satisfactory provisions made for street drainage. Natural watercourses shall not be obstructed or polluted. Surplus material and excavated material unsuitable for backfilling shall be transported and disposed of off the site in disposal areas obtained by the Contractor.

D. Dust Prevention: The Contractor shall prevent dust nuisance from his/her operations or from traffic by keeping the roads and/or construction areas sprinkled with water at all times.

1.10 CUTTING AND PATCHING

A. The Contractor shall do all cutting, fitting or patching of his/her portion of the work that may be required to make the several parts thereof join and coordinate in a manner satisfactory to the Engineer and in accordance with the Drawings and Specifications.

B. The work must be done by competent workmen skilled in the trade required by the restoration.

1.11 CLEANING

A. During Construction:

1. During construction the Contractor shall, at all times, keep the construction site and adjacent premises as free from material, debris and rubbish as is practicable and shall remove the same from any portion of the site if, in the opinion of Utilities, such material, debris, or rubbish constitutes a nuisance or is objectionable. The Contractor shall implement appropriate best management practices (BMPs) to prevent off-site tracking of material, and if tracking occurs, shall use all means necessary to remove the material, prevent material from entering roadway stormwater system and will adjust the associated BMPs to prevent future tracking.

B. Final Cleaning:

1. At the conclusion of the work, all tools, temporary structures and materials belonging to the Contractor shall be promptly taken away. The Contractor shall remove and promptly dispose of all water, dirt, rubbish or any other foreign substances in a legal manner.

2. The Contractor shall thoroughly clean all equipment and materials installed by him and shall deliver such materials and equipment undamaged in a bright, clean, polished and new operating condition.

C. Salvage

1. Any existing Utilities owned equipment or material including but not limited to valves, pipes, fittings, couplings, etc., which is removed or replaced as a result of construction, may be designated as salvage by Utilities, and if so, shall be carefully excavated if necessary and delivered to Utilities at a location designated by Utilities.

1.12 MISCELLANEOUS

A. Erosion and Sediment Control

1. Erosion and sediment control implemented as part of a SWPPP is performance based. If the best management practices (BMPs) initially installed are not maintaining compliance with the permit, the BMPs shall be adjusted or replaced in order to achieve compliance.

2. If BMPs originally included in the SWPPP are changed, the SWPPP document shall be adjusted to reflect the change.

B. Existing Facilities: The work shall be so conducted to maintain existing equipment in operation.

C. Use of Chemicals: Chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant or of other classification, must indicate approval of either United States Environmental Protection Agency, National Safety Foundation, or United States Department of Agriculture. Use of such chemicals and disposal of residues shall be in strict conformance with label instructions. Material Safety Data Sheets (MSDS) for chemicals used during project construction shall be submitted to Utilities for approval.

D. Cooperation with Other Contractors and Forces:

1. During progress of work under this Contract, it may be necessary for other contractors and persons employed by the Owner to work in or about the project.

2. The Owner reserves the right to put such other contractors to work and to afford such access to the Site of the Work to be performed hereunder at such times as the Owner deems proper.

3. The Contractor shall not impede or interfere with the work of such other contractors engaged in or about the Work and shall so arrange and conduct his/her work that such other contractors may complete their work at the earliest date possible.

E. Construction shall be conducted and shall result in construction of the improvements of this project in full accordance with the conditions of the permits granted for the project.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01010
SUMMARY OF PROJECT

PART 1 - GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

This Contract is for the construction of the Orange County Utilities South Water Reclamation Facility (SWRF) Preliminary Treatment Structure Odor Control System, including a two-stage in one vessel odor control unit, FRP fan, nutrient storage and feed pump, the respective above ground ductwork, exhaust fan, grit bagging system, demolition of the existing odor control system, demolition of portions of the existing ductwork, paving and grading, repairs and tie-in to the existing 30-inch FRP pipe, and structural repairs to the south side of the PTS.

Work consists of furnishing all labor, equipment, and materials for the construction of the facilities consisting of, but not limited to the equipment and structures associated with the following:

1. Biotower Odor Control System including all associated air ductwork, drain piping, valves, fittings, pumps, fan, nutrient feed system, wiring, accessories, supports, and demolition required for the installation of the new odor control system.
2. All associated piping modifications, fittings, and installation of grit bagging system.
3. All work associated with installation of an exhaust fan at the grit dumpster room.
4. All associated structural repairs to the PTS.
5. All associated paving and grading.
6. All associated modifications to the existing biotower equipment pad.
7. All associated demolition.
8. All associated electrical.
9. Instrumentation and controls for system operation and monitoring.

1.02 CONTRACTOR'S USE OF PREMISES

A. The Contractor shall assume full responsibility for the protection and safekeeping of products and materials at the job site. If additional storage or work areas are required, they shall be obtained by the Contractor at no additional cost to the Owner.

1.03 PROJECT SEQUENCE

A. Sequence
   a. Improvements to the biotower odor control pad, proposed odor control system, proposed fan, and proposed ductwork.
   b. Tie in to the existing ductwork and modifications of ductwork requiring interruption to existing odor control service.
   c. Demolition of the existing ductwork and ancillary equipment
   d. Paving, grading, and solid sodding.

B. The Contractor shall maintain service to the existing odor control system and shall sequence the project to minimize interruptions. The Contractor shall provide one (1) week notification to the Owner on planned downtimes to the existing odor control system.

C. Demolition of the existing odor control system and ductwork, unless is in the way of the proposed, shall be after the existing odor control system is in running condition.

D. The Contractor shall establish his work sequence based on the use of crews to facilitate completion of construction and testing within the specified Contract Time.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01025
MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Contractor shall receive and accept the compensation provided in the Proposal and the Contract as full payment for furnishing all materials, labor, tools and equipment, for performing all operations necessary to complete the work under the Contract, and also in full payment for all loss or damages arising from the nature of the work, or from any discrepancy between the actual quantities of work and quantities herein estimated by the Engineer, or form the action of the elements of from any unforeseen difficulties which may be encountered during the prosecution of the work until the final acceptance by the Owner.

B. The prices stated in the proposal include all costs and expenses for taxes, labor, equipment, materials, commissions, transportation charges and expenses, patent fees and royalties, labor for handling materials during inspection, together with any and all other costs and expenses for performing and completing the work as shown on the Drawings and specified herein.

C. The Contractor's attention is again called to the fact that the quotations for the various items of work are intended to establish a total price for completing the work in its entirety. Should the Contractor feel that the cost for any item of work has not been established by the Bid Form or Payment Items, he shall include the cost for that work in some other applicable bid item, so that his proposal for the project does reflect his total price for completing the work in its entirety.

1.02 MEASUREMENT

A. The quantities for payment under this Contract shall be determined by actual measurement of the completed items, in place, ready for service and accepted by the Owner, in accordance with the applicable method of measurement therefore contained herein.

1.03 PAYMENT

A. Payment will be made at the lump sum price for each of the items shown in the Bid Form, stored and/or installed and accepted, which price and payment shall constitute full compensation for furnishing all materials and performing all Work in connection therewith and incidental thereto.

B. The prices shown on the Bid Form establish a total price cost for completing the Work in its entirety. The Contractor shall furnish all materials, equipment, transportation, tools, labor, services and supplies, plus any miscellaneous items and services that may not be specifically identified in the Contract Drawings and Specifications but that can be inferred from the Contract Drawings and Specifications and are necessary to produce a completed project that is completely functional in a manner for which it was intended. If any items for a complete project are omitted or

not shown, the Contractor shall furnish and install them without additional cost to the Owner.

C. The Contractor shall prepare and submit an application for payment no more often than each month.

D. Retainage shall apply to all Contractor payments prior to final acceptance as provided for in the Contract General Requirements as indicated in the City's Invitation to Bid.

1.04 PAYMENT ITEMS

A. Payment will be made for the lump sum items listed on the Bid Form. Related work not specifically listed or identified, but evidently necessary for satisfactory completion of an item, shall be considered to be included.

B. No separate payment will be made for the following Work and its cost shall be included in appropriate Payment Items:

1. Maintenance and replacement of plantings and sodding.
2. Record drawings.
3. Construction photographs and videotape recordings.
4. Field office(s) and storage facilities.
5. Clean up.
6. Testing.
7. Appurtenant work.
8. Contractor fees associated with the performance of the Work.
9. Night work.

C. The following will clarify the work included for bid items in the Itemized Bid Form:

1. Base Bid (Bid Item No. 1)

a. Measurement: Measurement for this lump sum item shall be for the preparatory work and operations in mobilizing for beginning work on the Project and demobilizing for ending work on the Project, provision of bonds and insurance, securing required permits, the provision of safety equipment, first aid supplies, sanitary and other facilities, as required, preparation of an initial construction schedule, provision of preconstruction photographs and video documentation, demobilization and cleanup, project record documents, furnishing all labor, materials and equipment necessary for installation of a two-stage in one vessel odor control unit, FRP fan, nutrient storage and feed pump, the respective above ground ductwork, exhaust fan, grit bagging system, demolition of the existing odor control system, demolition of portions of the existing ductwork, paving and grading, repairs and tie-in to the existing 30-inch FRP pipe, all associated electrical and instrumentation and controls work, and structural repairs to the south side of the PTS.

The quantity to be paid for under this Item shall be measured as a lump sum quantity.

b. Payment: Payment of the appropriate percentage of the lump sum price shall be full compensation for mobilization, demobilization, project record documents, furnishing all labor, materials and equipment necessary for successful installation of a two-stage in one vessel odor control unit, FRP fan, nutrient storage and feed pump, the respective above ground ductwork, exhaust fan, grit bagging system, demolition of the existing odor control system, demolition of portions of the existing ductwork, paving and grading, repairs and tie-in to the existing 30-inch FRP pipe, all associated electrical and instrumentation and controls work, and structural repairs to the south side of the PTS. hauling, and disposal of debris as necessary to accomplish the work as shown on the drawings and specified Contract Documents.

2. Flowable Fill under the Preliminary Treatment Structure (Bid Item No. 2)

a. Measurement: Flowable fill shall be measured in actual square yards of flowable fill placed under the preliminary treatment structure and installed in accordance with the County requirements, drawings, and specifications. Contractor shall provide supporting documentation (i.e. drawings, delivery tickets, invoices, survey calculations, etc.) to verify actual installed quantities.

b. Payment: Payment will be made at the contract unit price bid per square yard as stated in the proposal for flowable fill and shall include all labor, materials and equipment to install, and spread flowable fill under the preliminary treatment structure, including equipment, and services necessary to fill the void underneath the preliminary treatment structure.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01027
APPLICATIONS FOR PAYMENTS

PART 1 - GENERAL

1.01 PAY REQUEST SUBMISSION

A. Submit applications for payment to the Engineer in accordance with the schedule established by General Conditions of the Contract between the Owner and Contractor.

1.02 FORMAT AND DATA REQUIRED

A. Submit applications typed on forms provided by the Owner, with itemized data typed on 8-1/2 inch x 11 inch or 8-1/2 inch x 14 inch white paper continuation sheets.

B. Provide itemized data on continuation sheet of format, schedules, line items and values: Those of the schedule of values accepted by the Engineer.

1.03 PREPARATION OF APPLICATION FOR EACH PROGRESS PAYMENT

A. Application Form:

1. Fill in required information, including that for Change Orders executed prior to date of submittal of application.
2. Fill in summary of dollar values to agree with respective totals indicated on continuation sheets.
3. Execute certification with signature of a responsible officer of Contract firm.

B. Continuation Sheets:

1. Fill in total list of all scheduled component items of work, with item number and scheduled dollar value for each item.
2. Fill in dollar value in each column for each scheduled line item when work has been performed or products stored. Round off values to nearest dollar, or as specified for Schedule of Values.
3. List each Change Order executed prior to date of submission, at the end of the continuation sheets. List by Change Order Number, and description, as for an original component item of work.
4. To receive approval for payment on component material stored on site, submit copies of the original paid invoices with the application for payment. Any materials stored on site that are included in the pay request must be installed prior to the next pay request submitted.

5. As provided for in the "Pay Estimate" form, the Contractor shall certify, for each current pay request, that all previous progress payment received from the Owner, under this Contract, have been applied by the Contractor to discharge in full all obligations of the Contractor in connection with Work covered by prior Applications for Payment, and all materials and equipment incorporated into the Work are free and clear of all liens, claims, security interest and encumbrances. Contractor shall attach to each Application for Payment like affidavits by all Subcontractors.

1.04 SUBSTANTIATING DATA FOR PROGRESS PAYMENTS

A. When the Owner or the Engineer requires substantiating data, Contractor shall submit suitable information, with a cover letter identifying:

1. Project
2. Application number and date
3. A detailed list of enclosures
4. For stored products:
   a. Item number and identification as shown on application
   b. A detailed description of specific material

B. Submit one copy of data and cover letter for each copy of each application.

C. As a prerequisite for payment, Contractor is to submit a "Surety Acknowledgement of Payment Request" letter showing amount of progress payment which the Contractor is requesting and partial release of liens.

D. The Contractor is to maintain an updated set of drawings to be used as record drawings in accordance with Section 01720: Project Record Drawings. As a prerequisite for monthly progress payments, the Contractor is to exhibit the updated record drawings for review by the Owner and the Engineer.

1.05 PREPARATION OF APPLICATION FOR FINAL PAYMENT

A. Fill in Application form as specified for progress payments.

1.06 SUBMITTAL PROCEDURE

A. Submit Applications for Payment to the Engineer at the time stipulated in the Agreement.

B. Number of copies for each Application for Payment:

1. Owner: Five (5) copies

2. Engineer: One (1) copy

3. Contractor: As required for his/her needs

C. When the Engineer finds an Application properly completed and correct, he/she will transmit certificate for payment to Owner, with copy for Contractor.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01041
PROJECT COORDINATION

PART 1 - GENERAL

1.01 COORDINATION

A. This Section includes requirements for coordinating with COUNTY's operations during the Work, and includes requirements for tie-ins and shutdowns necessary to complete the Work without impact on COUNTY's operations except as allowed in this Section.

B. Review installation procedures under other Specification sections and coordinate Work that must be performed with or before the Work specified in this Section.

C. All contacts, requests, changes, communications, and coordination with the County shall be initiated through the County's Resident Project Representative (R.P.R). Any other communication or request that is not initiated through the RPR will be null and void. The RPR will decide if a Construction Assistance Request (C.A.R) is needed. All training, spare parts distribution, and other activities described elsewhere shall always require a C.A.R. with seven (7) days notice.

1.02 SECURITY

A. Contractor shall be responsible for protection of the site, and all work, materials, equipment, and existing facilities thereon, against vandals and other unauthorized persons. Contractor shall comply with Orange County's security requirements to protect the South Water Reclamation Facility site.

B. The Contractor shall provide the following security measures:

1. Contractor will supply list of all personnel that will be at the SWRF site each morning to County's R.P.R.
2. All personnel, employees and or subcontractors and suppliers that pass through the security perimeter shall wear Contractor issued photo identification badges.
3. Contractor will supply list with names, driver license, and license plate numbers of all personnel.
4. All Contractor's and subcontractor's personnel passing through the security perimeter shall have background checks to identify any historical crimes dealing with terrorism, sabotage, or other government related illegal activities at the cost of the Contractor and before entering Orange County Utilities'

South Water Reclamation Facilities. Proof of background checks shall be submitted to County.

5. All project deliveries shall be inspected prior to entering the security perimeter of the Facility in order to verify contents. All delivery personnel and delivery vehicles shall be under supervision while within the security perimeter of the Facility in lieu of issuance of photo identification badges. The Contractor shall maintain staff to accept all deliveries to the site, the County will not be responsible for receipt of any deliveries.

6. If access other than the main gate off Sand Lake Road is utilized, a full time guard shall be provided at the construction gate during contractor working hours at the cost of the Contractor. All arrangements for alternative access shall be pre-arranged with the County. All alternative access must be secured and locked when not in use.

C. No Claim shall be made against County by reason of any act of an employee or trespasser, and CONTRACTOR shall make good all damage to County's property resulting from CONTRACTOR's failure to provide security measures as specified.

1.03 SMOKING POLICY

A. In order to protect the public health, safety, and welfare of citizens and employees, smoking tobacco or any other substance is prohibited in County owned or operated facilities and vehicles. Contractor's personnel will not be permitted to use tobacco products on County property, including County parking lots, break areas, and worksites. Smoking means the lighting of any cigarette, cigar or pipe, or the possession of any lighted cigarette, cigar or pipe, regardless of its composition. This requirement shall be enforced from the beginning of construction and violators will be removed from the property.

1.04 COUNTY'S WORK SCHEDULE.

A. The County reserves the right to have their R.P.R. present to witness and inspect all Work performed by the Contractor. Working hours for the R.P.R. are a 10-hour period between the hours of 7:00 a.m. and 7:00 p.m., Monday through Friday. Any Work beyond the 10-hour period shall be considered overtime and shall be requested in writing 24 hours prior. Contractor, with verbal permission of the R.P.R., may work 24 hours a day to provide clean-up, maintenance of vehicles and equipment, and other such items without the R.P.R. present.

B. Any Work required on Saturday or Sunday shall be considered overtime and shall be requested in writing 48 hours in advance. All requests must be approved by County in advance. Under emergency situations a verbal request may be made with a follow-up written request. County observes the following holidays: New Year's Day, Martin

Luther King Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day.

C. Contractor shall pay for the R.P.R.'s overtime. Overtime shall be defined as time beyond the 10-hour working period between 7:00 a.m. and 7:00 p.m. on Monday through Friday, and all time on Saturdays, Sundays, and on holidays observed by the County. Hourly rates for the R.P.R. shall be $50. per hour.

1.05 TRAINING

A. Unless otherwise specified, a minimum of 2 days of training shall be provided for each piece of equipment supplied, including all electrical installation, instruments, and testing equipment. Contractor shall video and audio record as specified in Section 01380. The Contractor shall submit a C.A.R. form seven days prior to beginning of training. Contractor shall submit training agenda, instructor names and resumes, and training handouts to be used. Training shall be based on O&M manuals supplied by the Contractor

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01050
SURVEYING & FIELD ENGINEERING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Provide and pay for field engineering services for the Project.

1. Survey work required in execution of the Project.
2. Civil, structural or other professional engineering services specified or required to execute Contractor's construction methods.
3. The method of field staking for the construction of the work shall be at the option of the Contractor. The Drawings provide the engineering surveys to establish reference points which were judged necessary to enable the Contractor to proceed with his work.
4. The accuracy of any method of staking shall be the responsibility of the Contractor. All engineering for vertical and horizontal control shall be the responsibility of the Contractor.
5. The Contractor shall be held responsible for the preservation of all stakes and marks. If any stakes or marks are carelessly or willfully disturbed by the Contractor, the Contractor shall not proceed with any work until he has established such points, marks lines and elevations as may be necessary for the prosecution of the work.
6. The Contractor shall retain the services of a registered land surveyor licensed in the State of Florida to identify existing control points and maintain a survey during construction and for record drawing purposes.

1.02 QUALIFICATIONS OF SURVEYOR OR ENGINEER

A. Qualified engineer or registered land surveyor, acceptable to the Owner and the Engineer.

B. Registered Professional Engineer of the discipline required for the specific service on the Project, currently licensed in the State of Florida.

1.03 SURVEY REFERENCE POINTS

A. 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 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 surveyor to replace Project control points which may be lost or destroyed at no additional cost to the Owner. Establish replacement based on original survey control.

1.04 PROJECT SURVEY REQUIREMENTS

A. Establish a minimum of two (2) permanent bench marks on site, referenced to data established by survey control points.

1. Record locations, with horizontal and vertical data, on Project Record Documents

B. Establish lines and levels, locate and lay out, by instrumentation and similar appropriate means:

1. Site improvements:

a. Stakes for grading, fill and topsoil replacement
b. Utility slopes and invert elevations

2. Batter boards for structures

3. Building foundations, column locations and floor levels

4. Controlling lines and levels required for mechanical and electrical trades

C. From time to time, verify layouts by same methods

1.05 RECORDS

A. Maintain a complete, accurate log of all control and survey work as it progresses. The Contractor shall be responsible for recording information on the approved plans concurrently with construction progress.

B. The Contractor's Surveyor shall be responsible for surveying utility assets concurrently (at a minimum monthly) with construction progress and providing as-built data to the Contractor. Monthly survey data and Contractor as-built record drawings shall be retained on the project site and made available to the Utilities representative.

C. Record drawings shall be legibly marked to record actual construction.

D. At the end of the project, submit a record drawing markup set of the original drawings, indicating the building corners and location of all structures, road

intersections, and elevations and stationing at 100 foot increments and for all valve and fitting locations.

E. As-Built Asset Attribute Data Table (See Table 3111-2 of the Orange County Standards and Construction Specifications Manual). The Contractor's Surveyor shall obtain field measurements of vertical and horizontal dimensions of constructed improvements for the table and include the Surveyor's statement regarding the constructed improvements being within the specified accuracies as described in Table 3111-1 Minimum Survey Accuracies per Asset (Water, Wastewater, Reclaimed Water and Existing) of the Orange County Standards and Construction Specifications Manual or if not, indicating the variances. Utilities will provide an electronic version of a blank table that shall be used to input data.

F. At the end of the project, submit an electronic survey file of both surveys depicted in B and D above in AutoCAD 2008 or other Engineer approved version of AutoCAD. Submit an electronic file of the As-Built Asset Attribute Data Table as depicted in E above.

G. Record drawings shall be provided in the following datum:

1. Horizontal Datum:

   State Plane, Florida East Zone

   Transverse Mercator Projection

   National NGS Datum NAD of 1983

   Readjustment of 1990 using the High Accuracy Reference Network correction

2. Vertical Datum:

   North American Vertical Datum of 1988

1.06 SUBMITTALS

A. Submit name and address of Surveyor and professional engineer to the Engineer.

B. On request of the Engineer, submit documentation to verify accuracy of field engineering work.

C. Submit certificate signed by registered engineer or surveyor certifying that elevations and locations of improvements are in conformance with the Contract Documents, or if not in conformance, certify as to variances from the Contract Documents.

D. Submit drawings showing locations of all structures constructed. This drawing shall be included with the project record documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01065
PERMITS AND FEES

PART 1 - GENERAL

A. The Contractor shall secure and pay for **all** permits and licenses related to his work, including, but not limited to, the necessary construction permits, as provided for in General Conditions except as otherwise provided herein.

B. Permits by Owner: The Owner prior to the advertisement of the project has applied for permits with the following agencies:

1. FDEP Wastewater permit not required (courtesy notification submitted).
2. Orange County Building Safety Division building permits. The Contractor is responsible for all fees which may include subcontractor and trade permit fees.

END OF SECTION

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SECTION 01070
ABBREVIATIONS AND SYMBOLS

PART 1 - GENERAL

1.01 STANDARDS AND ABBREVIATIONS

A. Referenced Standards: Any reference to published specifications or standards of any organization or association shall comply with the requirements of the specification or standard which is current on the date of Advertisement for Bids. In case of a conflict between the referenced specifications or standards, the one having the more stringent requirements shall govern.

B. In case of conflict between the referenced specifications or standards and the Contract Documents, the Contract Documents shall govern.

C. Abbreviations:

AA	Aluminum Association
AAA	American Arbitration Association
AABC	Associated Air Balance Council
AAMA	Architectural Aluminum Manufacturers Association
AASHO	The American Association of State Highway Officials
ABA	American Bar Association
ABMA	American Boiler Manufacturers Association
ABPA	Acoustical and Board Products Association
ACI	American Concrete Institute
ACPA	American Concrete Pipe Association
AEIC	Association of Edison Illuminating Companies
AFBMA	Anti-Friction Bearing Manufacturers Association
AGA	American Gas Association
AGC	Associated General Contractors of America
AGMA	American Gear Manufacturers Association

AHA	American Hardboard Association
AI	The Asphalt Institute
AIA	American Institute of Architects
AIA	American Insurance Association
AIEE	American Institute of Electrical Engineers (Now IEEE)
AIMA	Acoustical and Insulating Materials Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Condition Association
ANSI	American National Standard Institute
APA	American Plywood Association
API	American Petroleum Institute
APWA	American Public Works Association
AREA	American Railway Engineering Association
ARI	American Refrigeration Institute
ASA	American Standards Association (Now ANSI)
ASAHC	American Society of Architectural Hardware Consultants
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASSCBC	American Standard Safety Code for Building Construction
ASSHTO	American Association of State Highway Transportation Officials
ASTM	American Society for Testing and Materials

AWG	American Wire Gauge
AWI	Architectural Woodwork Institute
AWPA	American Wood Preservers Association
AWPB	American Wood Preservers Bureau
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Institute of America (formerly SCPI)
CDA	Copper Development Association
CFS	Cubic Feet Per Second
CMAA	Crane Manufacturers Association of America
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standard
DHI	Door and Hardware Institute
DIPRA	Ductile Iron Pipe Research Association
DOT Spec	Standard Specification for Road and Bridge Construction Florida Department of Transportation, 1982
E/A	Engineer and/or Architect
EDA	Economic Development Association
EEI	Edison Electric Institute
EPA	Environmental Protection Agency
FCI	Fluid Control Institute
FDEP	Florida Department of Environmental Protection
FDOT	Florida Department of Transportation

Fed Spec	Federal Specification
FPS	Feet Per Second
FS	Federal Standards
GPM	Gallons Per Minute
HMI	Hoist Manufacturers Institute
HP	Horsepower
HSBII	Hartford Steam Boiler Inspection and Insurance Co.
ID	Inside Diameter
IEEE	Institute of Electrical and Electronic Engineers
IFI	Industrial Fasteners Institute
IPCEA	Insulated Power Cable Engineers Association
IPS	Iron Pipe Size
MGD	Million Gallons Per Day
MHI	Materials Handling Institute
MMA	Monorail Manufacturers Association
NBFU	National Board of Fire Underwriters
NBHA	National Builders' Hardware Association
NBS	National Bureau of Standards
NCSA	National Crushed Stone Association
NCSPA	National Corrugated Steel Pipe Association
NEC	National Electrical Code
NECA	National Electrical Contractors' Association
NEMA	National Electrical Manufacturers' Association
NFPA	National Fire Protection Association

NLA	National Lime Association
NPC	National Plumbing Code
NPT	National Pipe Threads
NSC	National Safety Council
NSF	National Sanitation Foundation
OD	Outside Diameter
OSHA	U.S. Department of Labor, Occupational Safety and Health Act
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
PS	United States Products Standards
PSI	Pounds per Square Inch
PSIA	Pounds per Square Inch Absolute
PSIG	Pounds per Square Inch Gauge
RAS	Return Activated Sludge
RPM	Revolutions Per Minute
SAE	Society of Automotive Engineers
SDI	Steel Decks Institute
SJI	Steel Joists Institute
SJRWMD	St. Johns River Water Management District
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SSI	Scaffolding and Shoring Institute
SSPC	Steel Structures Painting Council
SSPC	Structural Steel Painting Council
STA	Station (100 feet) Intervals

TDH	Total Dynamic Head
TH	Total Head
UBC	Uniform Building Code
UL	Underwriter's Laboratories, Inc.
USASI or	United States of America Standards Institute

Additional abbreviations and symbols are shown on the Drawings.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01100
SPECIAL PROJECT PROCEDURES

PART 1 - GENERAL

1.01 EXCAVATION AROUND AND CONNECTION TO EXISTING UTILITIES

A. It is essential that the Contractor understand that the existing utilities must be kept in operation with minimal impact and shut-downs. To this end, the Contractor shall coordinate and consult with the Owner's operating personnel before excavating around or cutting into existing utilities on the site. Existing utilities of major concern are wastewater, electrical power conduits and cables, instrumentation conduits and cables and drain lines.

B. Some areas within the construction site will require hand excavation due to the congestion of underground piping systems and/or due to the criticality of piping systems that may be damaged unavoidably during machine excavation.

C. Cover for underground piping shall not be less than that indicated on the Drawings. In areas where other piping conflicts preclude the minimum cover desired, the piping shall be laid to provide the minimum cover obtainable.

D. All connections to existing piping systems shall be made as shown or indicated on the Drawings after consultation, cooperation, and coordination with the Owner's personnel. Some such connections may have to be made during off-peak hours (late night or early morning hours). The Contractor shall give a minimum of 72 hours notice to the Owner when tie-ins with the existing utilities are required. C.A.R. shall be submitted.

E. For major utility pipeline tie-ins and relocations, the Contractor shall submit a detailed Plan of Action for review and approval by the Owner and the Engineer. No major utility relocation or tie-ins shall proceed until the Plan of Action for that Work is approved.

F. The Contractor shall provide a start-up sequence for the project.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01200
PROJECT MEETINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. The Contractor shall cooperate and coordinate with the Engineer to schedule and administer the preconstruction meeting, monthly progress meetings, and specifically called meetings throughout the progress of the Work. The Contractor shall:

   a. Prepare agenda for meetings in electronic format
   b. Make physical arrangements for meetings
   c. Preside at meetings
   d. Take and distribute meeting minutes electronically

2. Representatives of Contractor, subcontractors, and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

3. The Owner shall attend meetings to ascertain that the Work is expedited consistent with Contract Documents and construction schedules.

4. The Contractor shall record the preconstruction meeting and each progress meeting in its entirety, and shall provide the Engineer with a regular cassette copy of such recording, having good quality and clarity, and a typed transcript of the minutes of each meeting. A copy of the minutes of each progress meeting shall be available five business days after the meeting.

B. Related Requirements Described Elsewhere:

1. Construction Progress Schedules: Section 01310

2. Project Record Documents: Section 01720

1.02 PRECONSTRUCTION MEETING

A. Engineer will schedule a preconstruction meeting no later than twenty (20) days after date of Notice to Proceed. The meeting shall be scheduled at the convenience of all parties.

B. Location: A local site, convenient for all parties, designated by the Engineer.

C. Attendance:

1. Owner and/or Owner's representative
2. Engineer and his professional consultants
3. Resident project representative
4. Contractor and his superintendent
5. Major subcontractors
6. Representatives of major suppliers and manufacturers as appropriate
7. Governmental and Utilities representatives as appropriate
8. Others as requested by the Contractor, Owner, and Engineer

D. The Engineer shall preside at the preconstruction meeting. The Contractor shall provide for keeping minutes and distribution of minutes to the Owner, Engineer and others. The purpose of the preconstruction meeting is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established.

E. The suggested agenda for the preconstruction meeting would include the following:

1. Distribution and discussion of:
   a. List of major subcontractors and suppliers
   b. Projected schedules
   c. Schedule of Values
2. Critical work sequencing: Relationships and coordination with other contracts and/or work and continuing water treatment plant operation.
3. Major equipment deliveries and priorities
4. Project coordination: Designation and responsible personnel
5. Procedures and processing of:
   a. Field decisions
   b. Proposal requests
   c. Request for Information
   d. Submittals
   e. Change Orders
   f. Applications for Payment
6. Submittal of Shop Drawings, project data and samples.
7. Adequacy of distribution of Contract Documents.
8. Procedures for maintaining Record Documents

9. Use of premises:

    a. Office, work, and storage areas
    b. Owner's requirements
    c. Access and traffic control

10. Construction facilities, controls, and construction aids
11. Temporary utilities
12. Safety and first aid procedures
13. Check of required Bond and Insurance certifications
14. Completion time for contract and liquidated damages
15. Request for extension of Contract Time
16. Procedures for periodic monthly (or whatever interval is deemed appropriate or necessary, however, a minimum of monthly meetings will be required) progress meetings, for all involved
17. Security procedures
18. Procedures for making partial payments
19. Guarantees on completed work
20. Equipment to be used
21. Project layout and staking of work
22. Project inspection
23. Labor requirements
24. Laboratory testing of material requirements
25. Provisions for material stored on site and monthly inventory of materials stored
26. Requirements of other organizations such as utilities, railroads, highway departments, building departments
27. Rights-of-way and easements
28. Housekeeping procedures
29. Liquidated damages
30. Posting of signs and installation of Project Sign
31. Pay request submittal dates
32. Equal opportunity requirements

1.03 MONTHLY PROGRESS MEETINGS

A. The Contractor shall schedule regular periodic meetings. The progress meetings will be held a minimum of once every thirty (30) days and at other times as required by the progress of the Work. The first meeting shall be held within thirty (30) days after the preconstruction meeting or thirty (30) days or less after the date of Notice to Proceed.

B. Hold called meetings as required by progress of the Work

C. Location of the meetings: At Facility Conference Room

D. Attendance:

1. Engineer and his professional Subconsultants as needed
2. Resident Project Representative
3. Contractor and his Superintendent
4. Owner's representatives
5. Subcontractors (active on the site, as appropriate to the agenda)
6. Others as appropriate to the agenda (suppliers, manufacturers, other subcontractors, etc.)

E. The Engineer shall preside at the meetings and provide for keeping minutes and distribution of the minutes to the Owner, Contractor, and others. The purpose of the meetings will be to review the progress of the Work.

F. The suggested agenda for the progress meetings will include but not be limited to the following:

1. Review approval of minutes of previous meeting
2. Review of Work progress since previous meeting and Work scheduled (3-week look ahead schedule)
3. Field observations, problems, conflicts
4. Problems which impede construction schedule
5. Review of off-site fabrication, delivery schedules
6. Corrective measures and procedures to regain projected schedule
7. Status of approved Project Schedule and revisions to the Construction Schedule as appropriate
8. Progress schedule during succeeding work period
9. Coordination of schedules
10. Review status of submittals and submittal schedule, expedite as required

11. Maintenance of quality standards

12. Pending changes and substitutions

13. Shop drawing problems

14. Review proposed changes for:

    a. Effect on Construction Schedule and on completion date
    b. Effect on other contracts of the Project

15. Critical/long lead items

16. Other business

G. The Contractor is to attend progress meetings and is to study previous meeting minutes and current agenda items, and be prepared to discuss pertinent topics and provide specific information including but not limited to:

1. Status of all submittals and what specifically is being done to expedite them.

2. Status of all activities behind schedule and what specifically will be done to regain the schedule.

3. Status of all material deliveries, latest contact with equipment manufacturer, and specific actions taken to expedite materials.

4. Status of open deficiencies and what is being done to correct the same.

H. The Contractor is to provide a current submittal log at each progress meeting in accordance with Section 01300: Submittals.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01300
SUBMITTALS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. The Contractor shall submit to the Engineer for review, shop drawings, test reports and data on materials and equipment (hereinafter in this article called data), material samples (hereinafter in this article called samples), and certifications as are required for materials and equipment specified in the Specifications and the Contract Drawings.

2. The Contractor shall submit to the Engineer a complete list of items for which shop drawings and/or equipment data are to be submitted. Included in this list shall be the names of all proposed manufacturers furnishing specified items. Review of this list by the Engineer shall in no way, expressed or implied, relieve the Contractor from submitting complete shop drawings and/or equipment data and providing materials, equipment, etc., fully in accordance with the Specifications.

3. The Contractor is to maintain an accurate updated submittal log and will bring this log to each scheduled progress meeting with the Owner and the Engineer. This log should include the following items:

   a. Submittal Description and assigned Submittal Number
   b. Date Submitted to Engineer
   c. Date Received Back from Engineer
   d. Status of Submittal (Approved, Approved as Noted, Not Approved/Resubmit)
   e. Date of Re-submittal and Return (as applicable)
   f. Date Equipment Released for Fabrication/Delivery
   g. Projected Date of Fabrication
   h. Projected Date of Delivery to Site
   i. Status of O&M Manuals Submittal

1.02 CONTRACTOR'S RESPONSIBILITY

A. It is the responsibility of the Contractor to check all drawings, data and samples prepared before submitting them to the Engineer for review. Each and every copy of the Drawings and data shall bear Contractor's stamp showing that they have been so checked. Shop drawings and/or equipment data submitted to the Engineer without the Contractor's stamp will be returned to the Contractor for conformance with this

requirement. Shop drawings shall indicate any deviations in the submittal from requirements of the Contract Documents. If the Contractor takes exception to the specifications, the Contractor shall note the exception in the letter of transmittal to the Engineer.

B. Determine and verify:

1. Field measurements
2. Field construction criteria
3. Catalog numbers and similar data
4. Conformance with Specifications

C. The Contractor shall furnish the Engineer a schedule of submittals with the expected dates for the submissions of shop drawings and/or equipment data and the expected time for fabrication and delivery. This schedule shall indicate those that are critical to the construction schedule.

D. The Contractor shall not begin any of the work covered by a drawing, data, or a sample returned for correction until a revision or correction thereof has been reviewed and returned to him/her, by the Engineer, with approval.

E. The Contractor shall submit to the Engineer all drawings and schedules sufficiently in advance of construction requirements to provide no less than thirty (30) calendar days for reviewing and approval/disapproval from the time the Engineer receives them.

F. All submittals shall be accompanied with a transmittal letter prepared in duplicate containing the following information:

1. Date
2. Project Title and Number
3. Contractor's Name and Address
4. The number of each Shop Drawings Submitted
5. Notification of Deviations from Contract Documents
6. Submittal Log Number Referencing the Specification Section Number

G. The Contractor shall submit electronic copies (PDF) of equipment or product data information and shop drawings.

H. The Contractor shall be responsible for and bear all costs of damages which may result from the ordering of any material or from proceeding with any part of work prior to the completion of the review by Engineer of the necessary shop drawings and/or equipment data.

I. The Contractor shall be fully responsible for observing the need for and making any changes in the arrangement of piping, connections, wiring, manner of installation, etc., which may be required by the materials/equipment he proposed to supply both as pertains to his own work and any work affected under other parts, headings, or divisions of drawings and specifications.

J. The Contractor shall not use shop drawings as a means of proposing alternate items to demonstrate compliance with the Drawings and Specifications.

1.03 ENGINEER'S REVIEW OF SUBMITTALS

A. The review by the Engineer of shop drawings, equipment data, and samples submitted by the Contractor will cover only general conformity to the Specifications, external connections, and dimensions which affect the installation. The Engineer's review and exceptions, if any, will not constitute an approval of dimensions, quantities, and details of the material, equipment, device, or item shown.

B. The review of shop drawings, equipment data, schedules, and/or O&M data will be general, and 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.

C. If the drawings or schedules as submitted describe variations and show a departure from the Contract requirements which the Engineer finds to be in the interest of the Owner and to be so minor as not to involve a change in Contract Price or time for performance, the Engineer may return the reviewed drawings without noting an exception.

D. When reviewed by the Engineer, each of the submittals will be identified as having received such review being so stamped and dated. Submittals stamped "APPROVED AS NOTED" or "DISAPPROVED, REVISE AND RESUBMIT" and with required corrections shown will be returned to the Contractor for correction and re-submittal.

E. Re-submittals will be handled in the same manner as first submittals. On re-submittals the Contractor shall direct specific attention, in writing or on resubmitted shop drawings, to revisions other than the corrections requested by the Engineer on previous submissions. The Contractor shall address and make any corrections required by the Engineer.

F. If the Contractor considers any correction indicated on the drawings to constitute a change to the Contract Drawings or Specifications, the Contractor shall give written notice thereof to the Engineer.

G. Shop drawings and other submittal data shall be reviewed by the Engineer for each original submittal and for the first re-submittal. Thereafter, review time for subsequent re-submittals shall be charged to the Contractor in accordance with the terms of the Engineer's Agreement with the Owner.

H. When the shop drawings and/or equipment data have been approved or approved as noted by the Engineer, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the Engineer.

I. No partial submittals will be reviewed. Submittals not complete will be returned to the Contractor for re-submittal.

J. All drawings, schematics, manufacturer's product data, certifications and other shop drawing submittals required by a system specification shall be submitted at one time as a package to facilitate interface checking.

1.04 SHOP DRAWINGS AND/OR EQUIPMENT DATA

A. Shop drawings shall be complete and detailed and shall consist of fabrication, erection, and setting drawings, manufacturer's scaled drawings, and wiring and control diagrams.

B. Equipment data shall include manufacturer's catalog sheets, brochures, diagrams, illustrations and other standard descriptive data and shall be clearly marked to identify pertinent materials, products or models.

1. If drawings show variations from Contract requirements because of standard shop practice or for other reasons, the Contractor shall describe such variations in his letter of transmittal. If acceptable, proper adjustment in the Contract shall be implemented where appropriate. If the Contractor fails to describe such variations, he shall not be relieved of the responsibility for executing the work in accordance with the Contract, even though such drawings have been reviewed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01310
CONSTRUCTION PROGRESS SCHEDULES

1.01 SUBMITTALS

A. Informational Submittals:

1. Preliminary Progress Schedule: Submit within time specified in the General Conditions.

2. Detailed Progress Schedule:

a. Submit initial Detailed Progress Schedule within 30 days following the Notice to Proceed date or 10 days before submission of the first Application for Payment, whichever shall first occur.
b. Submit an Updated Progress Schedule in accordance with Paragraph 1.03, Detailed Progress Schedule.

3. Submit with each Progress Schedule submission: Contractor's certification that Progress Schedule submission is actual schedule being utilized for execution of the Work.

a. Disk file compatible with latest version of Project Planner (P3) by Primavera Systems, Inc. unless otherwise approved by Engineer.
b. Progress Schedule: Five legible copies.
c. Narrative Progress Report: Same number of copies as specified for Progress Schedule.

4. Prior to final payment, submit a final Updated Progress Schedule.

1.02 PRELIMINARY PROGRESS SCHEDULE

A. In addition to basic requirements outlined in the General Conditions, show a detailed schedule, beginning with Notice to Proceed, for minimum duration of 90 days, and a summary of balance of Project through Final Completion.

B. Show activities including, but not limited to the following:

1. Notice to Proceed

2. Permits

3. Submittals including review time. Contractor may use Schedule of Submittals specified in Section 01300, Submittals.

4. Early procurement activities for long lead equipment and materials

5. Mobilization
6. Initial Site work
7. Earthwork
8. Specified Work sequences and construction constraints
9. Contract Milestone and Completion Dates
10. Owner-furnished products delivery dates or ranges of dates
11. Major structural, mechanical, equipment, electrical, architectural, and instrumentation and control Work
12. System startup summary
13. Project close-out summary
14. Demobilization summary

C. Update Preliminary Progress Schedule monthly as part of progress payment process. Failure to do so may result in the Owner withholding all or part of the monthly progress payment until the Preliminary Progress Schedule is updated in a manner acceptable to Engineer.

D. Format: In accordance with Article 1.04: Progress Schedule—Critical Path Network

1.03 DETAILED PROGRESS SCHEDULE

A. In addition to requirements of General Conditions, submit Detailed Progress Schedule beginning with Notice to Proceed and continuing through Final Completion.

B. Show the duration and sequences of activities required for complete performance of the Work reflecting means and methods chosen by Contractor.

C. When accepted by Engineer, Detailed Progress Schedule will replace Preliminary Progress Schedule and become Baseline Schedule. Subsequent revisions will be considered as Updated Progress Schedules.

D. Format: In accordance with Article 1.04: Progress Schedule—Critical Path Network

E. Update monthly to reflect actual progress and occurrences to date, including weather delays.

1.04 PROGRESS SCHEDULE-CRITICAL PATH NETWORK

A. General: Comprehensive computer-generated schedule using CPM, generally as outlined in Associated General Contractors of America (AGC) 580, “Construction

Project Planning and Scheduling Guidelines." If a conflict occurs between the AGC publication and this Specification, this Specification shall govern.

B. Contents:

1. Schedule shall begin with the date of Notice to Proceed and conclude with the date of Final Completion.

2. Identify Work calendar basis using days as a unit of measure.

3. Show complete interdependence and sequence of construction and Project-related activities reasonably required to complete the Work.

4. Identify the Work of separate stages and other logically grouped activities, and clearly identify critical path of activities.

5. Reflect sequences of the Work, restraints, delivery windows, review times, Contract Times and Project Milestones set forth in the Agreement and Section 01041: Project Coordination.

6. Include as applicable, at a minimum:

   a. Obtaining permits, submittals for early product procurement, and long lead time items
   b. Mobilization and other preliminary activities
   c. Initial Site work
   d. Specified Work sequences, constraints, and Milestones, including Substantial Completion date(s) Subcontract Work
   e. Major equipment design, fabrication, factory testing, and delivery dates
   f. Site Work
   g. Concrete Work
   h. Structural Work
   i. Equipment Work
   j. Mechanical Work
   k. Electrical Work
   l. Instrumentation and control Work
   m. Interfaces with Owner-furnished equipment
   n. Other important Work for each major facility
   o. Equipment and system startup and test activities
   p. Project closeout and cleanup
   q. Demobilization

7. No activity duration, exclusive of those for Submittals review and product fabrication/delivery, shall be less than 1 day or more than 30 days, unless otherwise approved.

8. Activity duration for Submittal review shall not be less than review time specified unless clearly identified and prior written acceptance has been obtained from Engineer.

9. Contractor shall include a mandatory 30 days, minimum float time for utility relocation work. County will not consider Contract Time extensions related to utility coordination matters unless the utility related delays exceed the 30 days float time and extend the critical path of the Project Schedule.

C. Network Graphical Display:

1. Plot or print on paper not greater than 30 inches by 42 inches or smaller than 22 inches by 34 inches, unless otherwise approved

2. Title Block: Show name of Project, Owner, date submitted, revision or update number, and the name of the scheduler. Updated schedules shall indicate data date

3. Identify horizontally across top of schedule the time frame by year, month, and day

4. Identify each activity with a unique number and a brief description of the Work associated with that activity

5. Indicate the critical path

6. Show, at a minimum, the controlling relationships between activities

7. Plot activities on a time-scaled basis, with the length of each activity proportional to the current estimate of the duration

8. Plot activities on an early start basis unless otherwise requested by Engineer

9. Provide a legend to describe standard and special symbols used

D. Schedule Report:

1. On 8-1/2-inch by 11-inch white paper, unless otherwise approved.

2. List information for each activity in tabular format, including, at a minimum:

   a. Activity Identification Number
   b. Activity Description
   c. Original Duration
   d. Remaining Duration
   e. Early Start Date (Actual start on Updated Progress Schedules)
   f. Early Finish Date (Actual finish on Updated Progress Schedules)
   g. Late Start Date
   h. Late Finish Date
   i. Total Float

3. Sort reports, in ascending order, as listed below:

a. Activity number sequence with predecessor and successor activity
b. Early-start
c. Total float

1.05 PROGRESS OF THE WORK

A. Updated Progress Schedule shall reflect:

1. Progress of Work to within 5 working days prior to submission
2. Approved changes in Work scope and activities modified since submission
3. Delays in Submittals or resubmittals, deliveries, or Work
4. Adjusted or modified sequences of Work
5. Other identifiable changes
6. Revised projections of progress and completion
7. Report of changed logic

B. Produce detailed sub-schedules during Project, upon request of Owner or Engineer, to further define critical portions of the Work such as facility shutdowns.

C. If Contractor fails to complete activity by its latest scheduled completion date and this Failure is anticipated to extend Contract Times (or Milestones), Contractor shall, within 7 days of such failure, submit a written statement as to how Contractor intends to correct nonperformance and return to acceptable current Progress Schedule. Actions by Contractor to complete the Work within Contract Times (or Milestones) will not be justification for adjustment to Contract Price or Contract Times.

D. Owner may order Contractor to increase plant, equipment, labor force or working hours if Contractor fails to:

1. Complete a Milestone activity by its completion date
2. Satisfactorily execute Work as necessary to prevent delay to overall completion of Project, at no additional cost to Owner

1.06 NARRATIVE PROGRESS REPORT

A. Format:

1. Organize same as Progress Schedule
2. Identify, on a cover letter, reporting period, date submitted, and name of author of report

B. Contents:

1. Number of days worked over the period, work force on hand, construction equipment on hand (including utility vehicles such as pickup trucks, maintenance vehicles, stake trucks)
2. General progress of Work, including a listing of activities started and completed over the reporting period, mobilization/demobilization of subcontractors, and major milestones achieved
3. Contractor's plan for management of Site (for example, lay down and staging areas, construction traffic), utilization of construction equipment, buildup of trade labor, and identification of potential Contract changes
4. Identification of new activities and sequences as a result of executed Contract changes
5. Documentation of weather conditions over the reporting period, and any resulting impacts to the Work
6. Description of actual or potential delays, including related causes, and the steps taken or anticipated to mitigate their impact
7. Changes to activity logic
8. Changes to the critical path
9. Identification of, and accompanying reason for, any activities added or deleted since the last report
10. Steps taken to recover the schedule from Contractor-caused delays

1.07 SCHEDULE ACCEPTANCE

A. Engineer's acceptance will demonstrate agreement that:

1. Proposed schedule is accepted with respect to:
    a. Contract Times, including Final Completion and all intermediate Milestones are within the specified times
    b. Specified Work sequences and constraints are shown as specified
    c. Specified Owner-furnished Equipment or Material arrival dates, or range of dates, are included
    d. Access restrictions are accurately reflected
    e. Startup and testing times are as specified
    f. Submittal review times are as specified
    g. Startup testing duration is as specified and timing is acceptable
2. In all other respects, Engineer's acceptance of Contractor's schedule indicates that, in Engineer's judgment, schedule represents reasonable plan for constructing Project in accordance with the Contract Documents. Engineer's review will not make any change in Contract requirements. Lack of comment

on any aspect of schedule that is not in accordance with the Contract Documents will not thereby indicate acceptance of that change, unless Contractor has explicitly called the nonconformance to Engineer's attention in submittal. Schedule remains Contractor's responsibility and Contractor retains responsibility for performing all activities, for activity durations, and for activity sequences required to construct Project in accordance with the Contract Documents.

B. Unacceptable Preliminary Progress Schedule:

1. Make requested corrections; resubmit within 10 days.

2. Until acceptable to Engineer as Baseline Progress Schedule, continue review and revision process, during which time Contractor shall update schedule on a monthly basis to reflect actual progress and occurrences to date.

C. Unacceptable Detailed Progress Schedule:

1. Make requested corrections; resubmit within 10 days.

2. Until acceptable to Engineer as Baseline Progress Schedule, continue review and revision process.

D. Narrative Report: All changes to activity duration and sequences, including addition or deletion of activities subsequent to Engineer's acceptance of Baseline Progress Schedule, shall be delineated in Narrative Report current with proposed Updated Progress Schedule.

1.08 ADJUSTMENT OF CONTRACT TIMES

A. In accordance with the General Conditions

B. Evaluation and reconciliation of Adjustments of Contract Times shall be based on the Updated Progress Schedule at the time of proposed adjustment or claimed delay.

C. Schedule Contingency:

1. Contingency, when used in the context of the Progress Schedule, is time between Contractor's proposed Completion Time and Contract Completion Time.

2. Contingency included in Progress Schedule is a Project resource available to both Contractor and Owner to meet Contract Milestones and Contract Times. Use of Schedule contingency shall be shared to the proportionate benefit of both parties.

3. Use of schedule contingency suppression techniques such as preferential sequencing and extended activity times is prohibited.

4. Pursuant to Contingency sharing provisions of this Specification, no time extensions will be granted, nor will delay damages be paid until a delay occurs which (i) consumes all available contingency time, and (ii) extends Work beyond the Contract Completion date.

D. Float:

1. In accordance with the General Conditions

E. Claims Based on Contract Times:

1. Where Engineer has not yet rendered formal decision on Contractor's Claim for adjustment of Contract Times, and parties are unable to agree as to amount of adjustment to be reflected in Progress Schedule, Contractor shall reflect an interim adjustment in the Progress Schedule as acceptable to Engineer.

2. It is understood and agreed that such interim acceptance will not be binding on either Contractor or Owner, and will be made only for the purpose of continuing to schedule Work until such time as formal decision has been rendered as to an adjustment, if any, of the Contract Times.

3. Contractor shall revise Progress Schedule prepared thereafter in accordance with Engineer's formal decision.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01370
SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Submit to the Engineer a Schedule of Values allocated to the lump sum price of the Work, at the Pre-Construction Conference, and as otherwise specified or requested to be submitted earlier as evidence of the Apparent Low Bidder's qualifications.

2. The Schedule of Values shall establish the lump sum value of the Work to be completed taken from the approved Critical Path Method (CPM) Construction Schedule, and shall be used as the basis for the Contractor's Applications for Payment.

B. Related Requirements Described Elsewhere:

1. Conditions of the Construction Contract

1.02 FORM AND CONTENT OF SCHEDULE OF VALUES

A. Type schedule on 8-1/2 inch x 11 inch white paper. Contractor's standard forms and computer printouts may be considered for approval by the Engineer upon Contractor's request. Identify schedule with:

1. Title of project and location
2. Owner and purchase order number
3. Engineer and project number
4. Name and address of Contractor
5. Contract designation
6. Date of submission

B. Schedule shall list the installed lump sum value of the Work in sufficient detail to serve as a basis for computing item prices for progress payments during construction.

C. For the various portions of the Work:

1. The amount for each item shall reflect a total installed cost including 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. Payment for materials shall be limited to the invoiced amount only.
   b. The total installed value.

D. Round off figures to nearest dollar amount.

E. The sum of the costs of all items listed in the schedule shall equal the total Contract Price.

F. The form of the Schedule of Values shall parallel the form presented in Table 01370-1. As a minimum, the Contractor shall provide a contract value for all of the items listed in Table 01370-1. The Contractor may add additional items for convenience of pay request approvals.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

TABLE 01370-1
SAMPLE SCHEDULE OF VALUES (EXAMPLE)

		No. of Units:	Units:
I.	General Requirements		
	- Mobilization/Demobilization		LS
	- Indemnification		LS
	- Bonds and Insurance		LS
	- Permitting		LS
II.	Site Improvements		
	- Temporary Erosion Control		
	- Paving and Grading		SY
	- Sodding		SY
	- Fill		CY
III.	Biotower Odor Control System		
	- Biotower and appurtenances		LS
	- Structural modifications including slab and demolition		LS
	- Air duct		LF (by size)
	- Dampers		EA (by size)

	-	Connection, start-up and testing	LS
IV.	Exhaust Fan and Building Repair		
	-	Exhaust Fan	EA
	-	Building Repair	LS
	-	Flowable Fill	CY
V.	Electrical Improvements		
	-	Electrical	LS
VI.	Instrumentation and Control Improvements		
	-	I&C, SCADA	LS

END OF SECTION

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SECTION 01380
AUDIO-VISUAL DOCUMENTATION

PART 1 - GENERAL

1.01 PURPOSE AND DESCRIPTION OF WORK

A. The purpose of the audio - visual documentation is to provide the Owner with regularly documented audio - visual records of the Construction process from the existing conditions through final completion.

1.02 PRE-CONSTRUCTION VIDEO REQUIREMENTS INCLUDED

A. The Contractor shall employ a professional videographer to take a Pre-Construction video of the entire work area including roads, piping, structures, equipment, etc. within 100-feet of the limits of Work and shall be made within 30-days of Work beginning. Special attention shall be made to show the building, deck, odor control area, existing paved roads, shoulders, signs, and other existing features.

B. The Contractor shall submit a quality audio-video recording documenting Pre-Construction field conditions for the entire project. The Pre-Construction video shall be submitted to the County and accepted prior to commencing any Work or using any Contractor laydown areas.

C. Electronic digital photography shall also be used as necessary to record and facilitate resolution of on-site issues through the transmission of electronic photographs by e-mail from the site to the Engineer's and Owner's offices.

PART 2 - PRODUCTS

2.01 AUDIO-VIDEO RECORDING

A. Each audio-video recording shall be saved on appropriate DVD media viewable on standard DVD players or computer.

B. Each DVD shall contain the following information and arrangement at the beginning as a title screen:

Orange County, Florida
PROJECT NAME
PROJECT NUMBER
CONTRACTOR: (Name of Contractor)
DATE: (When photo was taken)
VIDEO BY: (Firm Name of Videographer)
LOCATION: (Description of Location(s) and View(s))

C. Each DVD recording section shall begin with an audio description of the County's name, Contract name and number, Contractor's name, date and location information such as street name, direction of travel, viewing side, etc.

D. Information appearing on the video recording must be continuous and run simultaneously by computer generated transparent digital information. No editing or overlaying of information at a later date will be acceptable.

E. Digital information to appear in the upper left corner shall be as follows:

1. Name of Contractor
2. Day, date and time
3. Name of Project & Specification Number

F. Time must be accurate and continuously displayed on the video record

G. Written documentation must coincide with the information on the DVD so as to make easy retrieval of locations at a later date.

H. The video system shall have the capability to transfer individual frames of video electronically into hard copy prints or photographic negatives.

I. Audio shall be recorded at the same time as the video recording and shall have the same information as on the viewing screen. Special commentary shall be given for unusual conditions of buildings, sidewalks and curbing, foundations, trees and shrubbery, structures, equipment, pavement, etc.

J. All DVDs and boxes shall bear labels with the following information:

1. DVD Number
2. County's Name
3. Date of Recording
4. Project Name and Number
5. Location and Standing Limit of Video

2.02 CONSTRUCTION PHOTOGRAPHS

A. The Contractor shall employ a competent photographer to take construction record photographs prior to the start of work and periodically during the course of the Work.

B. Prints: Date imprinted 4-inch x 6-inch high resolution glossy single weight color print paper; 5 sets, in plastic protector sheets, bound in 3-ring binders to be provided to the County with each monthly Application for Payment and distributed by the County as follows:

1. County (2 sets)
2. Engineer (1 set)
3. Contractor (1 set)
4. Project Record Data (1 set stored by Contractor to be furnished to County upon Closeout)

C. Provide a CD with electronic photo files. Furnish a file index that lists photo no. and file name and description of view.

PART 3 - EXECUTION

3.01 VIDEO VIEWS REQUIRED

A. Complete coverage shall include all surface features within 100-feet of the Work area to be used by the Contractor and shall be supported by appropriate audio description made simultaneously with video coverage. Such coverage shall include, but not be limited to, all existing driveways, sidewalks, curbs, ditches, roadways, landscaping, trees, culverts, headwalls, and retaining walls, equipment, structures, pavements, manholes, vaults, handrails, etc. located within the work zone. Video coverage shall extend to the maximum height of all structures within this zone.

B. The video recorder shall take special efforts to point out and provide audio commentary on cracking, breakage, damage, and other defects in existing features.

C. All video recording shall be done during times of good visibility. No video recording shall be done during periods of visible precipitation, or when more than 10% of the ground area is covered with standing water, unless otherwise authorized by County.

D. Prior to commencement of audio-video recording, the Contractor shall notify the County in writing within 48-hours of the audio-video recording. The County may provide a designated representative to accompany and observe all video recording operations. Audio-video recording completed without a County Representative present will be unacceptable unless specifically authorized by the County.

3.02 AUDIO-VIDEO REQUIREMENTS

A. Major Locations:

1. The Contractor shall provide color digital video of each major facility and structures and facilities within and adjacent to the Construction before construction starts.

2. All videos shall be recorded with character generator operating with date, time, and location on screen. During video recording, the Contractor shall narrate video explaining what is being shown. All master videos shall be delivered to the County.

3.03 PHOTOGRAPHS

A. Technique

1. Factual Presentation

2. Correct exposure and focus

   a. High resolution and sharpness
   b. Maximum depth of field
   c. Minimum Distortion

B. Views Required

1. Photograph from locations to adequately illustrate condition of construction and state of progress.

   a. At successive periods of photography, take at least one photograph from the same overall view as previously photographed.
   b. Consult with the Engineer at each period of photography for instructions concerning views required.

C. Photo Identification (identify each print on back)

1. Name of Project

2. Name of Contractor

3. Orientation of View

4. Date and Time of Exposure

5. Name and Address of Photographer

6. Numbered Identification of Photo

3.04 DELIVERY OF PRINTS

A. Deliver prints and/or CDs monthly to accompany each Application for Payment.

B. Distribution of construction prints as soon as processed is anticipated to be as follows:

1. Owner (two (2) sets)
2. Engineer (two (2) sets)
3. Project record file (one (1) set to be stored by Contractor until the end of the project which shall be delivered with Project Record Documents as specified in Section 01720).
4. Contractor (one (1) set)

END OF SECTION

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SECTION 01400
QUALITY CONTROL

PART 1 - GENERAL

1.01 SITE INVESTIGATION AND CONTROL

A. Contractor shall verify all dimensions in the field and check field conditions continuously during construction. Contractor shall be solely responsible for any inaccuracies built into the Work due to Contractor's failure to comply with this requirement.

B. Contractor shall inspect related and appurtenant Work and report in writing to County any conditions which will prevent proper completion of the Work. Failure to report any such conditions shall constitute acceptance of all site conditions, and any required removal, repair, or replacement caused by unsuitable conditions shall be performed by the Contractor at Contractor's sole cost and expense.

1.02 INSPECTION OF THE WORK

A. The Work shall be conducted under the general observation of representatives of the County acting on behalf of the County to ensure strict compliance with the requirements of the Contract Documents. Such inspection may include mill, plant, shop, or field inspection, as required. The County shall be permitted access to all parts of the Work, including plants where materials or equipment are manufactured or fabricated. Inspection by the County are in addition to the inspections required of Contractor by his QC Representatives.

B. The presence of the County, however, shall not relieve the Contractor of the responsibility for the proper execution of the Work in accordance with all requirements of the Contract Documents. Compliance is a duty of the Contractor, and said duty shall not be avoided by any act or omission on the part of the County. Further, no requirement of this Contract may be waived or modified except by change order or formal (written) substitution approval.

C. All materials and articles furnished by the Contractor shall be subject to rigid inspection, and no materials or articles shall be used in the Work until they have been inspected and accepted by the County. No Work shall be backfilled, buried, cast in concrete, hidden, or otherwise covered until it has been inspected. Any Work so covered in the absence of inspection shall be subject to uncovering. Where uninspected Work cannot be uncovered, such as in concrete cast over reinforcing steel, all such Work shall be subject to demolition, removal, and reconstruction under proper inspection and no additional payment will be allowed therefore.

D. The Contractor is responsible for the Quality of his own work and shall designate a qualified individual, to be approved by the County, who will ensure that all work is performed in strict accordance with the Contract Documents. This quality representative shall inspect the work for the Contractor and provide to the County and the Contractor a report outlining all work accomplished, all inspections, and all testing performed for all days when work is performed. The objective of this report is to provide "Objective Evidence of Compliance" by the Contractor with the requirements of the Contract.

1.03 TIME OF INSPECTION AND TESTS

A. Samples and testing required under these Specifications shall be furnished and prepared in ample time for the completion of the necessary tests and analyses before said articles or materials are to be used. Except as otherwise provided in the Contract Documents, performance of the required tests will be by the Contractor and all costs therefore will be borne by the Contractor at no cost to the County. Whenever the Contractor is ready to backfill, bury, cast in concrete, hide, or otherwise cover any Work under this Contract, the County shall be notified not less than 24-hours in advance to request inspection before beginning any such Work of covering. Failure of the Contractor to notify the County at least 24-hours in advance of any such inspections shall be reasonable cause for the County to order a sufficient delay in the Contractor's schedule to allow time for such inspection, any remedial, or corrective work required, and all costs of such delays, including its impact on other portions of the Work, shall be borne by the Contractor.

1.04 SAMPLING AND TESTING

A. When not otherwise specified, all sampling and testing shall be in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and nature of the article or materials considered. However, the County reserves the right to use any generally accepted system of inspection which, in the opinion of the County, will ensure the County that the quality of the workmanship is in full accord with the Contract Documents.

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

C. Notwithstanding the existence of such waiver, the County shall reserve the right to make independent investigations and tests as specified in the following paragraph and, upon failure of any portion of the Work to meet any of the qualitative

requirements of the Contract Documents, shall be reasonable cause for the County to require the removal or correction and reconstruction of any such Work.

D. In addition to any other inspection or quality assurance provisions that may be specified, the County shall have the right to independently select, test, and analyze, at the expense of the County, additional test specimens of any or all of the materials to be used. Results of such tests and analyses shall be considered along with the tests or analyses made by the Contractor to determine compliance with the applicable specifications for the materials so tested or analyzed provided that wherever any portion of the Work is discovered, as a result of such independent testing or investigation by the County which fails to meet the requirements of the Contract Documents, all costs of such independent inspection and investigation and all costs of removal, correction, reconstruction, or repair of any such Work shall be borne by the Contractor.

1.05 RIGHT OF REJECTION

A. The County shall have the right at all times and places to reject any articles or materials to be furnished hereunder which, in any respect, fail to meet the requirements of the Contract Documents, regardless of whether the defects in such articles or materials are detected at the point of manufacture or after completion of the Work at the site. If the County or inspector, through an oversight or otherwise, has accepted materials or Work which is defective or which is contrary to the Contract Documents, such material, no matter in what stage or condition of manufacture, delivery, or erection, may be rejected by County.

B. Contractor shall promptly remove rejected articles or materials from the site of the Work after notification or rejection.

C. All costs of removal and replacement of rejected articles or materials, as specified herein, shall be borne by the Contractor.

D. If the Contractor fails to remove or replace defective work after notification to do so, the County may have the work removed and replaced by others and deduct all costs from the Contractor's pay requests.

1.06 TESTING LABS

A. All geotechnical testing laboratory services for field testing will be paid by the County. The lab(s) shall function as independent lab(s) and report independently to the County and the Contractor. The test lab(s) may not approve or allow any deviation from the Contract Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01410
TESTING AND TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Owner will employ, and pay for services of an Independent Testing Laboratory to perform testing specifically indicated on the Contract Documents or specified in the Specifications and may at any other time elect to have materials and equipment tested for conformity with the Contract Documents.

2. Contractor shall cooperate with the laboratory to facilitate the execution of its required services.

B. Related Requirements Described Elsewhere:

1. Conditions of the Contract.

2. Respective section of the Specifications: Certification of products.

3. Each Specification section listed: Laboratory tests required, and standards for testing.

C. The following schedule defines the responsibilities of various tests.

Test	Notes	Paid for By
Concrete	Slump test each delivery and compression test five cylinders every 50 C.Y. minimum.	Owner

D. Additional Tests: In the event that first test samples do not meet the applicable material specification, the Contractor shall take measures to conform the material and equipment to the Specifications. All subsequent tests required to show compliance with the Specifications shall be paid for by the Contractor.

1.02 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with Owner's personnel and laboratory personnel. Provide access to Work and manufacturer's operations.

B. Provide to the laboratory the preliminary design mix proposed to be used for concrete, and other materials mixes which require control by the testing laboratory.

C. Materials and equipment used in the performance of work under this Contract are subject to inspection and testing at the point of manufacturer 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 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.

D. Furnish incidental labor and facilities:

1. To provide access to Work to be tested.

2. To facilitate inspections and tests.

E. Notify Owner a minimum of three (3) working days in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01500
TEMPORARY FACILITIES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Provide temporary facilities which include but are not limited to the following:

1. Temporary electrical service
2. Temporary water service
3. Temporary sanitary facilities
4. Contractor's storage facilities
5. Temporary parking
6. Temporary security lighting

1.02 TEMPORARY ELECTRICAL SERVICE

A. Temporary electrical service shall be provided throughout the construction period.

B. Contractor shall coordinate with the Owner to obtain, install and maintain the service. Contractor is responsible for installing a power meter, and reimbursing the County for power used.

C. Adequate power shall be provided for the following:

1. Tools and equipment used in the construction work.

D. Provide 120/240 volt, single phase, 60 hertz service to the project site. The use of portable generators is allowed but any connections to the main power supply must be in accordance with the local power supplier rules.

E. Strict supervision of the use of the temporary services shall be provided to ensure conformance with applicable codes, to ensure that safe practices are followed, and to prevent the abuse of the services.

F. The temporary service shall be in accordance with all applicable OSHA, NFPA , state and local codes.

1.03 TEMPORARY WATER SERVICE

A. Temporary water service shall be provided throughout the construction period.

B. Contractor shall coordinate with the Owner to obtain, install, and maintain the service. Contractor is responsible for installing a water meter, and reimbursing the County for water used.

C. Adequate water shall be provided for the following:

1. Construction purposes.
2. Testing purposes
3. Cleaning purposes
4. Sanitary purposes

D. Proper backflow prevention shall be provided at the point of connection to the public water system and at other connections between potable and non-potable water lines.

E. Strict supervision of the use of the temporary services shall be provide to ensure conformance with applicable codes, to ensure that safe practices are followed, and to prevent the abuse of the services.

F. The temporary service shall be in accordance with all applicable OSHA, state and local codes.

1.04 TEMPORARY SANITARY FACILITIES

A. Temporary sanitary facilities shall be provided throughout the construction period. Facilities shall consist of portable toilets.

B. Contractor shall coordinate with a service to obtain and maintain the facilities.

C. Adequate facilities shall be provided for the following:

1. Construction workers.

D. Strict supervision of the use of the temporary facilities shall be provided to ensure conformance with applicable codes, to ensure that safe practices are followed, and to prevent the abuse of the facilities.

E. Costs of the installation and maintenance of the temporary facilities shall be paid by the Contractor.

F. The temporary facilities shall be in accordance with all applicable OSHA, state and local codes.

PART 2 - MATERIAL AND EQUIPMENT

2.01 GENERAL

A. The Contractor shall supply and maintain all temporary structures and equipment.

B. The temporary structures shall be clean and in good condition.

2.02 CONTRACTOR'S STORAGE FACILITIES

A. Lockable storage facilities shall be provided for storage of all equipment and sensitive materials. It shall be the Contractor's responsibility to secure and protect all equipment and materials from damage and theft.

PART 3 - EXECUTION

3.01 PREPARATION

A. The site shall be properly prepared for the setting of all temporary structures the installation of all temporary facilities.

3.02 INSTALLATION

A. Locate water piping and outlets convenient to work stations and avoid interference with traffic and work areas, materials handling equipment, and storage areas. When necessary to maintain pressure, provide temporary pumps, tanks, etc.

B. Electrical service and distribution may be overhead or underground. Locate to avoid interference with traffic and work areas, cranes, material handling equipment, and storage areas.

C. Set portable toilets level and anchor to prevent dislocation or tipping over. Service as often as necessary to prevent accumulation of wastes, and creation of unsanitary conditions.

3.03 REMOVAL OF TEMPORARY FACILITIES

A. Completely remove temporary structures, facilities, materials and equipment upon completion of construction.

B. Clean, and repair damage caused by installation and restore areas to specified or original condition.

END OF SECTION

SECTION 01505
MOBILIZATION

PART 1 - GENERAL

1.01 DEFINITION AND SCOPE

A. Mobilization shall include the obtaining of all permits, insurance, and bonds; moving onto the site of all equipment; temporary buildings and other construction facilities; all as required for the proper performance and completion of the Work. Mobilization shall include, but not be limited to the following:

1. Move onto the site all Contractor's equipment required for the first month's operations.
2. Install temporary construction power, wiring and lighting facilities.
3. Establish fire protection plan and safety program.
4. Secure construction water supply.
5. Provide on-site sanitary facilities and potable water facilities as specified.
6. Arrange for and erect Contractor's work and storage yard and employee's parking facilities.
7. Submit all required insurance certificates and bonds.
8. Obtain all required permits.
9. Post all OSHA, EPA, Department of Labor and all other required notices.
10. Have Contractor's superintendent at the job site full time.
11. Submit a detailed construction CPM schedule acceptable to the Engineer as specified.
12. Submit a schedule of values of the work.
13. Submit a schedule of submittals.

1.02 DEMOBILIZATION

A. Demobilization is the timely and proper removal of all Contractor owned material, or equipment, from the jobsite and the proper restoration or completion of work necessary to bring the site into full compliance with the contract documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01560
EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Work specified in this Section consists of designing, providing, maintaining and removing temporary erosion and sedimentation controls as necessary to protect the Work and prevent sedimentation from the Contractor's activities from entering water bodies or enter other parts of the County's or other property owners sites outside the Construction limits.

B. Temporary erosion controls include, but are not limited to; grassing, mulching, netting, watering and reseeding on-site surfaces and soil and borrow area surfaces, and providing interceptor ditches at end of berms and at those locations which will ensure that erosion during Construction will be either eliminated or maintained within acceptable limits as established by the regulatory agencies having jurisdiction.

C. Temporary sedimentation controls include, but are not limited to; silt dams, traps, barriers, and appurtenances at the foot of sloped surfaces which will ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits as established by the regulatory agencies having jurisdiction.

1.02 REQUIREMENTS

A. The Contractor is responsible for providing effective temporary erosion and sediment control measures during Construction or until final controls become effective.

B. The Contractor shall be responsible for filing Notice of Intent for Construction Activities with regulatory agencies (SJRWMD, SFWMD, and FDEP) as required by law, if thresholds are expected to be exceeded.

C. The areas of unstabilized soil cover shall be minimized at all times to limit erosion and sedimentation.

1.03 SUBMITTALS:

A. The Contractor shall prepare and submit an Erosion and Sedimentation Control Plan (Stormwater Pollution Prevention Plan) for County review and approval. The Plan shall be in effect throughout the Construction duration.

PART 2 - PRODUCTS

2.01 EROSION CONTROL

A. Seed: Scarified Argentine Bahia.

B. Sod: Argentine Bahia grass, Pensacola Bahia grass. Grassing and Sodding Materials: As specified in Section 981 FDOT Specification for Road & Bridge Construction.

C. Netting: Polypropylene mesh netting 5/8-inch x 3/4-inch (16 x 19mm) mesh with interwoven curlex fibers as manufactured by American Excelsior Company or equal. Netting: Fabricated of material in conformance with Section 985 FDOT Specification for Road & Bridge Construction.

2.02 SEDIMENTATION CONTROL

A. Bales: Clean, synthetic hay type. Minimum dimensions of 14-inch by 18-inch by 36-inches at the time of placement.

B. Netting: Fabricated of material in conformance with Section 985 FDOT Specification for Road & Bridge Construction.

C. Sediment Control Fencing (Silt Fencing): As manufactured by American Excelsior Company or equal.

D. Filter stone: Crushed stone conforming to Florida Department of Transportation Specifications.

E. Concrete block: Hollow, non-load bearing type.

F. Concrete: Exterior grade not less than 1-inch thick.

G. Turbidity Barriers: Floating or staked as required.

PART 3 - EXECUTION

3.01 TEMPORARY EROSION CONTROL

A. See Section 02578 "Solid Sodding."

3.02 SEDIMENTATION CONTROL

A. Install and maintain silt fences and dams, traps, barriers, and appurtenances as shown on the approved descriptions and working Drawings. Replace deteriorated hay bales

and dislodged filter stone. Repair portions of any devices damaged at no additional expense to the County.

B. Install all sediment control devices in a timely manner to ensure the control of sediment. At sites where exposure to sensitive areas is likely, complete installation of all sediment control devices before starting earthwork.

C. Use approved temporary erosion control features to correct conditions that develop during Construction that were not foreseen when the Erosion and Sedimentation Control Plan was first approved.

3.03 PERFORMANCE

A. Should any of the temporary erosion and sediment control measures employed by the Contractor fail to produce results that comply with the requirements of the Regulatory agency having jurisdiction, the County or the Professional, the Contractor shall immediately take whatever steps necessary to correct the deficiency at its own expense to protect the Work and any adjacent property to the site, as well as to prevent contamination of any river, stream, lake, tidal waters, reservoir, canal or other water impoundments.

B. The side slope areas with unstabilized or unprotected soil cover shall be minimized at all times to limit erosion and sedimentation.

C. Incorporate permanent erosion control features into the Project at the earliest practical time.

D. Remove temporary erosion and sedimentation controls when the Work is complete and in accordance with the Erosion and Sedimentation Control Plan (Stormwater Pollution Prevention Plan) and the Notice of Intent for Construction Activities filed with regulatory agencies.

3.04 MAINTENANCE OF EROSION AND CONTROL FEATURES

A. Provide routine maintenance of permanent and temporary erosion control features, at no expense to the County, until the Project is complete and accepted.

END OF SECTION

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SECTION 01600
MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Material and equipment incorporated into the Work:

1. Conform to applicable specifications and standards.
2. Comply with size, make, type and quality specified, or as specifically approved in writing by Engineer.
3. Manufactured and fabricated products:
    a. Design, fabricate and assemble in accordance with the best engineering and shop practices.
    b. Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.
    c. Two or more items of the same kind shall be identical, by the same manufacturer.
    d. Products shall be suitable for service conditions.
    e. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
4. Do not use material or equipment for any purpose other than that for which it is designed or is specified.

B. Related Work Described Elsewhere:

1. General Conditions and Requirements of the Contract
2. Submittals: Section 01300

1.02 APPROVAL OF MATERIALS

A. Only new materials and equipment shall be incorporated in the work. All materials and equipment furnished by Contractor shall be subject to the inspection and approval of Engineer. No material shall be delivered to the site without prior approval of Engineer.

B. The Contractor shall submit to Engineer, data relating to materials and equipment he proposes to furnish for the work. Such data shall be in sufficient detail to enable Engineer to identify the particular product to form an opinion as to its conformity to the specifications.

C. Facilities and labor for handling and inspection of all materials and equipment shall be furnished by Contractor. If Engineer requires, either prior to beginning or during progress of the work, Contractor shall submit samples of materials for such special tests as may be necessary to demonstrate that they conform to the specifications. Such samples shall be furnished, stored, packed and shipped as directed at Contractor's expense. Except as otherwise noted, Contractor will make arrangements for and pay for the tests.

D. Contractor shall submit data and samples sufficiently early to permit consideration and approval before materials are necessary for incorporation in the work. Any delay of approval resulting from Contractor's failure to submit samples or data promptly shall not be used as a basis of claim against Owner or Engineer.

E. In order to demonstrate the proficiency of workers or to facilitate the choice among several textures, types, finishes and surfaces, Contractor shall provide such samples of workmanship or finish as may be required.

F. The materials and equipment used on the work shall correspond to the approved samples or other data.

1.03 SUBSTITUTIONS AND PRODUCT OPTIONS

A. The substitution requirements of this Section are in addition to the requirements of the General Conditions and Special Conditions.

B. The intent of these Specifications is to provide Owner with a quality facility without discouraging competitive bidding. Substitutions may be submitted and will be evaluated as specified herein.

C. For products specified only by reference standards, performance and descriptive methods, without naming manufacturer's products, the Contractor may provide the products of any manufacturer complying with the Contract Documents, subject to the review of product data by Engineer as specified herein.

D. For products specified by naming a manufacturer's product followed by the words "or equal" or "or approved equal", the Contractor may provide any of the named products. He may substitute a product by another manufacturer as an equal only after review by the Engineer and Owner’s Representative as specified herein. In all cases, any product provided must comply with all of the specified requirements.

1.04 MANUFACTURER'S INSTRUCTIONS FOR INSTALLATION

A. When Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including five copies to Engineer.

B. Maintain one set of complete instructions at the job site during installation and until completion.

C. Handle, install, connect, clean, condition and adjust products in strict accord with such instructions and in conformity with specified requirements.

1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Engineer for further instructions.

2. Do not proceed with work without clear instructions.

D. Perform work in accordance with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

1.05 TRANSPORTATION AND HANDLING

A. Arrange deliveries of products in accordance with construction schedules. Coordinate to avoid conflict with work and conditions at the site.

1. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.

2. Immediately on delivery, inspect shipments to assure compliance with requirements of Contract Documents and approved submittals, and that products are properly protected and undamaged.

B. Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.

1.06 STORAGE AND PROTECTION

A. Store products in accord with manufacturer's instructions, with seals and labels intact and legible.

1. Store products subject to damage by the elements in weather tight enclosures.

2. Maintain temperature and humidity within the ranges required by manufacturer's instructions.

3. Store fabricated products above the ground, on blocking or skids, prevent soiling or staining. Cover products which are subject to deterioration with impervious sheet coverings, provide adequate ventilation to avoid condensation.

4. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.

B. All materials and equipment to be incorporated in the work shall be handled and stored by Contractor before, during and after shipment in a manner to prevent

warping, twisting, bending, breaking, chipping, rusting, and any injury, theft or damage of any kind whatsoever to the material or equipment.

C. Cement, sand and lime shall be stored under a roof and off the ground and shall be kept completely dry at all times. All structural and miscellaneous steel, 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.

D. All materials which, in the opinion of Engineer, have become so damaged as to be unfit for the use intended or specified shall be promptly removed from the site of the work, and Contractor shall receive no compensation for the damaged material or its removal.

E. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration.

F. Protection After Installation: Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Remove covering when no longer needed.

G. The Contractor shall be responsible for all material, equipment and supplies sold and delivered to Owner under this Contract until final inspection of the work and acceptance thereof by Owner. In the event any such material, equipment and supplies are lost, stolen, damaged or destroyed prior to final inspection and acceptance, Contractor shall replace same without additional cost to Owner.

H. Should Contractor fail to take proper action on storage and handling of equipment supplied under this Contract within seven days after written notice to do so has been given, Owner retains the right to correct all deficiencies noted in previously transmitted written notice and deduct the cost associated with these corrections from Contractor's Contract. These costs may be comprised of expenditures for labor, equipment usage, administrative, clerical, engineering and any other costs associated with making the necessary corrections.

1.07 STORAGE AND HANDLING OF EQUIPMENT ON SITE

A. Special attention shall be given to the storage and handling of materials on site. As a minimum, the procedure outlined below shall be followed:

1. Materials shall not be shipped until approved by the Engineer. The intent of this requirement is to avoid unnecessary delivery of unapproved materials and to reduce on-site storage time prior to installation and/or operation. Under no circumstances shall materials be delivered to the site more than one month prior to installation without written authorization from the Engineer.

Materials shipped to the site shall be stored in accordance with Paragraph 1.06, herein.

2. Manufacturer's storage instructions shall be carefully studied by Contractor and reviewed with Engineer by him. These instructions shall be carefully followed and a written record of this kept by the Contractor.

1.08 WARRANTY

A. For all major pieces of material, submit a warranty from the material manufacturer as specified in Section 01740. The manufacturer's warranty period shall be concurrent with the Contractor's for a minimum of three (3) year after project substantial completion by the Engineer and the Owner.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01650
START-UP AND TESTING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Provide material, personnel, and equipment as needed and as specified herein to perform the required start-up and demonstration tests.

B. The Contractor shall submit a start-up plan for review and approval by the County. A minimum of seven (7) days' notice shall be provided prior to the start-up of any system or equipment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PRELIMINARY FIELD TESTS

A. Start-up Certification: Prior to system start-up, the Contractor shall successfully complete all the field testing required of the individual components of the work. Submit one electronic copy of the Start-Up Form for each individual component, signed by Contractor, Owner's Representative. A sample Start-Up Form is provided at the end of this section. Copies of all test reports shall be provided within the respective copies of the Operation and Maintenance Manual. This form shall be completed and submitted before Instruction in Operation to Owner or a request for initiating any final inspection(s).

B. The Contractor shall demonstrate to the Owner's Representative that all temporary jumpers and/or bypasses have been removed and that all of the components are operating under their own controls as designated.

C. Coordinate start up activities with the Owner's operating personnel at the site and with the Engineer prior to commencing system start-up.

3.02 START-UP TESTS

A. Confirm that all equipment is properly energized, that the valves are set to their normal operating condition and that the flow path through the new work is unobstructed.

B. Start-up and training shall be initiated in accordance with and with the use of the operation and maintenance manuals.

C. The start-up tests will be conducted for section of the project as they become ready for substantial completion. Each biotower, fan, nutrient pump and tank, exhaust fan, as indicated in the specification and as necessary to demonstrate full functioning of all alarms, signals and biotower and fan and or tanks as a complete system. The Contractor shall submit a preliminary testing plan prior to testing of newly installed equipment. . If the system fails to operate successfully, or if the start-up is interrupted due to other contracts, the problems will be corrected and the test will start over. The party causing the interruption will be subject to the assessment of actual damages due to delay. During the start-up tests, instruct designated operating personnel in the function and operation of the Work.

D. The Contractor shall coordinate with the Owner for any adjustments desired or operational problems requiring debugging.

E. The Contractor shall make adjustments as necessary to correct any deficiencies.

3.03 DEMONSTRATION TESTS

A. After all Work components have been constructed, field tested and started-up in accordance with the individual specifications and manufacturer requirements, and perform the Demonstration Tests in the presence of the Engineer and the Owner. The demonstration shall be held upon completion of all systems at a date to be agreed upon in writing by the Owner or his representative.

B. During the demonstration test, operate the Work and cause various operational circumstances to occur. As a minimum, these circumstances will include average and peak flows, random equipment failures, drawdown tests and alarm conditions. Demonstrate the essential features of the equipment and its relationship to other equipment. Prior to the demonstration test, the Contractor shall submit two (2) copies of a detailed schedule of operational circumstances to describe the proposed test procedures for approval of completeness. These approved procedures will then be used as the agenda at the demonstration. Coordination of the test schedule will be accomplished through the Engineer.

C. The demonstration test procedures shall follow the example test procedure form provided at the end of this section. Provide similar test procedure forms for each section of the work to cover all aspects and features specified. The test procedures may be broken down into specific areas as follows:

1. Biotower Performance Testing
2. Biotower Fan Testing

3. Nutrient Pump and Tank Testing

4. Grit Bagging System Testing

5. Exhaust Fan Testing

D. Acceptability of the Work's performance will be based on the Work performing as specified, under these actual and simulated operating conditions and providing Odor Control system improvements as defined in the Contract Documents. The intent of the demonstration tests is for the Contractor to demonstrate to the Owner and the Engineer that the Work will function as a complete and operable system under normal as well as emergency operating conditions and is ready for acceptance.

E. Demonstrate the essential features of the whole system as it applies to the Work, including the mechanical equipment, piping, structures, finishes, controls, instrumentation, and power distribution. Use the approved procedures and circumstances to demonstrate the system. Any minor deficiencies found shall be noted and included on a punch list attached to the Certificate of Completed Demonstration. The system shall be demonstrated only once, after completion of start-up tests. If circumstances arise that interrupt the test procedures (such as weather, unforeseen process problems, or problems caused by the Contractor whether or not the problems are the fault of the Contractor, etc.), then the test shall be terminated and rescheduled to a later date after the problem is corrected. The test shall be run in its entirety if so directed by the Engineer.

F. Certificate of Completed Demonstration: Submit one (1) electronic copy of the Facility Performance Demonstration Certification Form for the Work, signed by the Contractor and the Engineer and insert one copy in each Operation and Maintenance Manual. A sample Facility Performance Demonstration Certification Form is provided at the end of this section.

FACILITY PERFORMANCE DEMONSTRATION CERTIFICATION FORM

OWNER:_____ **PROJECT:** _____

Unit Processes Description (List unit processes involved in facility startup):

_____
_____
_____
_____

Unit Processes Startup Sequence (Describe sequence for startup, including computerized operations, if any):

_____
_____
_____
_____
_____

Contractor Certification that Facility is capable of performing its intended function(s), including fully automatic operation:

Contractor: _____ **Date:** _____**, 20____**

Engineer: _____ **Date:** _____**, 20____**
(Authorized Signature)

END OF SECTION

SECTION 01700
CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Comply with requirements stated in the General Conditions and Requirements of the Contract and in specifications for administrative procedures in closing out the Work.

1.02 SUBSTANTIAL COMPLETION

A. The work may not be considered substantially complete unless the punch list items that remain, as identified by the Engineer and Owner, can be completed within thirty (30) days. All painting, finishes, cleanup, final pavement restoration shall have been completed and ready for inspection before substantial completion is given. Also, all building occupancy certificates will need to have been obtained. After (or concurrent with) the Demonstration Tests, with any minor deficiencies noted, the Contractor wishing to consider the Work substantially complete, shall have work completed as follows and submit to the Engineer:

1. A written notice that the Work is substantially complete
2. A list of items to be completed or corrected and explanations thereof
3. All Operations and Maintenance manuals have been submitted and approved in accordance with the Contract Documents
4. All equipment has been checked-out by the equipment manufacturer and Certificates of Manufacturer's Check-Out have been submitted in accordance with the Contract Documents
5. All start-up and demonstration testing completed and Certificates of Completed Demonstration submitted are in accordance with the Contract Documents
6. Project Record Documents are complete and have been submitted and reviewed in accordance with the Contract Documents.
7. The Biotower and Fan, Nutrient Pump and Tank, Exhaust Fan, and the Grit Bagging System are fully-operational and are able to pump and treat odorous air and bag the grit from four (4) grit chutes.
8. All training of Owner's personnel is completed.
9. All areas to be used and occupied are safe, operable in automatic and complete.

10. All deficiencies noted on inspection reports or non-conformances are corrected or the correction plan is approved.

B. Within a reasonable time after receipt of such notice, the Engineer will make an inspection, if necessary, to determine the status of completion.

C. Should Engineer determine that the Work is not substantially complete:

1. The Engineer will promptly notify Contractor in writing, giving the reasons therefore.

2. Contractor shall remedy the deficiencies in the Work and send a second written notice of substantial completion to Engineer.

3. Engineer will re-inspect the Work.

D. When Engineer finds that the Work is substantially complete, he will:

1. Prepare a tentative Certificate of Substantial Completion, with a tentative list of items to be completed or corrected before final inspection.

2. After consideration of any objections made by the Owner as provided in the General Conditions of the Contract, the Engineer will execute the Certificate of Substantial Completion with a revised tentative list of items to be completed or corrected.

1.03 FINAL INSPECTION AFTER COMPLETION

A. When Contractor considers the Work is complete with all minor deficiencies completed or corrected, he shall submit written certification that:

1. Contract Document requirements have been met.

2. Work has been inspected for compliance with Contract Documents.

3. Work has been completed in accordance with Contract Documents.

4. Equipment and systems have been tested in the presence of Owner's representative and are operational.

5. All minor deficiencies have been corrected or completed and the Work is ready for final inspection.

6. All operation and maintenance manuals have been submitted.

7. Project record documents are complete and submitted.

8. Transfer of all spares and expendables has been made to the Owner with a full accounting of the quantities and amounts due.

B. Manufacturers are required to inspect all equipment and workmanship on the project and provide written certification that the work is complete and eligible for full

warranty coverage. The certification shall be on company letterhead, signed by the authorized agent with contact information clearly indicated.

C. Engineer will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.

D. Should Engineer consider that the Work is incomplete or defective:

1. Engineer will promptly notify the Contractor in writing, listing the incomplete or defective work.

2. Contractor shall take immediate steps to remedy the stated deficiencies, and send a second written certification to Engineer that the Work is complete.

3. Engineer will re-inspect the Work.

E. When the Engineer finds that the Work is acceptable under the Contract Documents, he shall request the Contractor to make closeout submittals.

1.04 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: To requirements of Section 01730

D. Spare Parts and Maintenance Materials: To requirements of Technical Sections of the Specifications

E. Evidence of Payment and Release of Liens: To requirements of General and Special Conditions

F. Certificate of Insurance for Products and Completed Operations

G. Evidence of all Certifications of Warranties and Bonds

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.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01710
CLEANING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Execute cleaning, during progress of the Work, and at completion of the Work, as required by this section and the General Conditions.

B. Related Work Described Elsewhere:

1. General Conditions and Requirements of the Contract.
2. Each Specification Section: Cleaning for specific Products or Work.

1.02 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 hazard 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 daily cleaning to keep the Work, the site and adjacent properties free from accumulations of waste materials, rubbish and windblown debris, resulting from construction operations and shall render the site of the work in a neat and orderly condition. All suitable excess excavated material shall remain on site.

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. Construction techniques that minimize the production and distribution of dust shall be used.

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

3.03 FINAL CLEANING

A. Prior to final completion, or Owner occupancy, the Engineer 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

SECTION 01720
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 PURPOSE AND DESCRIPTION OF WORK

A. The purpose of the Project Record Documents is to provide the County with factual information regarding all aspects of the Work, both concealed and visible, to enable future location, identification and modification of the Work without lengthy and expensive site measurement, investigation or examination.

B. Provide professional surveying and mapping work required for the execution of the contract, including verification of existing survey data, construction layout, and production of the As-Built Drawings. This Work shall be performed by a Surveyor that is licensed by the State of Florida as a professional surveyor and mapper pursuant to Chapter 472, F.S.

C. The location of the constructed improvements as depicted in the contract drawings is required. To verify the As-Built Drawing accuracies and to insure the Work was constructed in conformance with the contract drawings, the following survey documents are required to be certified by the Surveyor.

1. Boundary Survey of Biotower Filter and Survey Map Report and

1.02 DEFINITIONS

A. Except where specific definitions are used within a specific section, the following terms, phrases, words and their derivation shall have the meaning given herein when consistent with the context in which they are used. Words used in the present tense include the future tense, words in the plural number include the singular number and words in the singular number include the plural number. The word "shall" is mandatory, and the word "may" is permissive.

1. **As-Built Drawings:** Drawings prepared by the Contractor's Surveyor shall depict the actual location of installed improvements for the completed WORK in a full size hard copy and an electronic AutoCAD file (dwg) format.

2. **Record Drawings:** Drawings, prepared by prepared and certified by the County's Consultant Engineer, shall be a compiled representation of the constructed project, a listing of the sources and the basis of information used in the preparation of the "record drawings", the constructed project meets the Engineer's design intent and note the material deviations from the design documents, and the accuracy of the location information is based upon the

Contractor's surveyor data supplied in the tables (As-Built Asset Attribute Data, Gravity Main, and Pipe Deflection).

3. **Boundary Survey:** Boundary survey, map and report certified by a Surveyor shall be provided that meets the requirements of Chapter 61G17-6 'Minimum Technical Standards', FAC.

4. **Surveyor:** Contractor's Surveyor that is licensed by the State of Florida as a professional surveyor and mapper pursuant to Chapter 472, F.S.

5. **Survey Map Report:** As a minimum the Survey Map Report shall identify any corners that had to be reset, measurements and computations made, sodium hypochlorite storage improvements boundary issues, and accuracies obtained.

1.03 QUALIFICATIONS OF THE SURVEYOR

A. The Surveyor, who is proposed by the Contractor to provide services for the Project, is subject to the approval of the County. Prior to any services being performed, the Contractor shall submit the name and address of any proposed Surveyor and a written acknowledgement from the Surveyor stating that he has the hardware, software and adequate scope of services in his agreement with the Contractor to fully comply with the requirements of this specification. These submittals shall be provided to the County prior to Notice to Proceed. It is recommended that the Surveyor attend the Preconstruction meeting. Any Surveyor, who has not previously performed work for the County in the past, shall attend the Preconstruction meeting.

1.04 RELATED REQUIREMENTS

A. All General Conditions, Supplements to the General Conditions, and any Addenda issued by the County are a part of this Section in the same manner as if fully written herein, and shall govern the Work of this Section, except where more stringent articles or requirements are stipulated, then they shall govern this Section.

B. The Contract Documents are complementary and what is required by anyone shall be as binding as if required by all.

C. Other requirements affecting Record Documents may appear in pertinent other sections of these specifications.

1.05 QUALITY ASSURANCE

A. Delegate the responsibility for maintenance of the Record Documents to one person on the Contractor's staff as approved by the County.

B. Thoroughly coordinate changes within the Record Documents, making adequate and proper entries on each page of specifications and each sheet of drawings and other documents where such entry is required to show progress and changes properly.

C. Make entries within 24-hours after receipt of information has occurred.

D. Survey documents shall comply with the minimum technical standards of Chapter 61G17-6 of the Florida Administrative Code (FAC) and Table 01720-1 Minimum Survey Accuracies specified in, whichever are more stringent. Asset attribute data shall be signed, sealed and dated by the Surveyor. All coordinates shall be geographically registered in the Florida State Plan Coordinate System using the contract drawings control points for horizontal and vertical controls.

Table 01720-1
Minimum Survey Accuracies

Asset/Location	Horizontal Accuracy (feet)	Elevation Accuracy (feet)	Location: horizontal center and vertical top, unless otherwise specified
Bench Marks	N/A	0.01	Point
Horizontal Control	0.01	N/A	Point
Easements and Tracts	*	N/A	Survey Monuments
Civil Site, Topo and Foundation Drawings	0.1	0.01	All
Hydrants	0.01	N/A	Operating Nut
Blow off Valves	0.01	N/A	Valve Enclosure
Air Release Valves	0.01	N/A	Valve Enclosure
Master Meters	0.01	N/A	Register
Meter Box	0.01	N/A	Top of Meter Box
Clean-out	0.01	N/A	Top of Clean-out
Pump skids	0.01	0.01	Top Center of pump and Pipe Inverts
Manholes	0.01	0.1	Top Center of Cover
Manhole	N/A	0.01	Pipe Inverts
System Valves	0.01	0.1	Operating Nut and Valve Body
Fittings	0.01	0.1	Top of Fitting and Ground
Piping at 100’ max intervals	0.01	0.1	Top of Pipe and Ground
Restrained Pipe	0.01	N/A	Limits
Connections	0.01	0.1	Pipe Invert
Bore & Jack Casing	0.01	0.1	Top of Casing at Limits of Casing

Existing Utilities**	0.01	0.1	Conflicts

* Shall conform to the requirements of the "Chapter 61G17-6, 'Minimum Technical Standards', FAC", certified by a Surveyor.

** Existing utilities including but not limited to water, wastewater, reclaimed water, storm, fiber optic cable, electric, gas and structures within the limits of construction.

1.06 SUBMITTALS

A. Comply with pertinent provisions for the timely submittal requirements under this article and specification section.

B. Prior to submitting a monthly payment application, the Contractor's progressive As-Built Drawings shall be acceptable to the County.

C. Progressive As-Built Drawings which will indicate the horizontal and vertical locations of all current constructed improvements with sufficient information and notes to easily determine if the improvements were constructed in conformance with the Contract Documents. The progressive As-Built Drawings shall include a Surveyor's certified statement regarding the constructed improvements being within the specified accuracies or if not indicating the variances, as described in Table 01720-1 Minimum Survey Accuracies. The Contractor shall also submit the following updated monthly tables certified by the Surveyor:

D. Prior to submitting a request for final payment or the County issuing a Certificate of Completion for the Work, the Contractor shall submit the final Record Documents to the County for approval. Retainage funds will be withheld at the County's discretion based on the quality and accuracy of the final Record Documents.

1.07 RECORD DOCUMENTS AT SITE

A. Maintain at the site and always available for County's use one record copy of:

1. Construction Contract, Drawings, Specifications, General Conditions, Supplemental Conditions, Bid Proposal, Instruction to Bidders, Addenda, and all other Contract Documents.
2. Change Orders, Verbal Orders, and other modifications to Contract.
3. Written instructions by the County as well as correspondence related to Requests for Information (RFIs).
4. Accepted Shop Drawings, Samples, product data, substitution and "or-equal" requests.
5. Field test records, inspection certificates, manufacturer certificates and construction photographs.
6. Progressive As-Built Drawings

7. Current Surveyor's tables for the As-Built Assets Attribute Data, pipe deflection data, and gravity main data.

B. Maintain the documents in an organized, clean, dry, legible condition and completely protected from deterioration and from loss and damage until completion of the Work, transfer of all record data to the final Record Documents and for submittal to the County.

PART 2 - PRODUCTS

2.01 AS-BUILT DRAWINGS

A. Maintain the electronic As-Built Drawings to accurately record progress of Work and change orders throughout the duration of the Contract.

B. Date all entries. Enter RFI No., Change Order No., etc. when applicable.

C. Call attention to the entry by highlighting with a "cloud" drawn around the area affected.

D. In the event of overlapping changes, use different colors for entries of the overlapping changes.

E. Design call-outs shall have a thin strike line through the design call-out and all As-Built information must be labeled (or abbreviated "AB") and be shown in a bolder text that is completely legible.

F. Make entries in the pertinent other documents while coordinating with the Engineer and the County for validity.

G. Entries shall consist of graphical representations, plan view and profiles, written comments, dimensions, State Plane Coordinates, details and any other information as required to document field and other changes of the actual Work completed. As a minimum, make entries to also record:

1. Depths of various elements of foundation in relation to finish floor datum and State Plane Coordinates and elevations.

2. Plan view and profile drawings: State Plane coordinates and elevations or depths for all assets shown in the Asset Attribute Data Table on each drawing if the fittings, valves, appurtenances, etc. are shown on that drawing sheet.

3. When electrical boxes, or underground conduits and plumbing are involved as part of the Work, record true elevations and locations, dimensions between boxes.

4. Actually installed pipe or other Work materials, class, pressure rating, diameter, size, specifications, etc. Similar information for other encountered

underground utilities, not installed by Contractor, their owner and actual location if different than shown in the Contract Documents.

5. Details, not on original contract Drawings, as needed to show the actual location of the Work completed in a manner that allows the County to find it in the future.

6. The Contractor shall mark all arrangements of conduits, circuits, piping, ducts and similar items shown schematically on the construction documents and show on the As-Built Drawings the actual horizontal and vertical alignments and locations.

7. Major architectural and structural changes including relocation of doors, windows, etc. Architectural schedule changes according to contractor's records and shop drawings.

2.02 RECORD DOCUMENTS

A. A full size, two (2) hard copy set of the final Record Documents and shall include all of the documents described below under this subsection 2.02.

B. The following documents shall be signed and sealed by the Surveyor:

1. Boundary Survey of Biotrickling Filter Replacement and Survey Map Report

C. Digital Set of the final Record Documents including but not limited to:

1. Scanned digital copies of the final As-Built Drawings.

2. Electronic Survey documents electronically sealed by the Surveyor.

3. Final Record Documents information.

4. Digital As-Built Drawing in the Engineer's current version of AutoCAD file (dwg) format for the Contract Drawings, updated to match the final Record Drawing information.

D. Biotrickling Filter Replacement site Boundary Survey and Map Report.

E. New Boundary Survey to re-establish easement corners, right-of-way monuments, or Biotower filter site corners with monuments if destroyed by the Work.

F. Scanned Documents: Scan the Survey Documents and other Record Documents reflecting changes from the Bid Documents.

G. The scanned As-Built drawing sets shall be complete and include the title sheet, plan/profile sheets, cross-sections, and details. Each individual sheet contained in the printed set of the As-Built Drawings shall be included in the electronic drawings, with each sheet being converted into an individual tif (tagged image file). The plan sheets shall be scanned in tif format Group 4 at 400 dpi resolution to maintain legibility of each drawing. Then, the tif images shall be embedded into a single pdf (Adobe

Acrobat) file representing the complete plan set. Review all Record Documents to ensure a complete record of the project.

H. Provide an encompassing digital AutoCAD file that includes all the information of the As-Built Drawings and any other graphical information in the As-Built Drawings. It shall include the overall Work, utility system layout and associated parcel boundaries and easements. Feature point, line and polygon information for new or altered Work and all accompanying geodetic control and survey data shall be included. The surveyor's certified as-built asset attribute data shall be added to the As-Built Drawings and Surveyor shall electronically seal the data in a comma-delineated ASCII format (txt).

PART 3 - EXECUTION

3.01 SURVEY FIELD WORK

A. Locate, reference, and preserve existing horizontal and vertical control points and property corners shown on the Drawings prior to starting any construction Work. If the Surveyor performing the Work discovers any discrepancies that will affect the Project, the Contractor must immediately report these findings to the County. All survey work shall meet the requirements as defined in Florida Administrative Code 61G17-6. Reference and preserve all survey points during construction. If survey points are disturbed, it is the responsibility of the Contractor's Surveyor to reset the points at the Contractor's expense. Copies of the Surveyor's field notes and/or electronic files for point replacement shall be provided to the County.

1. The Surveyor shall locate all improvements for the project As-Built Asset Attribute Data using State Plane Coordinates as the horizontal datum and the benchmark referenced on the Drawings as the vertical datum. The County's Engineer will provide electronic files of the Drawings to be used by the Surveyor in complying with these specifications.

2. The construction layout shall be established from the reference points shown or listed on the Drawings. The accuracy of any method of staking shall be the responsibility of the Contractor. All construction layout staking shall be done such as to provide for easy verification of the Work by the County.

B. Use survey control points to layout such work tasks as the following:

1. Clearing, grubbing, work limits, right-of-way lines and easements

2. Locations for pipelines and all associated structures and appurtenances

C. The Surveyor shall reference and replace any project control points, boundary corners, benchmarks, section corners, and right-of-way monuments that may be lost or destroyed, at no additional cost to the County. Establish replacement points based on

the original survey control. Copies of all reference field notes and/or electronic files for point replacement shall be submitted to the County.

3.02 CONSTRUCTION PROGRESS MEETINGS

A. Contractor shall provide progressive and a final version of the Record Documents both as paper copies and electronic format described below.

1. Construction Contract, As-Built Drawings, Specifications, General Conditions, Supplemental Conditions, Bid Proposal, Instruction to Bidders, Addenda, and all other Contract Documents.

2. Specifications and Addenda: Record manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed as well as any changes made by Field Order, Change Order or other.

3. Change orders, verbal orders, and other modifications to Contract.

4. Written instructions by the County as well as correspondence related to Requests for Information (RFIs).

5. 5. Accepted Shop Drawings, samples, product data, substitution and "or-equal" requests.

6. 6. Field test records, inspection certificates, manufacturer certificates and construction photographs.

3.03 FINAL RECORD DOCUMENTS SUBMITTAL

A. Submit the Final Record Documents within 20 days after Substantial Completion.

1. Participate in review meetings as required and make required changes and promptly deliver the Final Record Documents to the Engineer and County.

3.04 STORAGE AND PRESERVATION

A. Store Record Documents and samples at a protected location in the project field office apart from documents used for construction.

1. Provide files and racks for storage of documents

2. Provide locked cabinet or secure space for storage of samples.

B. File documents and samples in accordance with CSI format with section numbers matching those in the Contract Documents.

C. In the event of loss of recorded data, use means necessary to again secure the data to the County's approval.

1. Such means shall include, if necessary in the opinion of the County, removal and replacement of concealing materials.

2. In such cases, provide replacements of the concealing materials to the standards originally required by the Contract Documents.

END OF SECTION

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SECTION 01730
OPERATION AND MAINTENANCE MANUAL

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. The Contractor shall compile product data and related information appropriate for Owner's maintenance and operation of products furnished under Contract.
2. The Contractor shall prepare operating and maintenance data as specified in this Section and as referenced in other pertinent sections of Specifications.
3. The Contractor shall instruct Owner's personnel in maintenance of products and in operation of equipment and systems.

1.02 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 a technical writer to the extent required to communicate essential data.
4. Skilled as draftsman competent to prepare required drawings.

1.03 FORM OF SUBMITTALS

A. Prepare data in form of an instructional manual for use by Owner's personnel.

B. 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 products, or each piece of operating equipment.

    a. Provide typed description of products 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.

C. Binders:

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

D. Electronic Format:

1. In addition to hardcopies for the Owners personnel one (1) electronic copy (PDF) of all Operation and Maintenance Manuals shall be provided to the Owner and Engineer.

1.04 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 and telephone number of:

    a. Subcontractor or installer, manufacturer and supplier name, address and telephone number.
    b. A list of each product required to be included, indexed to content of the volume.
    c. Identify area of responsibility of each.
    d. Local source of supply for parts and replacement name, address and telephone number.

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.

3. Operation and maintenance information as herein specified.

4. Record shop drawings as submitted and approved with all corrections made for each product.

C. 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.

D. 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.

E. Copy of each warranty, bond and service contract issued.

1. 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.

1.05 MANUAL FOR MATERIALS AND FINISHES

A. Submit six (6) copies of complete manual in final form in addition to one (1) electronic copy (PDF).

B. Content: for applied materials and finishes:

1. Manufacturer's data, giving full information on products.

a. Catalog number, size, and composition.
b. Color and texture designations.
c. Information required for reordering special manufactured products.

2. Instructions for care and maintenance.

a. Manufacturer's recommendation for types of cleaning agents and methods.
b. Cautions against cleaning agents and methods which are detrimental to product.
c. Recommend schedule for cleaning and maintenance.

C. Content, for moisture protection and weather-exposed products:

1. Manufacturer's data, giving full information on products.

a. Applicable standards.
b. Chemical composition.
c. Details of installation.

2. Instructions for inspection, maintenance and repair.

D. Additional requirements for maintenance data: Respective sections of Specifications.

1.06 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Submit six (6) copies of complete manual in final form in addition to one (1) electronic copy (PDF).

B. Content, for each unit of equipment and system, as appropriate:

1. Description of unit and component parts.

a. Function, normal operating characteristics, and limiting conditions.
b. Performance curves, engineering data and tests.
c. Complete nomenclature and commercial number of replaceable parts.
d. Summary of information listed on equipment and motor data plates.

2. Operating procedures:

a. Start-up, break-in, routine and normal operating instructions.
b. Regulation, control, stopping, shut-down and emergency instructions.
c. Summer and winter operating instructions.
d. Special operating instructions.

3. Maintenance procedures:

a. Routine operations.
b. Guide to "trouble-shooting".
c. Disassembly, repair and reassembly.

d. Alignment, adjusting and checking.

4. Servicing and lubrication required.

5. Manufacturer's printed operating and maintenance instructions.

6. Description of sequence of operation by control manufacturer.

7. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.

   a. Predicted life of parts subject to wear.
   b. Items recommended to be stocked as spare parts.

8. As-installed control diagrams by controls manufacturer.

9. Each Contractor's coordination drawings.

10. Charts of valve tag numbers, with location and function of each valve.

11. List of original manufacturer's spare parts, manufacturer's current prices and recommended quantities to be maintained in storage.

12. Other data as required under pertinent sections of specifications.

13. Approved record shop drawings with all corrections made, and a copy of the warranty statement, check-out memo, and demonstration test procedures and certification.

C. Content, for each electric and electronic system, as appropriate:

1. Description of system and component parts.

   a. Function, normal operating characteristics, and limiting conditions.
   b. Performance curves, engineering data and tests.
   c. Complete nomenclature and commercial number of replaceable parts.

2. Circuit directories of panelboards.

   a. Electrical service
   b. Controls

3. As installed color coded wiring diagrams.

4. Operating procedures:

   a. Routine and normal operating instructions.
   b. Sequences required.
   c. Special operating instructions.

5. Maintenance procedures:

   a. Routine operations.
   b. Guide to "trouble-shooting.
   c. Disassembly, repair and reassembly.

d. Adjustment and checking.

6. Manufacturer's printed operating and maintenance instructions.

7. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

8. Other data as required under pertinent sections of specifications.

D. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.

E. Additional requirements for operating and maintenance data: Respective sections of Specifications.

1.07 SUBMITTAL SCHEDULE

A. Submit two (2) copies of preliminary draft of proposed formats and outlines of contents of Operation and Maintenance Manuals within 90 days after Notice to Proceed. Sets of example O&M manuals are available for examination upon request.

B. Submit two (2) copies of completed data in preliminary form no later than 20 days following Engineer's review of the last shop drawing of a product and/or other submittal specified under Section 01300, but no later than delivery of equipment. One copy will be returned with comments to be incorporated into the final copies and the other copy will be retained on-site for use in any early training.

C. Submit six (6) copies of approved manual in final form directly to the offices of the Engineer within 10 days after the reviewed copy or last item of the reviewed copy is returned.

D. Provide six (6) copies of addenda to the operation and maintenance manuals as applicable and certificates as specified within 30 days after final inspection.

1.08 INSTRUCTION OF OWNER'S PERSONNEL

A. Prior to demonstration test, fully instruct Owner's designated operating and maintenance personnel in operation, adjustment and maintenance of products, equipment and systems.

B. Operating and maintenance manual shall constitute the basis of instruction. Review contents of manual with personnel in full detail to explain all aspects of operations and maintenance.

C. Instructors shall be fully qualified personnel as outlined within the individual equipment specifications. If no specific training specifications are listed with the

equipment, the Contractor shall provide the instruction with qualified Contractor personnel.

D. The instructors shall provide for and prepare lesson scopes and handouts for up to five individuals designated by the Owner that outline the items to be covered. Separate sessions for operation and maintenance instruction shall be provided consecutively. Handouts shall be submitted to the Owner with at least one week's notice prior to the training sessions.

E. All instruction sessions shall be video taped with portable video cameras and tapes supplied by the Contractor. Video taping shall be made by the Contractor under the direction of the Owner with DVD compatible taping equipment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01740
WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Compile specified warranties and bonds, as in the General Conditions and as specified in these Specifications.

1. Manufacturers are required to inspect all equipment and workmanship on the project, and provide written certification that the work is complete and eligible for full warranty coverage. The certification shall be on company letterhead, signed by the authorized agent with contact information clearly indicated.

2. Submit to Engineer for review and transmittal to Owner.

B. Related Work Described Elsewhere: Contract Closeout 01700

1.02 SUBMITTAL REQUIREMENTS

A. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers, and subcontractors.

B. Number of original signed copies required: Two (2) each.

C. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.

1. Product or work item
2. Firm, 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: Instances which might affect the validity or warranty or bond
7. Contractor, name of responsible principal, address and telephone number

1.03 FORM OF SUBMITTALS

A. Prepare in duplicate packets

B. Format:

1. Size 8 1/2-inches x 11-inches, punch sheets for standard three-post binder. Fold larger sheets to fit into binders. The Contractor shall submit warranties in a separate/stand-alone binder.

2. Cover: Identify each packet with typed or printed title "WARRANTIES AND BONDS".

3. List:

a. Title of Project
b. Name of Contractor

C. Binders: Commercial quality, three (3) D-ring binder, with durable and cleanable plastic covers and maximum ring size of two inches.

1.04 WARRANTY SUBMITTALS REQUIREMENTS

A. For all material, submit a warranty from the product manufacturer. The manufacturer's warranty period shall be concurrent with Contractor's for three (3) year, unless otherwise specified, commencing at the time of substantial completion by Owner.

B. The Contractor shall be responsible for obtaining certificates for material warranty for all major items which list for more than $1,000. The Engineer reserves the right to request warranties for material not classified as major. The Contractor shall still warrant material not considered to be "major" in the Contractor's one-year warranty period even though certificates of warranty may not be required.

C. In the event that the material manufacturer or supplier is unwilling to provide a one (1) year warranty commencing at the time of Owner acceptance, the Contractor shall obtain from the manufacturer a two (2) year warranty commencing at the time of equipment delivery to the job site. This two-year warranty from the manufacturer shall not relieve Contractor of the one-year warranty starting at the time of Owner acceptance of the equipment.

D. Owner shall incur no labor or equipment cost during the guarantee period.

E. Guarantee shall cover all necessary labor, and materials resulting from faulty or inadequate design, improper assembly or erection, defective workmanship and materials, leakage, breakage or other failure of all equipment and components furnished by the Manufacturer.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01800
MISCELLANEOUS WORK AND CLEANUP

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. This Section includes operations which cannot be specified in detail as separate items but can be sufficiently described as to the kind and extent to work involved. The Contractor shall furnish all labor, materials, equipment and incidentals to complete the work under this Section.

2. The work of this Section includes, but is not limited to, the following 1) Restoring of driveways, 2) Cleaning and Clean up 3)Incidental work

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials required for this Section shall be of the same quality as materials that are to be restored.

PART 3 - EXECUTION

3.01 RESTORING OF DRIVEWAYS AND SIDEWALKS

A. Existing driveways and sidewalks disturbed by the Contractor shall be replaced. Paved drives and sidewaks shall be repaved to the limits and thickness existing prior to construction.

3.02 INCIDENTAL WORK

A. Do all incidental work not otherwise specified, but obviously necessary for the proper completion of the contract as specified and as shown on the Drawings.

END OF SECTION

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SECTION 02050
DEMOLITION OF EXISTING STRUCTURES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. This Section specifies the labor, materials, equipment, and incidentals required for the demolition, relocation, and/or disposal of all biotowers, fan, ductwork, biomedia (woodchips), rock/stone, filter fabric, checker plate, pipe supports, bolts, equipment, and accessories to be removed as shown on the Drawings and as specified herein. The proposed odor control system shall be installed prior to demolition of the existing structure. The Contractor shall maintain operation of the existing odor control including biofilters, fans, and ductwork until the proposed system has been installed, tested, and cleaned. Outages to areas worked on shall be minimized to one day.

2. There may be existing and active stormwater, wastewater, water, and other facilities on site as indicated on the Drawings. It is essential that these facilities, when encountered, remain intact and in service during the proposed demolition. Consequently, the Contractor shall be responsible for the protection of these facilities and shall diligently direct all his activities toward maintaining continuous operation of the existing facilities and minimizing operational inconvenience.

3. Demolition generally includes:

   a. Complete demolition and removal of two scrubbers, fan, ductwork, pipe supports, dampers, and mechanical and electrical equipment related to the Work as shown on the Drawings and specified herein.
   b. Complete demolition of the existing biofilters, including biofilter media (woodchips), rock/stone and perforated laterals with dome plates, and removal of the filter fabric. Contractor shall bring in fill and grade according to the project documents.
   c. Complete demolition and removal of all above and below ground structures, concrete slabs and foundations, as shown on the Drawings and specified herein.
   d. All material, equipment, rubble, debris, and other products of the demolition shall become the property of the Contractor for his disposal off-site in accordance with all applicable laws and ordinances at the Contractor's expense. The sale of salvageable materials by the Contractor shall only be conducted off-site. The sale of removed items on the site is prohibited by the County.

4. The Contractor shall examine the various Drawings, visit the site, determine the extent of the Work, the extent of work affected therein, and all conditions under which he is required to perform the various operations.

5. The Contractor shall fill and compact all voids left by the removal of pipe, structures, etc. with materials described herein to a grade that will provide for positive drainage of the disturbed area to drain run-off in direction consistent with the surrounding area. The Contractor shall provide all fill materials to the site as needed. Compaction of fill shall match the compaction of adjacent undisturbed material.

1.02 QUALITY ASSURANCE

A. Permits and Licenses: Contractor shall obtain all necessary permits and licenses for performing the Work and shall furnish a copy of same to the County prior to commencing the Work. The Contractor shall comply with the requirements of the permits.

B. Notices: Contractor shall issue written notices of planned demolition to companies or local authorities owning utility conduit, wires, or pipes running to or through the project site. Copies of said notices shall be submitted to the County.

C. Utility Services: Contractor shall notify utility companies or local authorities furnishing gas, water, electrical, telephone, or sewer service to remove any equipment in the structures to be demolished and to remove, disconnect, cap, or plug their services to facilitate demolition.

D. Contractor shall notify the Orange County Risk Management Department in writing prior to beginning any demolition work.

1.03 SHOP DRAWINGS AND SUBMITTALS

A. Submittals shall be submitted to the County for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."

B. Submit to the County for their approval, 2 copies of proposed methods and operations of demolition or relocation of the structures specified below prior to the start of Work. Include in the schedule the coordination of shut-off, capping, and continuation of utility service as required.

C. Provide a detailed sequence of demolition and removal work to ensure the uninterrupted progress of the County's operations.

D. Before commencing demolition work, all structure relocation, bypassing, capping, or modifications necessary will be completed. Actual work will not begin until the County has inspected and approved the prerequisite work and authorized commencement of the demolition work.

E. The above procedure must be followed for each individual demolition operation.

1.04 SITE CONDITIONS

A. Prior to demolition, the Contractor shall obtain written verification from the utility owner(s) that the existing utilities, including stormwater, wastewater, and/or water facilities, are not operational and are ready for demolition.

B. The County assumes no responsibility for the actual condition of the structures to be demolished or relocated.

C. Conditions existing at the time of inspection for bidding purposes will be maintained by the County insofar as practicable. However, variations within each site may occur prior to the start of demolition work.

D. No additional payment will be made for pumping or other difficulties encountered due to water.

E. Certain information regarding the reputed presence, size, character and location of existing underground structures, pipes and conduit has been shown on the Drawings. There is no certainty of the accuracy of this information, and the location of underground structures shown may be inaccurate and other obstructions than those shown may be encountered. The Contractor hereby distinctly agrees that the County is not responsible for the correctness or sufficiency of the information given; that in no event is this information to be considered as a part of the Contract; that he shall have no claim for delay or extra compensation on account of incorrectness of information regarding obstructions either revealed or not revealed by the Drawings; and that he shall have no claim for relief from any obligation or responsibility under this Contract in case the location, size, or character of any pipe or other underground structure is not as indicated on the Drawings, or in case any pipe or other underground structure is encountered that is not shown on the Drawings.

1.05 RESTRICTIONS

A. No building, tank or structure, or any part thereof, shall be demolished until an application has been filed by the Contractor with the Building Department Inspector and a permit issued if a permit is required. The fee for this permit shall be the Contractor's responsibility. Demolition shall be in accordance with applicable provisions of the Building Code of the State of Florida.

B. No explosives shall be used at any time during the demolition. No burning of combustible material will be allowed.

C. Contractor shall notify the Orange County Risk Management Department prior to beginning any demolition work.

1.06 DISPOSAL OF MATERIAL

A. All salvageable or useable material or equipment to be retained by the County shall be shown on Drawings, and shall be moved to a designated area by Contractor for pick up by County. Material to be retained by County shall be cleaned and placed neatly on pallets. The Contractor shall promptly remove all other materials from the site as indicated or shown on the Drawings.

B. All materials not retained by the County shall become the Contractor's property and shall be removed off-site.

C. The on-site storage of removed items is prohibited by the County. Off-site sale of salvageable material by the Contractor is acceptable.

1.07 TRAFFIC AND ACCESS

A. Conduct work to ensure minimum interference with on-site and off-site roads, streets, sidewalks, and occupied or used facilities.

B. Special attention is directed towards maintaining safe and convenient access to the existing facilities remaining in operation by plant personnel and plant associated vehicles, including trucks and delivery vehicles.

C. Do not close or obstruct streets, sidewalks, or other occupied or used facilities without permission from the County. Provide alternate routes around closed or obstructed traffic in access ways.

1.08 PROTECTION

A. Conduct operations to minimize damage by falling debris or other causes to adjacent buildings, structures, roadways, other facilities, and persons. Provide interior and exterior shoring, bracing, or support to prevent movement or settlement or collapse of structures to be demolished and adjacent facilities to remain.

1.09 DAMAGE

A. Promptly repair damage caused to adjacent facilities by demolition operations as directed by the County at no cost to the County.

1.10 UTILITIES

A. Maintain existing utilities as directed by the County to remain in service and protect against damage during demolition operations.

B. Do not interrupt existing utilities serving occupied or operational facilities, except when authorized by County. Provide temporary services during interruptions to existing utilities as acceptable to the County.

C. The Contractor shall cooperate with the County to shut off utilities serving structures of the existing facilities as required by demolition operations.

D. The Contractor shall be solely responsible for making all necessary arrangements and for performing any necessary work involved in connection with the interruption of all public and private utilities or services.

1.11 EXTERMINATION

A. If required, before starting demolition, the Contractor shall employ a certified rodent and vermin exterminator and treat the facilities in accordance with governing health laws and regulations. Any rodents, insects, or other vermin appearing before or during the demolition shall be killed or otherwise prevented from leaving the immediate vicinity of the demolition work.

1.12 POLLUTION CONTROL

A. For pollution control, use water sprinkling, temporary enclosures, and other suitable methods as necessary to limit the amount of dust rising and scattering in the air to the lowest level of air pollution practical for the conditions of work. The Contractor shall comply with the governing regulations.

B. Clean adjacent structures and improvements of all dust and debris caused by demolition operations as directed by the County. Return areas to conditions existing prior to the start of Work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 REMOVAL OF EXISTING PROCESS EQUIPMENT, PIPING, AND APPURTENANCES

A. Equipment to be retained by the County will be designated for retention by the County prior to bidding as specified in Paragraph 1.06 above. Subject to the constraints of maintaining existing facilities in operation as shown on the Drawings, all other process equipment, non-buried valving and piping, and appurtenances shall be removed from the site.

3.02 DEMOLITION PROCEDURES

The Contractor shall adhere to the following demolition procedures as referenced on the Drawings:

A. TO BE DEMOLISHED: Demolition shall be the breaking up, cutting, filling of any holes resulting, final grading of the area, performing any other operations required, and the removal from the site of all structures and equipment (structures, substructures, floor slabs, equipment, tanks, pipes, ductwork, fittings, electrical systems, light poles, wiring, underground conduits and wiring, isolated slabs, and sidewalks) as indicated on the Drawings. All pieces of concrete, metal, and any other

demolished material shall be removed to a depth of at least 5-feet below existing grade. Broken pieces of concrete may be size reduced by an on-site crusher, but in any event must be removed from the project site.

Before commencing structural demolition, remove all mechanical, electrical, piping, and miscellaneous appurtenances. Completely remove the structure by thoroughly breaking up concrete into pieces no more than 2-feet across the largest dimension.

B. TO BE REMOVED: Where indicated on the Drawings, the structures and equipment shall be completely removed from the site with all associated connecting piping or electrical service. The item shall be taken whole or in parts to be salvaged or disposed of by the Contractor.

C. TO BE ABANDONED: Where indicated on the Drawings, the structures and equipment shall be left in place, drained, and the contents properly disposed. The upper 4-feet of the structure shall be cut and removed, including the cover slab and access port, frame, and cover. All structures to be abandoned with bottom slabs shall be drilled (2 holes minimum, 2.0-inch diameter each) or hole punched to prevent flotation and filled with common fill.

D. PIPING TO BE REMOVED: Where indicated on the Drawings, pipe (ductwork and conduit) shall be drained and the contents properly disposed. The pipe (ductwork or conduit) shall then be completely removed from the site, including fittings, valves, and other in-line devices. Connections to existing piping to remain shall be plugged by mechanical means (M.J. plugs, tie-rods, or thrust blocks). Piping shall be removed in accordance with Specification Section 02080 "Abandonment, Removal and Salvage or Disposal of Existing Pipe."

E. PIPING TO BE ABANDONED: Where indicated on the Drawings, piping (ductwork or conduit) shall be left in place. All such piping shall be drained and the contents properly disposed. The pipe (ductwork or conduit) shall then be filled with grout (flowable fill) and each end of the pipe (ductwork or conduit) shall be plugged using a concrete plug in a manner acceptable to the County. Piping shall be abandoned in accordance with Specification Section 02080 "Abandonment, Removal and Salvage or Disposal of Existing Pipe."

F. TO BE PROTECTED: Where indicated on the Drawings, the utility service, fence, structure, tree, or device so designated shall be temporarily protected during the prosecution of the demolition work as specified in Division 1.

G. TO REMAIN: Where indicated on the Drawings, the designated facilities shall remain intact and in service during the prosecution of the demolition work.

3.03 DEWATERING OF EXISTING PROCESS UNITS AND DISPOSAL OF RESIDUE

The Contractor shall notify the County prior to beginning the dewatering work on any existing process units which contain wastewater, grit, or sludge. The Contractor, at his own

expense, shall remove the entire contents of each structure and dispose off site. The proper transport and disposal of all residues shall remain the responsibility of the Contractor.

END OF SECTION

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SECTION 02215
FINISH GRADING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Provide finish grading to all areas within the limits of construction.

B. Grade sub-soil. Cut out areas to receive stabilizing base course materials for paving and sidewalks. Place, finish grade, and compact topsoil.

1.02 PROTECTION

A. Prevent damage to existing fencing, trees, landscaping, natural features, benchmarks, pavement, and utility lines. Correct damage at no cost to the County.

1.03 SHOP DRAWINGS AND SUBMITTALS

A. Submittals shall be submitted to the County for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."

PART 2 - PRODUCTS

2.01 MATERIALS

A. Topsoil: Friable loam free from subsoil, roots, grass, excessive amount of weeds, stones, and foreign matter; acidity range (pH) of 5.5 to 7.5; containing a minimum of 4% and a maximum of 25% organic matter. The topsoil shall be suitable for the proposed plant growth shown on the Drawings and specified. Use topsoil stockpiles on site if conforming to these requirements. If there is not sufficient topsoil available at the project site, the Contractor shall furnish additional topsoil as required to complete the Work at no additional cost to the County.

PART 3 - EXECUTION

3.01 SUB SOIL PREPARATION

A. Rough grade sub-soil systematically to allow for a maximum amount of natural settlement and compaction. Eliminate uneven areas and low spots. Remove debris,

roots, branches, stones, etc. Remove sub-soil that has been contaminated with petroleum products.

B. Cut out areas to subgrade elevation which are to receive stabilizing base for paving and sidewalks.

C. Bring sub soil to required levels, profiles, and contours. Make changes in grade gradual. Blend slopes into level areas.

D. Slope grade away from building a minimum of 2-inches in 10-feet unless indicated otherwise on the Drawings.

E. Cultivate subgrade to a depth of 3-inches where topsoil is to be placed. Repeat cultivation in areas where equipment used for hauling and spreading topsoil has compacted sub-soil.

3.02 PLACING TOPSOIL

A. Place topsoil in areas where seeding, sodding, and planting is to be performed. Place to the following minimum depths, up to finished grade elevations.

1. 6-inches for seeded areas
2. 4-1/2-inches for sodded areas
3. 24-inches for shrub beds
4. 18-inches for flower beds

B. Use topsoil in relatively dry state. Place during dry weather.

C. Fine grade topsoil eliminating rough and low areas to ensure positive drainage. Maintain levels, profiles, and contours of subgrades.

D. Remove stones, roots, grass, weeds, debris, and other foreign material while spreading.

E. Manually spread topsoil around trees, plants, and buildings to prevent damage which may be caused by grading equipment.

F. Lightly compact placed topsoil.

3.03 SURPLUS MATERIAL

A. Remove surplus sub soil and topsoil from site.

B. Leave stockpile areas and entire job site clean and raked, ready to receive landscaping.

END OF SECTION

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SECTION 02220
EXCAVATING, BACKFILLING, AND COMPACTING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Excavate, backfill, and compact as required for the construction of the utility system consisting of piping and appurtenances, and structural construction as shown on the Drawings and specified herein. The Contractor shall furnish all labor, materials, equipment, and incidentals necessary to perform all excavation, backfill, compaction, grading, and slope protection to complete the Work. The Contractor shall be responsible for having determined to his satisfaction, prior to the submission of his bid, all under ground utilities locations and appurtenances shown on the construction Drawings.

B. Definitions:
   1. Maximum Density: Maximum weight in pounds per cubic foot of a specific material as determined by AASHTO T-180 (ASTM D155).
   2. Optimum Moisture: Percentage of water in a specific material at maximum density.
   3. Rock Excavation: Excavation of any hard natural substance which requires the use of explosives and/or special impact tools such as jack hammers, sledges, chisels, or similar devices specifically designed for use in cutting or breaking rock, but exclusive of trench excavating machinery.
   4. Suitable: Suitable materials for fills shall be non-cohesive, non-plastic granular local sand and shall be free from vegetation, organic material, marl, silt, or muck. The Contractor shall furnish all additional fill material required.
   5. Unsuitable: Unsuitable materials are highly organic soil (peat or muck) classified as A-8 in accordance with AASHTO Designation M 145.

C. Plan For Earthwork: The Contractor shall be responsible for having determined to his satisfaction, prior to the submission of his bid, the conformation of the ground, the character and quality of the substrata, the types and quantities of materials to be encountered, the nature of the groundwater conditions, the prosecution of the Work, the general and local conditions, and all other matters which can in any way affect the Work under this Contract. Prior to commencing the excavation, the Contractor shall submit a plan of his proposed operations, including maintenance of traffic, to the County for review. The Contractor shall consider, and his plan for excavation shall reflect, the equipment and methods to be employed in the excavation. The prices established in the Proposal for the Work to be done will reflect all costs pertaining to the Work.

1.02 QUALITY ASSURANCE

A. Testing laboratory employed by the County will make such tests as are deemed advisable. The Contractor shall schedule his work to permit a reasonable time for testing before placing succeeding lifts and shall keep the laboratory informed of his progress. Costs for initial testing shall be paid by the County; however, tests which have to be repeated because of the failure of the tested material to meet specification shall be paid for by the Contractor and the cost of re-testing shall be deducted from payments due the Contractor.

B. Standards
   1. AASHTO: American Association of State Highway and Transportation Officials
   2. ANSI: American National Standards Institute
   3. ASCE: American Society of Civil Engineers
   4. ASTM: American Society for Testing and Materials
   5. AWWA: American Water Works Association
   6. OSHA 29 CFR Subpart P – Excavations and Trenches a) 1926.650, 1926.651, 1926.652
   7. OSHA 29 CFR Subpart J - a) 1910.146 for Confined Space Entry

1.03 JOB CONDITIONS

A. Existing Utilities
   1. The Contractor is responsible for subsurface verification of existing utilities prior to construction. Locate existing utilities in the area of work in accordance with Sunshine State One Call regulations, Chapter 556, "Underground Facility Damage Prevention and Safety Act", FS.
   2. Should uncharted or incorrectly charted piping or other utility be encountered during excavation, notify the County. Keep all facilities in operation and repair damaged utilities to the satisfaction of the County.
   3. Damage and repair costs to such piping or utilities are the Contractor's responsibility.
   4. If utilities are to remain in place, the Contractor shall provide adequate means of protection.

B. Test borings and the sub-surface exploration data if previously done on the site will be made available upon request and are for the Contractor's information only.

1.04 PROTECTION

A. Sheeting and Bracing
   1. Requirements of the Trench Safety Act shall be adhered to at all times.

2. Furnish, put in place, and maintain such sheeting and bracing as may be 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, to protect adjacent structures and power poles from undermining, and to protect workers from hazardous conditions or other damage. Such support shall consist of braced steel sheet piling, braced wood lagging and soldier beams or other acceptable methods. If the County is of the opinion that at any point sufficient or proper supports have not been provided, the County may order additional supports put in at the expense of the Contractor, and compliance with such order shall not relieve or release the Contractor from his responsibility for the sufficiency of such supports. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and compacted. Where soil cannot be properly compacted to fill a void, lean concrete shall be used as backfill at no additional expense to the County.
3. The Contractor shall construct the sheeting outside the neat lines of the foundation unless indicated otherwise for the method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting and bracing shall be adequate to withstand all pressure to which the structure or trench will be subjected. Any movement or bulging which may occur shall be corrected by the Contractor at their own expense so as to provide the necessary clearances and dimensions.
4. Where sheeting and bracing is required to support the sides of excavations for structures, the Contractor shall engage a Professional Geotechnical Engineer, registered in the State of Florida, to design the sheeting and bracing. The sheeting and bracing installed shall be in conformity with the design, and the Professional Engineer shall provide certification of this.
5. The installation of sheeting, particularly by driving or vibrating, may cause distress to existing structures. The Contractor shall evaluate the potential for such distress and, if necessary, take all precautions to prevent distress of existing structures because of sheeting installation.
6. The Contractor shall leave in place to be embedded in the backfill all sheeting and bracing not shown on the Drawings but which the County may direct him in writing to leave in place at any time during the progress of the Work for the purpose of preventing damage to structures, utilities, or property, whether public or private. The County may direct that timber used for sheeting and bracing be cut off at any specified elevation.
7. All sheeting and bracing not left in place shall be carefully removed in such manner as not to endanger the construction or other structures, utilities, 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, or otherwise as may be directed by the County.
8. The right of the County to order sheeting and bracing left in place shall not be construed as creating any obligation on the County's part to issue such orders, and their failure to exercise this right 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.

9. No wood sheeting is to be withdrawn if driven below mid-diameter of any pipe, and under no circumstances shall any wood sheeting be cut off at a level lower than 1-foot above the top of any pipe.

B. Pumping and Drainage:

1. The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove all water entering excavations, and shall keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fills, structures, or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing the water level to return to the natural level as stipulated in Section 02140 "Dewatering." The Contractor shall engage a Professional Geotechnical Engineer registered in the State of Florida to design the dewatering systems. The Contractor shall submit to the County for a plan for dewatering systems prior to commencing work. The dewatering system installed shall be in conformity with the overall construction plan, and the Professional Engineer shall provide certification of this. The Professional Engineer shall be required to monitor the performance of the dewatering systems during the progress of the Work and require such modifications as may be required to assure that the systems are performing satisfactorily.
2. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at the proposed bottom of excavation and to preserve the integrity of adjacent structures. Dewatering by trench pumping will not be permitted if migration of fine grained natural material from bottom, sidewalls, or bedding material will occur.
3. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped from the excavation to maintain a bottom free from standing water.
4. The Contractor shall take all additional precautions to prevent uplift of any structure during construction.
5. Permission to use any storm sewers or drains for water disposal purposes shall be obtained from the authority having jurisdiction. Any requirements and costs for such use shall be the responsibility of the Contractor. However, the Contractor shall not cause flooding by overloading or blocking up the flow in the drainage facilities, and he shall leave the facilities unrestricted and as clean as originally found. Any damage to facilities shall be repaired or restored as directed by the County or the authority having jurisdiction, at no cost to the County.
6. The Contractor shall prevent flotation by maintaining a positive and continuous operation of the dewatering system. The Contractor shall be fully responsible and liable for all damages which may result from failure of this system.
7. Removal of dewatering equipment shall be accomplished after compaction/density testing has been completed and the system is no longer required. The Contractor shall remove the material and equipment constituting the system.
8. The Contractor shall take all necessary precautions to preclude the accidental discharge of fuel, oil, or other contaminates in order to prevent adverse effects on groundwater quality.

1.05 TESTING AND INSPECTION SERVICE

A. The County will provide a geotechnical testing and inspection service. The services include testing soil materials and quality control testing during filling and backfilling operations. Samples of soil materials shall be furnished to the testing service by the Contractor. The County shall pay costs of initial geotechnical testing. The Contractor shall pay for any subsequent testing required due to failure and laboratory stand-by charges incurred.

B. The Contractor shall provide monthly density testing reports to the County during backfilling activities. Density testing reports not submitted in a timely manner shall result in rejection of the pipe installed and rejection of the density testing reports until such time that density re-testing is coordinated and repeated at the Contractors expense.

C. Density testing scheduled subsequent to backfilling activities shall be coordinated with, and witnessed by the County. Failure by the Contractor to coordinate or have the County present shall result in rejection of the submitted density testing reports and re-testing at the Contractor's expense.

D. Dewatering systems shall not be removed until compaction/density testing has been completed.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General:
   1. All fill material shall be subject to the review and acceptance of the County.
   2. All fill material shall be free of organic material, trash, or other objectionable material. The Contractor shall remove excess or unsuitable material from the job site.

B. Common Fill Material: Common fill shall consist of mineral soil, substantially free of clay, organic material, muck, loam, wood, trash, and other objectionable material which may be compressible or which cannot be compacted properly. Common fill shall not contain stones larger than 3-1/2-inches in any dimension in the top 12-inches or 6-inches in any dimension in the balance of fill area. Common fill shall not contain asphalt, broken concrete, masonry, rubble or other similar materials. It shall have physical properties that allow it to be easily spread and compacted during filling. Additional common fill shall be no more than 12 % by weight finer than the No. 200 mesh sieve, unless finer material is approved for use in a specific location by the County. Select Common Fill shall be as specified as above from common fill, except that the material shall contain no stones larger than 1/2-inches in largest dimension, and shall be no more than 5 % by weight finer than the No. 200 mesh sieve.

C. Structural Fill: Structural fill shall be reasonably well graded sand to gravelly sand having the following gradation:

US Sieve Size	Percent Passing By Weight
No. 1	100
No. 4	75 - 100
No. 40	15 - 80
No. 100	0 - 30
No. 200	0 - 12

D. Class 1 Soils*: Manufactured angular, granular material, 1/4 to 1-1/2-inches (6 to 4 mm) size, including materials having significance such as crushed stone or rock, broken coral, crushed slag, cinders, or crushed shells. Sieve analysis for crushed stone is given below separately.

Crushed Stone: Crushed stone shall consist of clean mineral aggregate free from clay, loam or organic matter, conforming to ASTM C33 stone size No. 89 and with particle size limits as follows:

U.S. Sieve Size	% Passing By Weight
½	100
3/8	100
No. 4	20 – 25
No. 8	5 – 30
No. 16	0 - 10
No. 50	0 - 2

E. Class II Soils**:
1. GW: Well graded gravels and gravel-sand mixtures, little or no fines. Fifty percent or more retained on No. 4 sieve. More than 95 % retained on No. 200 sieve. Clean.
2. GP: Poorly graded gravels and gravel-sand mixtures, little or no fines. Fifty percent or more retained on No. 4 sieve. More than 95 % retained on No. 200 sieve. Clean.
3. SW: Well graded sands and gravelly sands, little or no fines. More than passes No. 4 sieve. More than 95 % retained on No. 200 sieve. Clean.
4. SP: Poorly graded sands and gravelly sands, little or no fines. More than 50 % passes No. 4 sieve. More than 95 % retained on No. 200 sieve. Clean.

*Soils defined as Class I materials are not defined in ASTM D2487.
**In accordance with ASTM D2487, less than 5 % pass No. 200 sieve.

F. Coarse Sand: Sand shall consist of clean mineral aggregate with particle size limits as follows:

U.S. Sieve Size	Percent Passing By Weight
3/8	100
No. 10	85 – 100
No. 40	20 – 40
No. 200	0 - 12

G. Other Material: All other material, not specifically described, but required for proper completion of the Work shall be selected by the Contractor and acceptable by the County.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clearing:
   1. The construction areas shall be cleared of all obstructions and vegetation including large roots and undergrowth within 10-feet of the lines of the excavation.
   2. Strip and stockpile topsoil on the site at the location to be determined by the County.

3.02 EXCAVATION

A. General: Excavations for roadways, structures, and utilities must be carefully executed in order to avoid interruption of utility service.

B. Excavating for Roadways/Structures/Utilities:
   1. Excavation shall be made to such dimensions as will give suitable room for building the foundations and the structures, for bracing and supporting, for pumping and draining, and for all other work required.
      a. Excavation for precast or prefabricated structures shall be carried to an elevation 2-feet lower than the proposed outside bottom of the structure to provide space for the select backfill material. Prior to placing the select backfill, the excavation shall be measured by the County to verify that the excavation has been carried to the proper depth and is reasonably uniform over the area to be occupied by the structure.
      b. Excavation for structures constructed or cast in place in dewatered excavations shall be carried down to the bottom of the structure where dewatering methods are such that a dry excavation bottom is exposed and the naturally occurring material at this elevation leveled and left ready to receive construction. Material disturbed below the founding elevation in dewatered excavations shall be replaced with Class B concrete.
      c. Footings: Cast-in-place concrete footing sides shall be formed immediately after excavation.
   2. Immediately document the location, elevation, size, material type and function of all new subsurface installations, and utilities encountered during the course of

construction.

3. Excavation equipment operators and other concerned parties shall be familiar with subsurface obstructions as shown on the Drawings and should anticipate the encounter of unknown obstructions during the course of the Work.
4. Encounters with subsurface obstructions shall be hand excavated.
5. Excavation and dewatering shall be accomplished by methods that preserve the undisturbed state of subgrade soils. Subgrade soils which become soft, loose, "quick" or otherwise unsatisfactory for support of structures as a result of inadequate dewatering or other construction methods shall be removed and replaced by crushed stone as required by the County at the Contractor's expense.
6. The bottom of excavations shall be rendered firm and dry before placing any piping or structure.
7. All pavements shall be cut with saws or approved power tools prior to removal.
8. Excavated material shall be stockpiled in such a manner as to prevent nuisance conditions. Surface drainage shall not be hindered. Excavated material not suitable for backfill shall be removed from the site and disposed of by the Contractor.

3.03 DRAINAGE

A. The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering excavations, and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition. The dewatering method used shall prevent disturbance of earth below grade.

B. All water pumped or drained from the Work shall be disposed of in a suitable manner without undue interference with other work, without damage to surrounding property, and in accordance with pertinent rules and regulations.

C. No construction, including pipe laying, shall be allowed in water. No water shall be allowed to contact masonry or concrete within 24-hours after being placed. The Contractor shall constantly guard against damage due to water and take full responsibility for all damage resulting from his failure to do so.

D. The Contractor will be required at his expense to excavate below grade and refill with crushed stone (gradation 57 or 89) or other acceptable fill material if the County determines that adequate dewatering has not been provided.

3.04 UNDERCUT

A. If the bottom of any excavation is below that shown on the Drawings or specified because of Contractor error, convenience, or unsuitable subgrade due the Contractor's excavation methods, he shall refill to normal grade with fill at his own cost. Fill material and compaction method shall be approved by the County.

3.05 FILL AND COMPACTION

A. Compact and backfill excavations and construct embankment according to the following schedule. (Modified Proctor standard shall be ASTM D-1557):

STRUCTURES AND ROADWORK

Area	Material	Compaction
Beneath Structures	Structural Fill	12-inch lifts, compacted to 98% maximum density as determined by AASHTO T-180. Fill Should not be placed over any in-place soils until those deposits have been compacted to 98% Modified Proctor.
Around Structures	Structural Fill	12-inch lifts, 95% of maximum density as determined by AASHTO T-180. Rubber Tire or vibratory plate compactors shall be used
Beneath Paved Surfaces	Common Fill	12-inch lifts, 98% by maximum density as determined by AASHTO T-180 or as required by the FDOT Standards.
Open Areas	Common Fill	12-inch lifts, 95% by maximum density as determined by AASHTO T-180.

B. Pipe shall be laid in open trenches unless otherwise indicated on the Drawings or elsewhere in the Contract Documents.

C. Excavations shall be backfilled to the original grade or as indicated on the Drawings. Deviation from this grade because of settling shall be corrected. The backfill operation shall be performed to comply with all rules and regulations and in such a manner that it does not create a nuisance or safety hazard.

D. Embankments shall be constructed true to lines, grades, and cross sections shown on the plans or ordered by the County. Embankments shall be placed in successive layers of not more than 8-inches in thickness, loose measure, for the full width of the embankment. As far as practicable, traffic over the Work during the construction phase shall be distributed so as to cover the maximum surface area of each layer.

E. If the Contractor requests approval to backfill material utilizing lifts and/or methods other than those specified herein, such request shall be in writing to the County. Acceptance will be considered only after the Contractor has performed tests, at the Contractor's expense, to identify the material used and density achieved throughout the backfill area utilizing the method of backfill requested. The County's acceptance shall be in writing.

F. One compaction test location shall be required for each 300 linear feet of pipe and for every 100 square feet of backfill around structures as a minimum. The County may determine that more compaction tests are required to certify the installation depending on field conditions. The locations of the compaction tests within the trench shall be in conformance with the following schedule:
   1. At least one test at the spring line of the pipe.

2. At least one test for each 12-inch layer of backfill within the pipe bedding zone for pipes 24-inches and larger.
3. One test at an elevation of 1-foot above the top of pipe.
4. One test for each 2-feet of backfill placed from 1-foot above the top of the pipe to finished grade elevation.
5. Density testing is required for sanitary sewer manholes. Tests shall be staggered around the manhole within 3-feet of the structure's outside diameter.
   a. First test shall be 1-foot above the structure base.
   b. Second test shall be 2-feet above the first test and subsequent tests every 2-feet up the finished grade.
6. The Contractor shall provide additional compaction and testing prior to commencing further construction if the County's testing reports and inspection indicate that the fill has been placed below specified density.
7. The Contractor shall coordinate testing with the County approved testing laboratory and shall provide monthly test results to the County in a timely manner during construction activities. Density testing scheduled subsequent to backfilling activities shall be coordinated with the County and witnessed by the County representative. Failure by the Contractor to coordinate or have the County representative present shall result in rejection of the submitted density testing reports and re-testing at the Contractor's expense. Density testing reports not submitted in a timely manner shall result in rejection of the pipe installed and rejection of the density testing reports until such time that density re-testing is coordinated and repeated at the Contractor's expense as deemed necessary by the County's representative.
8. Dewatering systems shall not be removed until compaction/density testing has been completed.

END OF SECTION

SECTION 02578
SOLID SODDING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Establishing a stand of grass by furnishing and placing grass sod. Included are fertilizing, watering, and maintenance as required to assure a healthy stand of grass. All disturbed areas shall be sodded. Solid sodding shall be placed on all slopes, within 10-feet of all proposed structures, and in all areas where existing grass or sod (regardless of its condition) is removed or disturbed by Contractor's operation unless otherwise specified or shown on the Drawings. Seeding and mulching shall not be allowed on this project.

1.02 SHOP DRAWINGS AND SUBMITTALS

A. Submittals shall be submitted to the County for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."

1. A certification of sod quality by the producer shall be delivered to the County ten days prior to use.

PART 2 - PRODUCTS

2.01 GENERAL

A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 GRASS SOD

A. Grass shall be Bahia, well matted with grass roots. The sod shall be taken up in rectangles, preferably 12-inch by 24-inch, shall be a minimum of 2-inches in thickness, and shall be live, fresh, and uninjured at the time of planting.

B. It shall be reasonably free of weeds and other grasses and shall have a soil mat of sufficient thickness adhering firmly to the roots to withstand all necessary handling. The sod shall be planted as soon as possible after being dug and shall be shaded and kept moist until it is planted.

2.03 FERTILIZER

A. Commercial fertilizers shall comply with the state fertilizer laws.

B. The numerical designations for fertilizer indicate the minimum percentages (respectively) of (1) total nitrogen, (2) available phosphoric acid, and (3) water-soluble potash contained in the fertilizer.

C. The chemical designation of the fertilizer shall be 6-6-6. At least 50% of the nitrogen shall be derived from organic sources. At least 50% of the phosphoric acid shall be from normal super phosphate or an equivalent source, which will provide a minimum of two units of sulfur. The amount of sulfur shall be indicated on the quantitative analysis card attached to each bag or other container.

2.04 WATER FOR GRASSING

A. The water used in the sodding operations shall be by the Contractor as approved by the County.

PART 3 - EXECUTION

3.01 PREPARATION OF GROUND

A. The area over which the sod is to be placed shall be scarified or loosened to a depth and then raked smooth and free from debris. Where the soil is sufficiently loose and clean, the County, at its discretion, may authorize the elimination of ground preparation.

3.02 APPLICATION OF FERTILIZER

A. Before applying fertilizer, the soil pH shall be brought to a range of 6.0 - 7.0.

B. The fertilizer shall be spread uniformly over the area to be sodded at the rate of 700-pounds per acre, or 16-pounds per 1,000 square feet, by a spreading device capable of uniformly distributing the material at the specified rate. Immediately after spreading, the fertilizer shall be mixed with the soil to a depth of approximately 4-inches.

C. On steep slopes, where the use of a machine for spreading or mixing is not practicable, the fertilizer shall be spread by hand and raked in and thoroughly mixed with the soil to a depth of approximately 2-inches.

3.03 PLACING SOD

A. The sod shall be placed on the prepared surface, with edges in close contact and shall be firmly and smoothly embedded by light tamping with appropriate tools.

B. Where sodding is used in drainage ditches, or on slopes of 4:1 or greater, the setting of the pieces shall be staggered to avoid a continuous seam along the line of flow. Along the edges of such staggered areas, the offsets of individual strips shall not exceed 6-inches. In order to prevent erosion caused by vertical edges at the outer limits, the outer pieces of sod shall be tamped so as to produce a featheredge effect.

C. On slopes greater than 2:1, the Contractor shall, if necessary, prevent the sod from sliding by means of wooden pegs driven through the sod blocks into firm earth at suitable intervals.

D. Sod which has been cut for more than 72-hours shall not be used unless specifically authorized by the County after the inspection thereof. Sod which is not planted within 24-hours after cutting shall be stacked in an approved manner, maintained, and properly moistened. Any pieces of sod that, after placing, show an appearance of extreme dryness shall be removed and replaced by fresh, uninjured pieces.

E. Sodding shall not be performed when weather and soil conditions are, in the County's opinion, unsuitable for proper results.

3.04 WATERING

A. The areas on which the sod is to be placed shall contain sufficient moisture, as determined by the County, for optimum results. After being placed, the sod shall be kept in a moist condition to the full depth of the rooting zone for at least 2-weeks. Thereafter, the Contractor shall apply water as needed until the sod roots and starts to grow for a minimum of 60-days (or until final acceptance, whichever is latest).

3.05 MAINTENANCE

A. The Contractor shall maintain, at his expense, the sodded areas in a satisfactory condition until final acceptance of the Project. Such maintenance shall include repairing of any damaged areas and replacing areas in which the establishment of the grass stand does not appear to be developing satisfactorily.

B. Replanting or repair necessary due to the Contractor's negligence, carelessness, or failure to provide routine maintenance shall be at the Contractor's expense.

END OF SECTION

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SECTION 03100
CONCRETE FORMWORK

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and cut, remove, repair or otherwise modify parts of existing concrete structures or appurtenances as shown on the Drawings and as specified herein. Work under this Section shall also include bonding new concrete to existing concrete.

B. Secure to forms as required or set for embedment as required, all miscellaneous metal items, sleeves, reglets, anchor bolts, inserts and other items furnished under other Sections and required to be cast into concrete, or approved in advance by the Engineer.

1.02 RELATED WORK

A. Concrete Reinforcement is included in Section 03200.

B. Concrete Joints and Joint Accessories are included in Section 03250

C. Cast-in-Place Concrete is included in Section 03300.

D. Grout is included in Section 03600.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, shop drawings and product data showing materials of construction and details of installation for:

1. Form release agent
2. Form ties

1.04 REFERENCE STANDARDS

A. American Concrete Institute (ACI)

1. ACI 301 - Standard Specification for Structural Concrete
2. ACI 318 - Building Code Requirements for Reinforced Concrete
3. ACI 347 - Formwork for Concrete

B. American Plywood Association (APA)

1. Material grades and designations as specified

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

1.05 SYSTEM DESCRIPTION

A. General: Architectural Concrete is wall, slab, beam or column concrete which will have surfaces exposed to view in the finished work. It includes similar exposed surfaces in water containment structures from the top of walls to 2-ft below the normal water surface in open tanks and basins.

B. Formwork shall be designed and erected in accordance with the requirements of ACI 301 and ACI 318 and as recommended in ACI 347 and shall comply with all applicable regulations and codes. The design shall consider any special requirements due to the use of plasticized and/or retarded set concrete.

PART 2 - PRODUCTS

2.01 GENERAL

A. The usage of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configurations desired.

2.02 MATERIALS

A. Forms for cast-in-place concrete shall be made of wood, metal, or other approved material. Construct wood forms of sound lumber or plywood of suitable dimensions and free from knotholes and loose knots. Where used for exposed surfaces, dress and match boards. Sand plywood smooth and fit adjacent panels with tight joints. Metal forms may be used when approved by the Engineer and shall be of an appropriate type for the class of work involved. All forms shall be designed and constructed to provide a flat, uniform concrete surface requiring minimal finishing or repairs.

B. Wall Forms

1. Forms for all exposed exterior and interior concrete walls shall be "Plyform" exterior grade plywood panels manufactured in compliance with the APA and bearing the trademark of that group, or equal acceptable to the Engineer. Provide B grade or better veneer on all faces to be placed against concrete during forming. The class of material and grades of interior plies shall be of sufficient strength and stiffness to provide a flat, uniform concrete surface requiring minimal finishing and grinding.

2. All joints or gaps in forms shall be taped, gasketed, plugged, and/or caulked with an approved material so that the joint will remain watertight and will withstand placing pressures without bulging.

C. Rustication strips shall be at the location and shall conform to the details shown on the Drawings. Moldings for chamfers and rustications shall be milled and planed smooth. Rustications and corner strips shall be of a nonabsorbent material, compatible with the form surface and fully sealed on all sides to prohibit the loss of paste or water between the two surfaces.

D. Form Release Agent

1. Coat all forming surfaces in contact with concrete using an effective, non-staining, non-residual, water based, bond-breaking form coating unless otherwise noted. Form release agent shall be Farm Fresh by Unitex or approved equal.

2.

E. Form Ties

1. Form ties encased in concrete other than those specified in the following paragraphs shall be designed so that, after removal of the projecting part, no metal shall remain within 1-1/2-in of the face of the concrete. The part of the tie to be removed shall be at least 1/2-in diameter or be provided with a wood or metal cone at least 1/2-in diameter and 1-1/2-in long. Form ties in concrete exposed to view shall be the cone-washer type.

2. Form ties for exposed exterior and interior walls shall be as specified in the preceding paragraph except that the cones shall be of approved wood or plastic.

3. Flat bar ties for panel forms, if used, shall have plastic or rubber inserts having a minimum depth of 1-1/2-in and sufficient dimensions to permit proper patching of the tie hole.

4. Common wire shall not be used for form ties.

5. Alternate form ties consisting of tapered through-bolts at least 1-in in diameter at smallest end or through-bolts that utilize a removable tapered sleeve of the same minimum size may be used at the Contractor's option. Obtain Engineer's acceptance of system and spacing of ties prior to ordering or purchase of forming. Clean, fill and seal form tie hole with non-shrink cement grout.

PART 3 - EXECUTION

3.01 GENERAL

A. Forms shall be used for all cast-in-place concrete including sides of footings. Forms shall be constructed and placed so that the resulting concrete will be of the shape, lines, dimensions and appearance indicated on the Drawings.

B. Forms for walls shall have removable panels at the bottom for cleaning, inspection and joint surface preparation. Forms for walls of considerable height shall have closable intermediate inspection ports. Tremies and hoppers for placing concrete shall be used to allow concrete inspection, to prevent segregation and to prevent the accumulation of hardened concrete on the forms above the fresh concrete.

C. Molding, bevels, or other types of chamfer strips shall be placed to produce block outs, rustications, or chamfers as shown on the Drawings or as specified herein. Chamfer strips shall be provided at horizontal and vertical projecting corners to produce a 3/4-in chamfer. Rectangular or trapezoidal moldings shall be placed in locations requiring sealants where specified or shown on the Drawings. Sizes of moldings shall conform to the sealants manufacturer's recommendations.

D. Forms shall be sufficiently rigid to withstand construction loads and vibration and to prevent displacement or sagging between supports. Construct forms so that the concrete will not be damaged by their removal. The Contractor shall be entirely responsible for the adequacy of the forming system.

E. Before form material is re-used, all surfaces to be in contact with concrete shall be thoroughly cleaned, all damaged places repaired, all projecting nails withdrawn and all protrusions smoothed. Reuse of wooden forms for other than rough finish will be permitted only if a "like new" condition of the form is maintained.

3.02 FORM TOLERANCES

A. Forms shall be surfaced, designed and constructed in accordance with the recommendations of ACI 347 and shall meet the following additional requirements for the specified finishes.

1. Formed Surface Exposed to View: Edges of all form panels in contact with concrete shall be flush within 1/16-in and forms for plane surfaces shall be such that the concrete will be plane within 3/16-in in 4-ft. Forms shall be tight to prevent the passage of mortar, water and grout. The maximum deviation of the finish wall surface at any point shall not exceed 1/4-in from the intended surface as shown on the Drawings. Form panels shall be arranged symmetrically and in an orderly manner to minimize the number of seams.

2. Formed surfaces not exposed to view or buried shall meet requirements of Class "C" Surface in ACI 347.

3. Formed rough surfaces including mass concrete, pipe encasement, electrical duct encasement and other similar installations shall have no minimum requirements for surface smoothness and surface deflections. The overall dimensions of the concrete shall be plus or minus 1-in.

3.03 FORM PREPARATION

A. Wood forms in contact with the concrete shall be coated with an effective release agent prior to form installation.

B. Steel forms shall be thoroughly cleaned and mill scale and other ferrous deposits shall be sandblasted or otherwise removed from the contact surface for all forms, except those utilized for surfaces receiving a rough finish. All forms shall have the contact surfaces coated with a release agent.

3.04 REMOVAL OF FORMS

A. The Contractor shall be responsible for all damage resulting from removal of forms. Forms and shoring for structural slabs or beams shall remain in place in accordance with ACI 301 and ACI 347. Form removal shall conform to the requirements specified in Section 03300 and a curing compound applied.

3.05 INSPECTION

A. The Engineer on site shall be notified when the forms are complete and ready for inspection at least 6 hours prior to the proposed concrete placement.

B. Failure of the forms to comply with the requirements specified herein or to produce concrete complying with requirements of Section 03300 shall be grounds for rejection of that portion of the concrete work. Rejected work shall be repaired or replaced as directed by the Engineer at no additional cost to the Owner. Such repair or replacement shall be subject to the requirements of this Section and approval of the Engineer.

END OF SECTION

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SECTION 03150
MODIFICATIONS AND REPAIR TO CONCRETE

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and cut, remove, repair or otherwise modify parts of existing concrete structures or appurtenances as shown on the Drawings and as specified herein. Work under this Section shall also include bonding new concrete to existing concrete.

1.02 RELATED WORK

A. Concrete Formwork is included in Section 03100.

B. Concrete Reinforcement is included in Section 03200.

C. Concrete Joints and Accessories are included in Section 03250.

D. Cast-in-Place Concrete is included in Section 03300.

E. Concrete Finishes are included in Section 03350.

F. Grout is included in Section 03600.

1.03 SUBMITTALS

A. Submit manufacturer's technical literature on all product brands proposed for use, to the Engineer for review. The submittal shall include the manufacturer's installation and/or application instructions.

B. When substitutions for acceptable brands of materials specified herein are proposed, submit brochures and technical data of the proposed substitutions to the Engineer for approval before delivery to the project.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM C881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

2. ASTM C882 - Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Sheer.

3. ASTM C883 - Standard Test Method for Effective Shrinkage of Epoxy-Resin Systems Used with Concrete.

4. ASTM D570 - Standard Test Method for Water Absorption of Plastics.

5. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.

6. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics.

7. ASTM D732 - Standard Test Method for Shear Strength of Plastics by Punch Tool.

8. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

B. Where reference is made to one of the above standards, the latest revision as referenced in the FBC shall be used.

1.05 QUALITY ASSURANCE

A. No existing structure or concrete shall be shifted, cut, removed, or otherwise altered until authorization is given by the Engineer.

B. When removing materials or portions of existing structures and when making openings in existing structures, all precautions shall be taken and all necessary barriers, shoring and bracing and other protective devices shall be erected to prevent damage to the structures beyond the limits necessary for the new work, protect personnel, control dust and to prevent damage to the structures or contents by falling or flying debris. Unless otherwise permitted, shown or specified, line drilling will be required in cutting existing concrete.

C. Manufacturer Qualifications: The manufacturer of the specified products shall have a minimum of 10 years experience in the manufacture of such products and shall have an ongoing program of training, certifying and technically supporting the Contractor's personnel.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver the specified products in original, unopened containers with the manufacturer's name, labels, product identification and batch numbers.

B. Store and condition the specified product as recommended by the manufacturer.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General

1. Materials shall comply with this Section and any state or local regulations.

B. Epoxy Bonding Agent

1. General

a. The epoxy bonding agent shall be a two-component, solvent-free, asbestos-free moisture insensitive epoxy resin material used to bond plastic concrete to hardened concrete complying with the requirements of ASTM C881, Type II and the additional requirements specified herein.

2. Material

a. Properties of the cured material:

i. Compressive Strength (ASTM D695): 8500 psi minimum at 28 days.
ii. Tensile Strength (ASTM D638): 4000 psi minimum at 14 days.
iii. Flexural Strength (ASTM D790 - Modulus of Rupture): 6,300 psi minimum at 14 days.
iv. Shear Strength (ASTM D732): 5000 psi minimum at 14 days.
v. Water Absorption (ASTM D570 - 2 hour boil): One percent maximum at 14 days.
vi. Bond Strength (ASTM C882) Hardened to Plastic: 1500 psi minimum at 14 days moist cure.
vii. Effective Shrinkage (ASTM C883): Passes Test.
viii. Color: Gray.

3. Approved manufacturers include: Sika Corporation, Lyndhurst, NJ - Sikadur 32, Hi-Mod; Master Builder's, Cleveland, OH - Concresive Liquid (LPL) or equal.

C. Epoxy Paste

1. General

a. Epoxy Paste shall be a two-component, solvent-free, asbestos free, moisture insensitive epoxy resin material used to bond dissimilar materials to concrete such as setting railing posts, dowels, anchor bolts and all-threads into hardened concrete and shall comply with the requirements of ASTM C881, Type I, Grade 3 and the additional requirements specified herein. It may also be used to patch existing surfaces where the glue line is 1/8-in or less.

2. Material

a. Properties of the cured material:

i. Compressive Properties (ASTM D695): 10,000 psi minimum at 28 days.
ii. Tensile Strength (ASTM D638): 3,000 psi minimum at 14 days. Elongation at Break - 0.3 percent minimum.
iii. Flexural Strength (ASTM D790 - Modulus of Rupture): 3,700 psi minimum at 14 days.
iv. Shear Strength (ASTM D732): 2,800 psi minimum at 14 days.
v. Water Absorption (ASTM D570): 1.0 percent maximum at 7 days.
vi. Bond Strength (ASTM C882): 2,000 psi at 14 days moist cure.
vii. Color: Concrete grey.

3. Approved manufacturer's include:

a. Overhead applications: Sika Corporation, Lyndhurst, NJ - Sikadur Hi-mod LV 31; Master Builders, Inc., Cleveland, OH - Concresive 1438 or equal.
b. Sika Corporation, Lyndhurst, N.J. - Sikadur Hi-mod LV 32; Master Builders, Inc., Cleveland, OH - Concresive 1438 or equal.

D. Non-Shrink Precision Cement Grout, Non-Shrink Cement Grout, Non-Shrink Epoxy Grout and Polymer Modified mortar are included in Section 03600 GROUT.

E. Adhesive Anchors: As indicated on design drawings.

F. Crack Repair Epoxy Adhesive

1. General

a. Crack Repair Epoxy Adhesive shall be a two-component, solvent-free, moisture insensitive epoxy resin material suitable for crack grouting by injection or gravity feed. It shall be formulated for the specific size of opening or crack being injected.
b. All concrete surfaces containing potable water or water to be treated for potable use that are repaired by the epoxy adhesive injection system shall be coated with an acceptable epoxy coating approved by the FDA for use in contact with potable water.

2. Material

a. Properties of the cured material

i. Compressive Properties (ASTM D695): 10,000 psi minimum at 28 days.
ii. Tensile Strength (ASTM D638): 5,300 psi minimum at 14 days. Elongation at Break - 2 to 5 percent.
iii. Flexural Strength (ASTM D790 - Modulus of Rupture): 12,000 psi minimum at 14 days (gravity); 4,600 psi minimum at 14 days (injection)
iv. Shear Strength (ASTM D732): 3,700 psi minimum at 14 days.
v. Water Absorption (ASTM D570 - 2 hour boil): 1.5 percent maximum at 7 days.
vi. Bond Strength (ASTM C882): 2,400 psi at 2 days dry; 2,000 psi at 14 days dry plus 12 days moist.
vii. Effective Shrinkage (ASTM 883): Passes Test.

3. Approved manufacturer's include:

a. For standard applications: Sika Corporation, Lyndhurst, NJ - Sikadur Hi-Mod; Master Builders Inc., Cleveland, OH - Concressive 1380 or equal.
b. For very thin applications; Sika Corporation, Lyndhurst, NJ - Sikadur Hi-Mod LV; Master Builders Inc., Cleveland, OH - Concressive 1468 or equal.

PART 3 - EXECUTION

3.01 GENERAL

A. Cut, repair, reuse, demolish, excavate or otherwise modify parts of the existing structures or appurtenances, as indicated on the Drawings, specified herein, or necessary to permit completion of the Work. Finishes, joints, reinforcements, sealants, etc, are specified in respective Sections. All work shall comply with other requirements of this of Section and as shown on the Drawings.

B. All commercial products specified in this Section shall be stored, mixed and applied in strict compliance with the manufacturer's recommendations.

C. In all cases where concrete is repaired in the vicinity of an expansion joint or control joint the repairs shall be made to preserve the isolation between components on either side of the joint.

D. When drilling holes for dowels/bolts at new or existing concrete, drilling shall stop if rebar is encountered. As approved by the Engineer, the hole location shall be relocated to avoid rebar. Rebar shall not be cut without prior approval by the Engineer. Where possible, rebar locations shall be identified prior to drilling using "rebar locators" so that drilled hole locations may be adjusted to avoid rebar interference.

3.02 CONCRETE REMOVAL

A. Concrete designated to be removed to specific limits as shown on the Drawings or directed by the Engineer, shall be done by line drilling at limits followed by chipping or jack-hammering as appropriate in areas where concrete is to be taken out. Remove concrete in such a manner that surrounding concrete or existing reinforcing to be left in place and existing in place equipment is not damaged. Sawcutting at limits of concrete to be removed shall only be done if indicated on the Drawings, or after obtaining written approval from the Engineer.

B. Where existing reinforcing is exposed due to saw cutting/core drilling and no new material is to be placed on the sawcut surface, a coating or surface treatment of epoxy paste shall be applied to the entire cut surface to a thickness of 1/4-in.

C. In all cases where the joint between new concrete or grout and existing concrete will be exposed in the finished work, except as otherwise shown or specified, the edge of concrete removal shall be a 1-in deep saw cut on each exposed surface of the existing concrete.

D. Concrete specified to be left in place which is damaged shall be repaired by approved means to the satisfaction of the Engineer.

E. The Engineer may from time to time direct the Contractor to make additional repairs to existing concrete. These repairs shall be made as specified or by such other methods as may be appropriate.

3.03 CONNECTION SURFACE PREPARATION

A. Connection surfaces shall be prepared as specified below for concrete areas requiring patching, repairs or modifications as shown on the Drawings, specified herein, or as directed by the Engineer.

B. Remove all deteriorated materials, dirt, oil, grease, and all other bond inhibiting materials from the surface by dry mechanical means, i.e. - sandblasting, grinding, etc, as approved by the Engineer. Be sure the areas are not less than 1/2-in in depth. Irregular voids or surface stones need not be removed if they are sound, free of laitance, and firmly embedded into parent concrete, subject to the Engineer's final inspection.

C. If reinforcing steel is exposed, it must be mechanically cleaned to remove all contaminants, rust, etc, as approved by the Engineer. If half of the diameter of the reinforcing steel is exposed, chip out behind the steel. The distance chipped behind the steel shall be a minimum of 1/2-in. Reinforcing to be saved shall not be damaged during the demolition operation.

D. Reinforcing from existing demolished concrete which is shown to be incorporated in new concrete shall be cleaned by mechanical means to remove all loose material and products of corrosion before proceeding with the repair. It shall be cut, bent or lapped to new reinforcing as shown on the Drawings and provided with a minimum cover all around as specified on the contract drawings or 2-in.

E. The following are specific concrete surface preparation "methods" are to be used where called for on the Drawings, specified herein or as directed by the Engineer. All installation of anchors shall be according to the manufacturer’s recommendations.

1. Method A: After the existing concrete surface at connection has been roughened and cleaned, thoroughly moisten the existing surface with water. Brush on a 1/16-in layer of cement and water mixed to the consistency of a heavy paste. Immediately after application of cement paste, place new concrete or grout mixture as detailed on the Drawings.

2. Method B: After the existing concrete surface has been roughened and cleaned, apply epoxy bonding agent at connection surface. The field preparation and application of the epoxy bonding agent shall comply strictly with the manufacturer's recommendations. Place new concrete or grout mixture to limits shown on the Drawings within time constraints recommended by the manufacturer to ensure bond.

3. Method C: Drill a hole 1/4-in larger than the diameter of the dowel. The hole shall be blown clear of loose particles and dust just prior to installing epoxy. The drilled hole shall first be filled with epoxy paste, and then dowels/bolts shall be buttered with paste then inserted by tapping. Unless otherwise shown on the Drawings, deformed bars shall be drilled and set to a depth of ten bar diameters and smooth bars shall be drilled and set to a depth of fifteen bar diameters. If not noted on the Drawings, the Engineer will provide details regarding the size and spacing of dowels.

4. Method D: Combination of Method B and C.

5. Method E: Capsule anchor system shall be set in existing concrete by drilling holes to the required depth to develop the full tensile and shear strengths of the anchor material being used. The anchor bolts system shall be installed per the manufacturer's recommendation in holes sized as required. The anchor stud bolt, rebar or other embedment item shall be tipped with a double 45 degree chamfered point, securely fastened into the chuck of all rotary percussion hammer drill and drilled into the capsule filled hole.

3.04 GROUTING

A. Grouting shall be as specified in Section 03600.

3.05 CRACK REPAIR

A. Cracks on horizontal surfaces shall be repaired by gravity feeding crack sealant into cracks per manufacturer's recommendations. If cracks are less than 1/16-in in thickness they shall be pressure injected.

B. Cracks on vertical surfaces shall be repaired by pressure injecting crack sealant through valves sealed to surface with crack repair epoxy adhesive per manufacturer's recommendations.

END OF SECTION

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SECTION 03200
CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install all concrete reinforcement complete as shown on the Drawings and as specified herein.

B. Furnish only all deformed steel reinforcement required to be entirely built into concrete masonry unit construction.

1.02 RELATED WORK

A. Concrete Formwork is included in Section 03100.

B. Cast-in-place Concrete is included in Section 03300.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, shop drawings and product data showing materials of construction and details of installation for:

1. Reinforcing steel. Placement drawings shall conform to the recommendations of ACI 315. All reinforcement in a concrete placement shall be included on a single placement drawing or cross referenced to the pertinent main placement drawing. The main drawing shall include the additional reinforcement (around openings, at corners, etc) shown on the standard detail sheets. Bars to have special coatings and/or to be of special steel or special yield strength are to be clearly identified.

2. Bar bending details. The bars shall be referenced to the same identification marks shown on the placement drawings.

3. Schedule of all placements to contain synthetic reinforcing fibers. The amount of fibers per cubic yard to be used for each of the placements shall be noted on the schedule. The name of the manufacturer of the fibers and the product data shall be included with the submittal.

B. Submit Test Reports, in accordance with Section 01300, of each of the following items.

1. Certified copy of mill test on each steel proposed for use showing the physical properties of the steel and the chemical analysis.

2. Welder's certification. The certification shall be in accordance with AWS D1.4 when welding of reinforcement required.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

2. ASTM A184 - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.

3. ASTM A185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement

4. ASTM A496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement

5. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement

6. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

7. ASTM A616 - Standard Specification for Rail-Steel Deformed and Plain Bars for Concrete Reinforcement

8. ASTM A617 - Standard Specification for Axle-Steel Deformed and Plain Bars for Concrete Reinforcement

9. ASTM A706 - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.

10. ASTM A767 - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement

11. ASTM A775 - Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

12. ASTM A884 - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement.

13. ASTM A934 - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.

B. American Concrete Institute (ACI)

1. ACI 301 - Standard Specification for Structural Concrete

2. ACI 315 - Details and Detailing of Concrete Reinforcement.

3. ACI 318 - Building Code Requirements for Structural Concrete

4. ACI SP-66 - ACI Detailing Manual

C. Concrete Reinforcing Steel Institute (CRSI)

1. Manual of Standard Practice

D. American Welding Society (AWS)

1. AWS D1.4 - Structural Welding Code Reinforcing Steel

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

1.02 QUALITY ASSURANCE

E. Provide services of a manufacturer's representative, with at least 2 years experience in the use of the reinforcing fibers for a preconstruction meeting and assistance during the first placement of the material.

1.05 DELIVERY, HANDLING AND STORAGE

A. Reinforcing steel shall be substantially free from mill scale, rust, dirt, grease, or other foreign matter.

B. Reinforcing steel shall be shipped and stored with bars of the same size and shape fastened in bundles with durable tags, marked in a legible manner with waterproof markings showing the same "mark" designations as those shown on the submitted Placing Drawings.

C. Reinforcing steel shall be stored off the ground and kept free from dirt, oil, or other injurious contaminants.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials shall be new, of domestic manufacture and shall comply with the following material specifications.

B. Deformed Concrete Reinforcing Bars: ASTM A615, Grade 60 deformed bars.

C. Concrete Reinforcing Bars required on the Drawings to be Welded: ASTM A706.

D. Welded Steel Wire Fabric: ASTM A185. Provide in flat sheets.

E. Welded Deformed Steel Wire Fabric: ASTM A497.

F. Welded Plain Bar Mats: ASTM A704 and ASTM A615 Grade 60 plain bars.

G. Fabricated Deformed Steel Bar Mats: ASTM A184 and ASTM A615 Grade 60 deformed bars.

H. The following alternate materials are allowed:

1. ASTM A615 Grade 60 may be used for ASTM A706 provided the following requirements are satisfied:

a. The actual yield strength of the reinforcing steel based on mill tests shall not exceed the specified yield strength by more than 18,000 psi. Retests shall not exceed this value by more than an additional 3000 psi.

b. The ratio of the actual ultimate tensile strength to the actual tensile yield strength of the reinforcement shall not be less than 1.25.

c. The carbon equivalency (CE) of bars shall be 0.55 or less.

I. Reinforcing Steel Accessories

1. Plastic Protected Bar Supports: CRSI Bar Support Specifications, Class 1 - Maximum Protection.

2. Stainless Steel Protected Bar Supports: CRSI Bar Support Specifications, Class 2 - Moderate Protection.

3. Precast Concrete Block Bar Supports: CRSI Bar Support Specifications, Precast Blocks. Blocks shall have equal or greater strength than the surrounding concrete.

4. Steel Protected Bar Supports: #4 Steel Chairs with plastic or rubber tips.

J. Tie Wire

1. Tie Wires for Reinforcement shall be 16-gauge or heavier, black annealed wire or stranded wire.

2.02 FABRICATION

A. Fabrication of reinforcement shall be in compliance with the CRSI Manual of Standard Practice.

B. Bars shall be cold bent. Bars shall not be straightened or rebent.

C. Bars shall be bent around a revolving collar having a diameter of not less than that recommended by the ACI 318.

D. Bar ends that are to be butt spliced, placed through limited diameter holes in metal, or threaded, shall have the applicable end(s) saw-cut. Such ends shall terminate in flat surfaces within 1-1/2 degrees of a right angle to the axis of the bar.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Surface condition, bending, spacing and tolerances of placement of reinforcement shall comply with the CRSI Manual of Standard Practice. The Contractor shall be solely responsible for providing an adequate number of bars and maintaining the spacing and clearances shown on the Drawings.

B. Except as otherwise indicated on the Drawings, the minimum concrete cover of reinforcement shall be as follows:

1. Concrete cast against and permanently exposed to earth: 3-in

2. Concrete exposed to soil, water, sewage, sludge and/or weather: 2-in (Including bottom cover of slabs over water or sewage)

3. Concrete not exposed to soil, water, sewage, sludge and/or weather:

a. Slabs (top and bottom cover), walls, joists, shells and folded plate members – 3/4-in

b. Beams and columns (principal reinforcement, ties, spirals and stirrups) - 1-1/2-in

C. Reinforcement which will be exposed for a considerable length of time after being placed shall be coated with a heavy coat of neat cement slurry.

D. No reinforcing steel bars shall be welded either during fabrication or erection unless specifically shown on the Drawings or specified herein, or unless prior written approval has been obtained from the Engineer. All bars that have been welded, including tack welds, without such approval shall be immediately removed from the

work. When welding of reinforcement is approved or called for, it shall comply with AWS D1.4.

E. Reinforcing steel interfering with the location of other reinforcing steel, conduits or embedded items, may be moved within the specified tolerances or one bar diameter, whichever is greater. Greater displacement of bars to avoid interference shall only be made with the approval of the Engineer. Do not cut reinforcement to install inserts, conduits, mechanical openings or other items without the prior approval of the Engineer.

F. Securely support and tie reinforcing steel to prevent movement during concrete placement. Secure dowels in place before placing concrete.

G. Reinforcing steel bars shall not be field bent except where shown on the Drawings or specifically authorized in writing by the Engineer. If authorized, bars shall be cold-bent around the standard diameter spool specified in the CRSI. Do not heat bars. Closely inspect the reinforcing steel for breaks. If the reinforcing steel is damaged, replace, Cadweld or otherwise repair as directed by the Engineer. Do not bend reinforcement after it is embedded in concrete unless specifically shown otherwise on the Drawings.

3.02 REINFORCEMENT AROUND OPENINGS

A. Unless specific additional reinforcement around openings is shown on the Drawings, provide additional reinforcing steel on each side of the opening equivalent to one half of the cross-sectional area of the reinforcing steel interrupted by an opening. The bars shall have sufficient length to develop bond at each end beyond the opening or penetration.

3.03 SPLICING OF REINFORCEMENT

A. Splices designated as compression splices on the Drawings, unless otherwise noted, shall be 30 bar diameters, but not less than 12-in. The lap splice length for column vertical bars shall be based on the bar size in the column above.

B. Tension lap splices shall be provided at all laps in compliance with ACI 318. Splices in adjacent bars shall be staggered. Class A splices may be used when 50 percent or less of the bars are spliced within the required lap length. Class B splices shall be used at all other locations.

C. Splicing of reinforcing steel in concrete elements noted to be "tension members" on the Drawings shall be avoided whenever possible. However, if required for constructability, splices in the reinforcement subject to direct tension shall be welded to develop, in tension, at least 125 percent of the specified yield strength of the bar. Splices in adjacent bars shall be offset the distance of a Class B splice.

D. Install wire fabric in as long lengths as practicable. Wire fabric from rolls shall be rolled flat and firmly held in place. Splices in welded wire fabric shall be lapped in accordance with the requirements of ACI-318 but not less than 12-in. The spliced fabrics shall be tied together with wire ties spaced not more than 24-in on center and laced with wire of the same diameter as the welded wire fabric. Do not position laps midway between supporting beams, or directly over beams of continuous structures. Offset splices in adjacent widths to prevent continuous splices.

E. Mechanical reinforcing steel splicers shall be used only where shown on the Drawings. Splices in adjacent bars shall be offset by at least 30 bar diameters. Mechanical reinforcing splices are only to be used for special splice and dowel conditions approved by the Engineer.

3.04 ACCESSORIES

A. Determine, provide and install accessories such as chairs, chair bars and the like in sufficient quantities and strength to adequately support the reinforcement and prevent its displacement during the erection of the reinforcement and the placement of concrete.

B. Use precast concrete blocks where the reinforcing steel is to be supported over soil.

C. Stainless steel bar supports or steel chairs with stainless steel tips shall be used where the chairs are set on forms for a concrete surface that will be exposed to weather, high humidity, or liquid (including bottom of slabs over liquid containing areas). Use of galvanized or plastic tipped metal chairs is permissible in all other locations unless otherwise noted on the Drawings or specified herein.

D. Alternate methods of supporting top steel in slabs, such as steel channels supported on the bottom steel or vertical reinforcing steel fastened to the bottom and top mats, may be used if approved by the Engineer.

3.05 INSPECTION

A. In no case shall any reinforcing steel be covered with concrete until the installation of the reinforcement, including the size, spacing and position of the reinforcement has been observed by the Engineer and the Engineer's release to proceed with the concreting has been obtained. The Engineer shall be given ample prior notice of the readiness of placed reinforcement for observation. The forms shall be kept open until the Engineer has finished his/her observations of the reinforcing steel.

END OF SECTION

SECTION 03250
CONCRETE JOINTS AND JOINT ACCESSORIES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install accessories for concrete joints as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Concrete Formwork is included in Section 03100.

B. Concrete Reinforcement is included in Section 03200.

C. Cast-In-Place Concrete is included in Section 03300.

D. Concrete Finishes are included in Section 03350.

E. Grout is included in Section 03600.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, shop drawings and product data. Submittals shall include at least the following:

1. Premolded joint fillers: Product data including catalogue cut, technical data, storage requirements, installation requirements, location of use and conformity to ASTM standards.

2. Bond breaker: Product data including catalogue cut, technical data, storage requirements, installation requirements, location of use and conformity to ASTM standards.

3. Compressible joint filler: Product data including catalogue cut, technical data, storage requirements, installation requirements, location of use and conformity to ASTM standards.

4. Bonding agents: Product data including catalogue cut, technical data, storage requirements, product life, application requirements and conformity to ASTM standards.

B. Certifications

1. Certification that all materials used within the joint system is compatible with each other.

2. Certifications that materials used in the construction of joints are suitable for use in contact with potable water 30 days after installation.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM A675 - Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.

2. ASTM C881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

3. ASTM C1059 - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.

4. ASTM D1751 - Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction. (Nonextruding and Resilient Bituminous Types).

5. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

B. U.S. Army Corps of Engineers (CRD).

1. CRD C572 - Specification for Polyvinylchloride Waterstops.

C. Federal Specifications

1. FS SS-S-210A - Sealing Compound for Expansion Joints.

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

PART 2 - PRODUCTS

2.01 GENERAL

A. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

B. All materials used together in a given joint (bond breakers, backer rods, joint fillers, sealants, etc) shall be compatible with one another. Coordinate selection of suppliers and products to ensure compatibility. Under no circumstances shall asphaltic bond breakers or joint fillers be used in joints receiving sealant.

2.02 MATERIALS

A. Premolded Joint Filler

1. Premolded joint filler - structures. Self-expanding cork, premolded joint filler shall conform to ASTM D1752, Type III. The thickness shall be 3/4-in unless shown otherwise on the Drawings.

2. Premolded joint filler - sidewalk and roadway concrete pavements or where fiber joint filler is specifically noted on the Drawings. The joint filler shall be asphalt-impregnated fiber board conforming to ASTM D1751. Thickness shall be 3/4-in unless otherwise shown on the Drawings.

B. Bond Breaker

1. Bond breaker tape shall be an adhesive-backed glazed butyl or polyethylene tape which will satisfactorily adhere to the premolded joint filler or concrete surface as required. The tape shall be the same width as the joint.

2. Except where tape is specifically called for on the drawings, bond breaker for concrete shall be either bond breaker tape or a nonstaining type bond prevention coating such as Williams Tilt-up Compound by Williams

Distributors Inc.; Silcoseal 77, by SCA Construction Supply Division, Superior Concrete Accessories or equal.

C. Bonding Agent

1. Epoxy bonding agent shall be a two-component, solvent-free, moisture insensitive, epoxy resin material conforming to ASTM C881, Type II. The bonding agent shall be Sikadur 32 Hi-Mod by Sika Corporation of Lyndhurst, N.J.; Concresive Liquid (LPL) by Master Builders of Cleveland, OH or equal. Acrylic may be used if approved by the Engineer.

D. Compressible Joint Filler

1. The joint filler shall be a non-extruded watertight strip material use to fill expansion joints between structures. The material shall be capable of being compressed at least 40 percent for 70 hours at 68 degrees F and subsequently recovering at least 20 percent of its original thickness in the first 1/2 hour after unloading. Compressible Joint filler shall be Evasote 380 E.S.P, by E-Poxy Industries, Inc., Ravena, NY , Sikaflex 1a by Sika or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Construction Joints

1. Make construction joints only at locations shown on the Drawings or as approved by the Engineer. Any additional or relocation of construction joints proposed by the Contractor, must be submitted to the Engineer for written approval.

2. Additional or relocated joints should be located where they least impair strength of the member. In general, locate joints within the middle third of spans of slabs, beams and girders. However, if a beam intersects a girder at the joint, offset the joint a distance equal to twice the width of the member being connected. Locate joints in walls and columns at the underside of floors, slabs, beams or girders and at tops of footings or floor slabs. Do not locate joints between beams, girders, column capitals, or drop panels and the slabs above them. Do not locate joints between brackets or haunches and walls or columns supporting them.

3. All joints shall be perpendicular to main reinforcement. Continue reinforcing steel through the joint as indicated on the Drawings. When joints in beams are allowed, provide a shear key and inclined dowels as approved by the Engineer.

4. Provide sealant grooves for joint sealant where indicated on the Drawings.

5. At all construction joints and at concrete joints designated on the Drawings to be "roughened", uniformly roughen the surface of the concrete to a full amplitude (distance between high and low points or side to side) of approximately 1/4-in to expose a fresh face. Thoroughly clean joint surfaces of loose or weakened materials by water-blasting or sandblasting and prepare for bonding.

6. Provide waterstops in all wall and slab construction joints in liquid containment structures and at other locations shown on the Drawings.

7. Keyways shall not be used in construction joints unless specifically shown on the Drawings or approved by the Engineer.

END OF SECTION

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor and materials required and install cast-in-place concrete complete as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Concrete Formwork is included in Section 03100.

B. Concrete Reinforcement is included in Section 03200.

C. Concrete Joints and Joint Accessories are included in Section 03250.

D. Concrete Finishes are included in Section 03350.

E. Grout is included in Section 03600.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, shop drawings and product data including the following:

1. Sources of cement, pozzolan and aggregates.

2. Material Safety Data Sheets (MSDS) for all concrete components and admixtures.

3. Air-entraining admixture. Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations and conformity to ASTM standards.

4. Water-reducing admixture. Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations and conformity to ASTM standards.

5. High-range water-reducing admixture (plasticizer). Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations, retarding effect, slump range and conformity to ASTM standards. Identify proposed locations of use.

6. Concrete mix for each formulation of concrete proposed for use including constituent quantities per cubic yard, water-cementitious materials ratio, concrete slump, type and manufacturer of cement. Provide either a. or b. below for each mix proposed.

a. Standard deviation data for each proposed concrete mix based on statistical records.

b. The curve of water-cementitious materials ratio versus concrete cylinder strength for each formulation of concrete proposed based on laboratory tests. The cylinder strength shall be the average of the 28 day cylinder strength test results for each mix. Provide results of 7 and 14 day tests if available.

7. Sheet curing material. Product data including catalogue cut, technical data and conformity to ASTM standard.

8. Liquid curing compound. Product data including catalogue cut, technical data, storage requirements, product life, application rate and conformity to ASTM standards. Identify proposed locations of use.

B. Samples

1. Fine and coarse aggregates if requested by the Engineer.

C. Test Reports

1. Fine aggregates - sieve analysis, physical properties, and deleterious substance.

2. Coarse aggregates - sieve analysis, physical properties, and deleterious substances.

3. Cements - chemical analysis and physical properties for each type.

4. Pozzolans - chemical analysis and physical properties.

5. Proposed concrete mixes - compressive strength, slump and air content.

D. Certifications

1. Certify admixtures used in the same concrete mix are compatible with each other and the aggregates.

2. Certify admixtures are suitable for use in contact with potable water after 30 days of concrete curing.

3. Certify curing compound is suitable for use in contact with potable water after 30 days (non-toxic and free of taste or odor).

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

2. ASTM C33 - Standard Specification for Concrete Aggregates.

3. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

4. ASTM C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

5. ASTM C94 - Standard Specification for Ready-Mixed Concrete.

6. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete

7. ASTM C150 - Standard Specification for Portland Cement

8. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete

9. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

10. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

11. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.

12. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

13. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.

14. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

15. ASTM C1017 - Standard Specification for Chemical Admixtures for use in Producing Flowing Concrete.

B. American Concrete Institute (ACI).

1. ACI 304 - Guide for Measuring, Mixing, Transporting and Placing Concrete.

2. ACI 305 - Hot Weather Concreting.

3. ACI 306.1 - Standard Specification for Cold Weather Concreting.

4. ACI 318 - Building Code Requirements for Structural Concrete.

5. ACI 350 - Environmental Engineering Concrete Structures.

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

1.05 QUALITY ASSURANCE

A. Reinforced concrete shall comply with ACI 318, the recommendations of ACI 350R and other stated requirements, codes and standards. The most stringent requirement of the codes, standards and this Section shall apply when conflicts exist.

B. Only one source of cement and aggregates shall be used on any one structure. Concrete shall be uniform in color and appearance.

C. Well in advance of placing concrete, discuss with the Engineer the sources of individual materials and batched concrete proposed for use. Discuss placement methods, waterstops and curing. Propose methods of hot and cold weather concreting

as required. Prior to the placement of any concrete containing a high-range water-reducing admixture (plasticizer), the Contractor, accompanied by the plasticizer manufacturer, shall discuss the properties and techniques of batching and placing plasticized concrete.

D. If, during the progress of the work, it is impossible to secure concrete of the required workability and strength with the materials being furnished, the Engineer may order such changes in proportions or materials, or both, as may be necessary to secure the desired properties. All changes so ordered shall be made at the Contractor's expense.

E. If, during the progress of the work, the materials from the sources originally accepted change in characteristics, the Contractor shall, at his/her expense, make new acceptance tests of aggregates and establish new design mixes.

F. Testing of the following materials shall be furnished by Contractor to verify conformity with this Specification Section and the stated ASTM Standards.

1. Fine aggregates for conformity with ASTM C33 - sieve analysis, physical properties, and deleterious substances.

2. Coarse aggregates for conformity with ASTM C33 - sieve analysis, physical properties, and deleterious substances.

3. Cements for conformity with ASTM C150 - chemical analysis and physical properties.

4. Pozzolans for conformity with ASTM C618 - chemical analysis and physical properties.

5. Proposed concrete mix designs - compressive strength, slump and air content.

G. Field testing and inspection services will be provided by the Owner. The cost of such work, except as specifically stated otherwise, shall be paid by the Owner. Testing of the following items shall be by the Owner to verify conformity with this Specification Section.

1. Concrete placements - compressive strength (cylinders), compressive strength (cores), slump, and air content.

2. Other materials or products that may come under question.

H. All materials incorporated in the work shall conform to accepted samples.

1.06 DELIVERY, STORAGE AND HANDLING

A. Cement: Store in weather-tight buildings, bins or silos to provide protection from dampness and contamination and to minimize warehouse set.

B. Aggregate: Arrange and use stockpiles to avoid excessive segregation or contamination with other materials or with other sizes of like aggregates. Build stockpiles in successive horizontal layers not exceeding 3-ft in thickness. Complete each layer before the next is started. Do not use frozen or partially frozen aggregate.

C. Sand: Arrange and use stockpiles to avoid contamination. Allow sand to drain to uniform moisture content before using. Do not use frozen or partially frozen aggregates.

D. Admixtures: Store in closed containers to avoid contamination, evaporation or damage. Provide suitable agitating equipment to assure uniform dispersion of ingredients in admixture solutions which tend to separate. Protect liquid admixtures from freezing and other temperature changes which could adversely affect their characteristics.

E. Pozzolan: Store in weather-tight buildings, bins or silos to provide protection from dampness and contamination.

F. Sheet Curing Materials: Store in weather-tight buildings or off the ground and under cover.

G. Liquid Curing Compounds: Store in closed containers.

PART 2 - PRODUCTS

2.01 GENERAL

A. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

2.02 MATERIALS

A. Materials shall comply with this Section and any applicable State or local requirements.

B. Cement: Domestic portland cement complying with ASTM C150. Air entraining cements shall not be used. Cement brand shall be subject to approval by the Engineer and one brand shall be used throughout the Work. The following cement type(s) shall be used:

1. Class A,B,C,D Concrete - Type II with the addition of fly ash resulting in C_3A being below 5 percent of total cementitious content, Type III limited to 5 percent C_3A or Type V.

C. Fine Aggregate: Washed inert natural sand conforming to the requirements of ASTM C33.

D. Coarse Aggregate: Well-graded crushed stone or washed gravel conforming to the requirements of ASTM C33. Grading requirements shall be as listed in ASTM C33 Table 2 for the specified coarse aggregate size number. Limits of Deleterious Substances and Physical Property Requirements shall be as listed in ASTM C33 Table 3 for severe weathering regions. Size numbers for the concrete mixes shall be as shown in Table 1 herein.

E. Water: Potable water free from injurious amounts of oils, acids, alkalis, salts, organic matter, or other deleterious substances.

F. Admixtures: Admixtures shall be free of chlorides and alkalis (except for those attributable to water). When it is required to use more than one admixture in a concrete mix, the admixtures shall be from the same manufacturer. Admixtures shall be compatible with the concrete mix including other admixtures and shall be suitable for use in contact with potable water after 30 days of concrete curing.

1. Air-Entraining Admixture: The admixture shall comply with ASTM C260. Proportioning and mixing shall be in accordance with manufacturer's recommendations.

2. Water-Reducing Agent: The admixture shall comply with ASTM C494, Type A. Proportioning and mixing shall be in accordance with manufacturer's recommendations.

3. High-Range Water-Reducer (Plasticizer): The admixture shall comply with ASTM C494, Type F and shall result in non-segregating plasticized concrete with little bleeding and with the physical properties of low water/cement ratio concrete. The treated concrete shall be capable of maintaining its plastic state in excess of 2 hours. Proportioning and mixing shall be in accordance with manufacturer's recommendations. Where walls are 14" thick or less and the wall height exceeds 12 ft a mix including a plasticizer must be used.

4. Admixtures causing retarded or accelerated setting of concrete shall not be used without written approval from the Engineer. When allowed, the admixtures shall be retarding or accelerating water reducing or high range water reducing admixtures.

G. Pozzolan (Fly Ash): Pozzolan shall be Class C or Class F fly ash complying with ASTM C618 except the Loss on Ignition (LOI) shall be limited to 3 percent maximum.

H. Sheet Curing Materials. Waterproof paper, polyethylene film or white burlap-polyethylene sheeting all complying with ASTM C171.

I. Liquid Curing Compound. Liquid membrane-forming curing compound shall comply with the requirements of ASTM C309, Type 1-D (clear or translucent with fugitive dye) and shall contain no wax, paraffin, or oil. Curing compound shall be approved for use in contact with potable water after 30 days (non-toxic and free of taste or odor).

2.03 MIXES

A. Development of mix designs and testing shall be by an independent testing laboratory acceptable to the Engineer engaged by and at the expense of the Contractor.

B. Select proportions of ingredients to meet the design strength and materials limits specified in Table 1 and to produce concrete having proper placability, durability, strength, appearance and other required properties. Proportion ingredients to produce a homogenous mixture which will readily work into corners and angles of forms and

around reinforcement without permitting materials to segregate or allowing excessive free water to collect on the surface.

C. The design mix shall be based on standard deviation data of prior mixes with essentially the same proportions of the same constituents or, if such data is not available, be developed by a testing laboratory, acceptable to the Engineer, engaged by and at the expense of the Contractor. Acceptance of mixes based on standard deviation shall be based on the modification factors for standard deviation tests contained in ACI 318. The water content of the concrete mix, determined by laboratory testing, shall be based on a curve showing the relation between water cementitious ratio and 7 and 28 day compressive strengths of concrete made using the proposed materials. The curves shall be determined by four or more points, each representing an average value of at least three test specimens at each age. The curves shall have a range of values sufficient to yield the desired data, including the specified design strengths as modified below, without extrapolation. The water content of the concrete mixes to be used, as determined from the curve, shall correspond to strengths 16 percent greater than the specified design strengths. The resulting mix shall not conflict with the limiting values for maximum water cementitious ratio and net minimum cementitious content as specified in Table 1.

D. Compression Tests: Provide testing of the proposed concrete mix or mixes to demonstrate compliance with the specified design strength requirements in conformity with the above paragraph.

E. Entrained air, as measured by ASTM C231, shall be as shown in Table 1.

1. If the air-entraining agent proposed for use in the mix requires testing methods other than ASTM C231 to accurately determine air content, make special note of this requirement in the admixture submittal.

F. Slump of the concrete as measured by ASTM C143, shall be as shown in Table 1. If a high-range water-reducer (plasticizer) is used, the slump indicated shall be that measured before plasticizer is added. Plasticized concrete shall have a slump ranging from 7 to 10-in.

G. Proportion admixtures according to the manufacturer's recommendations. Two or more admixtures specified may be used in the same mix provided that the admixtures in combination retain full efficiency and have no deleterious effect on the concrete or on the properties of each other.

TABLE 1

CONCRETE MIX REQUIREMENTS

Class	Design Strength (1)	Cement (2)	Fine Aggregate (2)	Coarse Aggregate (3)	Cementitious Content (4)
A	2500	C150 Type II	C33	57	440 min.
B	3000	C150 Type II	C33	57	480 min.
C	4000	C150 Type II	C33	57	560 min.
D	5000	C150 Type II	C33	57	600 min.

Class	W/Cm Ratio (5)	Fly Ash	AE Range (6)	WR (7)	HRWR (8)	Slump Range Inches
A	0.62 max.	--	3.5 to 5	Yes	*	1-4
B	0.54 max.	--	3.5 to 5	Yes	*	1-3
C	0.44 max.	25% max	3.5 to 5	Yes	*	3-5
D	0.40 max.	--	3.5 to 5	Yes	*	3-5

NOTES:
(1) Minimum compressive strength in psi at 28 days
(2) ASTM designation
(3) Size Number in ASTM C33
(4) Cementitious content in lbs/cu yd
(5) W/Cm is Water-Cementitious ratio by weight
(6) AE is percent air-entrainment
(7) WR is water-reducer admixture
(8) HRWR is high-range water-reducer admixture
* HRWR used at contractor's option except where walls are 14" thick or less and the wall height exceeds 12 ft a mix including a plasticizer must be used.

PART 3 - EXECUTION

3.01 MEASURING MATERIALS

A. Concrete shall be composed of portland cement, fine aggregate, coarse aggregate, water and admixtures as specified and shall be produced by a plant acceptable to the Engineer. All constituents, including admixtures, shall be batched at the plant except a high-range water-reducer may also be added in the field.

B. Measure materials for batching concrete by weighing in conformity with and within the tolerances given in ASTM C94 except as otherwise specified. Scales shall have been certified by the local Sealer of Weights and Measures within 1 year of use.

C. Measure the amount of free water in fine aggregates within 0.3 percent with a moisture meter. Compensate for varying moisture contents of fine aggregates. Record the number of gallons of water as-batched on printed batching tickets.

D. Admixtures shall be dispensed either manually using calibrated containers or measuring tanks, or by means of an automatic dispenser approved by the manufacturer of the specific admixture.

1. Charge air-entraining and chemical admixtures into the mixer as a solution using an automatic dispenser or similar metering device.

2. Inject multiple admixtures separately during the batching sequence.

3.02 MIXING AND TRANSPORTING

A. Batch plants shall have a current NRMCA Certification or equal.

B. Concrete shall be ready-mixed concrete produced by equipment acceptable to the Engineer. No hand-mixing will be permitted. Clean each transit mix truck drum and reverse drum rotation before the truck proceeds under the batching plant. Equip each transit-mix truck with a continuous, nonreversible, revolution counter showing the number of revolutions at mixing speeds.

C. Ready-mix concrete shall be transported to the site in watertight agitator or mixer trucks loaded not in excess of their rated capacities as stated on the name plate.

D. Keep the water tank valve on each transit truck locked at all times. Any addition of water above the appropriate W/Cm ratio must be directed by the Engineer. Added water shall be incorporated by additional mixing of at least 35 revolutions. All added water shall be metered and the amount of water added shall be shown on each delivery ticket.

E. All central plant and rolling stock equipment and methods shall comply with ACI 318 and ASTM C94.

F. Select equipment of size and design to ensure continuous flow of concrete at the delivery end. Metal or metal-lined non-aluminum discharge chutes shall be used and shall have slopes not exceeding 1 vertical to 2 horizontal and not less than 1 vertical

to 3 horizontal. Chutes more than 20-ft long and chutes not meeting slope requirements may be used if concrete is discharged into a hopper before distribution.

G. Retempering (mixing with or without additional cement, aggregate, or water) of concrete or mortar which has reached initial set will not be permitted.

H. Handle concrete from mixer to placement as quickly as practicable while providing concrete of required quality in the placement area. Dispatch trucks from the batching plant so they arrive at the work site just before the concrete is required, thus avoiding excessive mixing of concrete while waiting or delays in placing successive layers of concrete in the forms.

I. Furnish a delivery ticket for ready mixed concrete to the Engineer as each truck arrives. Each ticket shall provide a printed record of the weight of cement and each aggregate as batched individually. Use the type of indicator that returns for zero punch or returns to zero after a batch is discharged. Clearly indicate the weight of fine and coarse aggregate, cement and water in each batch, the quantity delivered, the time any water is added, and the numerical sequence of the delivery. Show the time of day batched and time of discharge from the truck. Indicate the number of revolutions of the truck mixer.

J. Temperature and Mixing Time Control

1. In cold weather, do not allow the as-mixed temperature of the concrete and concrete temperatures at the time of placement in the forms to drop below 40 degrees F.

2. If water or aggregate has been heated, combine water with aggregate in the mixer before cement is added. Do not add cement to mixtures of water and aggregate when the temperature of the mixture is greater than 90 degrees F.

3. In hot weather, cool ingredients before mixing to maintain temperature of the concrete below the maximum placing temperature of 90 degrees F. If necessary, substitute well-crushed ice for all or part of the mixing water.

4. The maximum time interval between the addition of mixing water and/or cement to the batch and the placing of concrete in the forms shall not exceed the values shown in Table 2.

TABLE 2

MAXIMUM TIME TO DISCHARGE OF CONCRETE

Air or Concrete Temperature (whichever is higher)	Maximum Time
80 to 90 Degree F (27 to 32 Degree C)	45 minutes
70 to 79 Degree F (21 to 26 Degree C)	60 minutes
40 to 69 Degree F (5 to 20 Degree C)	90 minutes

If an approved high-range water-reducer (plasticizer) is used to produce plasticized concrete, the maximum time interval shall not exceed 90 minutes.

3.03 CONCRETE APPEARANCE

A. Concrete mix showing either poor cohesion or poor coating of the coarse aggregate with paste shall be remixed. If this does not correct the condition, the concrete shall be rejected. If the slump is within the allowable limit, but excessive bleeding, poor workability, or poor finishability are observed, changes in the concrete mix shall be obtained only by adjusting one or more of the following:

1. The gradation of aggregate.
2. The proportion of fine and coarse aggregate.
3. The percentage of entrained air, within the allowable limits.

B. Concrete for the work shall provide a homogeneous structure which, when hardened, will have the required strength, durability and appearance. Mixtures and workmanship shall be such that concrete surfaces, when exposed, will require no finishing. When concrete surfaces are stripped, the concrete, when viewed in good lighting from 10-ft away, shall be pleasing in appearance, and at 20-ft shall show no visible defects.

3.04 PLACING AND COMPACTING

A. Placing

1. Verify that all formwork completely encloses concrete to be placed and is securely braced prior to concrete placement. Remove ice, excess water, dirt and other foreign materials from forms. Confirm that reinforcement and other embedded items are securely in place. Have a competent workman at the location of the placement who can assure that reinforcing steel and embedded

items remain in designated locations while concrete is being placed. Sprinkle semi-porous subgrades or forms to eliminate suction of water from the mix. Seal extremely porous subgrades in an approved manner.

2. Deposit concrete as near its final position as possible to avoid segregation due to rehandling or flowing. Place concrete continuously at a rate which ensures the concrete is being integrated with fresh plastic concrete. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials or on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within the section. If the section cannot be placed continuously, place construction joints as specified or as approved.

3. Pumping of concrete will be permitted. Use a mix design and aggregate sizes suitable for pumping and submit for approval.

4. Remove temporary spreaders from forms when the spreader is no longer useful. Temporary spreaders may remain embedded in concrete only when made of galvanized metal or concrete and if prior approval has been obtained.

5. Do not place concrete for supported elements until concrete previously placed in the supporting element (columns, slabs and/or walls) has reached adequate strength.

6. Where surface mortar is to form the base of a finish, especially surfaces designated to be painted, work coarse aggregate back from forms with a suitable tool to bring the full surface of the mortar against the form. Prevent the formation of excessive surface voids.

7. Slabs

    a. After suitable bulkheads, screeds and jointing materials have been positioned, the concrete shall be placed continuously between construction joints beginning at a bulkhead, edge form, or corner. Each batch shall be placed into the edge of the previously placed concrete to avoid stone pockets and segregation.

    b. Avoid delays in casting. If there is a delay in casting, the concrete placed after the delay shall be thoroughly spaded and consolidated at the edge of that previously placed to avoid cold joints. Concrete shall then be brought to correct level and struck off with a straightedge. Bullfloats or darbies shall be used to smooth the surface, leaving it free of humps or hollows.

    c. Where slabs are to be placed integrally with the walls below them, place the walls and compact as specified. Allow 1 hour to pass between placement of the wall and the overlying slab to permit consolidation of the wall concrete. Keep the top surface of the wall moist so as to prevent cold joints.

8. Formed Concrete

a. Place concrete in forms using tremie tubes and taking care to prevent segregation. Bottom of tremie tubes shall preferably be in contact with the concrete already placed. Do not permit concrete to drop freely more than 4-ft. Place concrete for walls in 12 to 24-in lifts, keeping the surface horizontal. If plasticized concrete is used, the maximum lift thickness may be increased to 7-ft and the maximum free fall of concrete shall not exceed 15-ft.

B. Compacting

1. Consolidate concrete by vibration, puddling, spading, rodding or forking so that concrete is thoroughly worked around reinforcement, embedded items and openings and into corners of forms. Puddling, spading, etc, shall be continuously performed along with vibration of the placement to eliminate air or stone pockets which may cause honeycombing, pitting or planes of weakness.

2. All concrete shall be placed and compacted with mechanical vibrators. The number, type and size of the units shall be approved by the Engineer in advance of placing operations. No concrete shall be ordered until sufficient approved vibrators (including standby units in working order) are on the job.

3. A minimum frequency of 7000 rpm is required for mechanical vibrators. Insert vibrators and withdraw at points from 18 to 30-in apart. At each insertion, vibrate sufficiently to consolidate concrete, generally from 5 to 15 seconds. Do not over vibrate so as to segregate. Keep a spare vibrator on the site during concrete placing operations.

4. Concrete Slabs: Concrete for slabs less than 8-in thick shall be consolidated with vibrating screeds; slabs 8 to 12-in thick shall be compacted with internal vibrators and (optionally) with vibrating screeds. Vibrators shall always be placed into concrete vertically and shall not be laid horizontally or laid over.

5. Walls and Columns: Internal vibrators (rather than form vibrators) shall be used unless otherwise approved by the Engineer. In general, for each vibrator needed to melt down the batch at the point of discharge, one or more additional vibrators must be used to densify, homogenize and perfect the surface. The vibrators shall be inserted vertically at regular intervals, through the fresh concrete and slightly into the previous lift, if any.

6. Amount of Vibration: Vibrators are to be used to consolidate properly placed concrete but shall not be used to move or transport concrete in the forms. Vibration shall continue until:

   a. Frequency returns to normal.
   b. Surface appears liquefied, flattened and glistening.
   c. Trapped air ceases to rise.
   d. Coarse aggregate has blended into surface, but has not disappeared.

3.05 CURING AND PROTECTION

A. Protect all concrete work against injury from the elements and defacements of any nature during construction operations.

B. Curing Methods

1. Curing Methods for Concrete Surfaces: Cure concrete to retain moisture and maintain specified temperature at the surface for a minimum of 7 days after placement. Curing methods to be used are as follows:

   a. Water Curing: Keep entire concrete surface wet by ponding, continuous sprinkling or covered with saturated burlap. Begin wet cure as soon as concrete attains an initial set and maintain wet cure 24 hours a day.
   b. Sheet Material Curing: Cover entire surface with sheet material. Securely anchor sheeting to prevent wind and air from lifting the sheeting or entrapping air under the sheet. Place and secure sheet as soon as initial concrete set occurs.
   c. Liquid Membrane Curing: Apply over the entire concrete surface except for surfaces to receive additional concrete. Curing compound shall NOT be placed on any concrete surface where additional concrete is to be placed, where concrete sealers or surface coatings are to be used, or where the concrete finish requires an integral floor product. Curing compound shall be applied as soon as the free water on the surface has disappeared and no water sheen is visible, but not after the concrete is dry or when the curing compound can be absorbed into the concrete. Application shall be in compliance with the manufacturer's recommendations.

2. Specified applications of curing methods.

   a. Slabs for Water Containment Structures: Water curing only.
   b. Slabs on Grade and Footings (not used to contain water): Water curing, sheet material curing or liquid membrane curing.
   c. Structural Slabs (other than water containment): Water curing or liquid membrane curing.
   d. Horizontal Surfaces which will Receive Additional Concrete, Coatings, Grout or Other Material that Requires Bond to the substrate: Water curing.
   e. Formed Surfaces: None if nonabsorbent forms are left in place 7 days. Water cure if absorbent forms are used. Sheet cured or liquid membrane cured if forms are removed prior to 7 days. Exposed horizontal surfaces of formed walls or columns shall be water cured for 7 days or until next placement of concrete is made.
   f. Concrete Joints: Water cured or sheet material cured.

C. Finished surfaces and slabs shall be protected from the direct rays of the sun to prevent checking and crazing.

D. Cold Weather Concreting:

1. "Cold weather" is defined as a period when for more than 3 successive days, the average daily outdoor temperature drops below 40 degrees F. The average daily temperature shall be calculated as the average of the highest and the lowest temperature during the period from midnight to midnight.

2. Cold weather concreting shall conform to ACI 306.1 and the additional requirements specified herein. Temperatures at the concrete placement shall be recorded at 12 hour intervals (minimum).

3. Discuss a cold weather work plan with the Engineer. The discussion shall encompass the methods and procedures proposed for use during cold weather including the production, transportation, placement, protection, curing and temperature monitoring of the concrete. The procedures to be implemented upon abrupt changes in weather conditions or equipment failures shall also be discussed. Cold weather concreting shall not begin until the work plan is acceptable to the Engineer.

4. During periods of cold weather, concrete shall be protected to provide continuous warm, moist curing (with supplementary heat when required) for a total of at least 350 degree-days of curing.

   a. Degree-days are defined as the total number of 24 hour periods multiplied by the weighted average daily air temperature at the surface of the concrete (eg: 5 days at an average 70 degrees F = 350 degree-days).
   b. To calculate the weighted average daily air temperature, sum hourly measurements of the air temperature in the shade at the surface of the concrete taking any measurement less than 50 degrees F as 0 degrees F. Divide the sum thus calculated by 24 to obtain the weighted average temperature for that day.

5. Salt, manure or other chemicals shall not be used for protection.

6. The protection period for concrete being water cured shall not be terminated during cold weather until at least 24 hours after water curing has been terminated.

E. Hot Weather Concreting

1. "Hot weather" is defined as any combination of high air temperatures, low relative humidity and wind velocity which produces a rate of evaporation estimated in accordance with ACI 305R, approaching or exceeding 0.2 lbs/sqft/hr).

2. Concrete placed during hot weather, shall be batched, delivered, placed, cured and protected in compliance with the recommendations of ACI 305R and the additional requirements specified herein.

a. Temperature of concrete being placed shall not exceed 90 degrees F and every effort shall be made to maintain a uniform concrete mix temperature below this level. The temperature of the concrete shall be such that it will cause no difficulties from loss of slump, flash set or cold joints.

b. All necessary precautions shall be taken to promptly deliver, to promptly place the concrete upon its arrival at the job and to provide vibration immediately after placement.

c. The Engineer may direct the Contractor to immediately cover plastic concrete with sheet material.

3. Discuss with the Engineer a work plan describing the methods and procedures proposed to use for concrete placement and curing during hot weather periods. Hot weather concreting shall not begin until the work plan is acceptable to the Engineer.

3.06 REMOVAL OF FORMS

A. Except as otherwise specifically authorized by the Engineer, forms shall not be removed before the concrete has attained a strength of at least 30 percent of its specified design strength, nor before reaching the following number of day-degrees of curing (whichever is the longer):

TABLE 3

MINIMUM TIME TO FORM REMOVAL

Forms for	Degree Days
Beams and slabs	500
Walls and vertical surfaces	100

(See definition of degree-days in Paragraph 3.05D above).

B. Shores shall not be removed until the concrete has attained at least 70 percent of its specified design strength and also sufficient strength to support safely its own weight and construction live loads.

3.07 INSPECTION AND FIELD TESTING

A. The batching, mixing, transporting, placing and curing of concrete shall be subject to the inspection of the Engineer at all times. The Contractor shall advise the Engineer of his/her readiness to proceed at least 24 hours prior to each concrete placement. The Engineer will inspect the preparations for concreting including the preparation of previously placed concrete, the reinforcing steel and the alignment, cleanliness and

tightness of formwork. No placement shall be made without the inspection and acceptance of the Engineer.

B. Sets of field control cylinder specimens will be taken by the Engineer (or inspector) during the progress of the work, in compliance with ASTM C31. The number of sets of concrete test cylinders taken of each class of concrete placed each day shall not be less than one set per day, nor less than one set for each 150 cu yds of concrete nor less than one set for each 5,000 sq ft of surface area for slabs or walls.

1. A "set" of test cylinders consists of four cylinders: one to be tested at 7 days and two to be tested and their strengths averaged at 28 days. The fourth may be used for a special test at 3 days or to verify strength after 28 days if 28 day test results are low.

2. When the average 28 day compressive strength of the cylinders in any set falls below the specified design strength or below proportional minimum 7 day strengths (where proper relation between seven and 28 day strengths have been established by tests), proportions, water content, or temperature conditions shall be changed to achieve the required strengths.

C. Cooperate in the making of tests by allowing free access to the work for the selection of samples, providing an insulated closed curing box for specimens, affording protection to the specimens against injury or loss through the operations and furnish material and labor required for the purpose of taking concrete cylinder samples. All shipping of specimens will be paid for by the Owner. Curing boxes shall be acceptable to the Engineer.

D. Slump tests will be made in the field immediately prior to placing the concrete. Such tests shall be made in accordance with ASTM C143. If the slump is greater the specified range, the concrete shall be rejected.

E. Air Content: Test for air content shall be made on fresh concrete samples. Air content for concrete made of ordinary aggregates having low absorption shall be made in compliance with either the pressure method complying with ASTM C231 or by the volumetric method complying with ASTM C173.

F. The Engineer may have cores taken from any questionable area in the concrete work such as construction joints and other locations as required for determination of concrete quality. The results of tests on such cores shall be the basis for acceptance, rejection or determining the continuation of concrete work.

G. Cooperate in obtaining cores by allowing free access to the work and permitting the use of ladders, scaffolding and such incidental equipment as may be required. Repair all core holes. The work of cutting and testing the cores will be at the expense of the Owner.

H. See Specification Section 03900 for Leak Testing.

3.08 FAILURE TO MEET REQUIREMENTS

A. Should the strengths shown by the test specimens made and tested in compliance with the previous provisions fall below the values given in Table 1, the Engineer shall have the right to require changes in proportions outlined to apply to the remainder of the work. Furthermore, the Engineer shall have the right to require additional curing on those portions of the structure represented by the test specimens which failed. The cost of such additional curing shall be at the Contractor's expense. In the event that such additional curing does not give the strength required, as evidenced by core and/or load tests, the Engineer shall have the right to require strengthening or replacement of those portions of the structure which fail to develop the required strength. The cost of all such core borings and/or load tests and any strengthening or concrete replacement required because strengths of test specimens are below that specified, shall be entirely at the expense of the Contractor. In such cases of failure to meet strength requirements the Contractor and Engineer shall confer to determine what adjustment, if any, can be made in compliance with Sections titled "Strength" and "Failure to Meet Strength Requirements" of ASTM C94. The "purchaser" referred to in ASTM C94 is the Contractor in this Section.

B. When the tests on control specimens of concrete fall below the specified strength, the Engineer will permit check tests for strengths to be made by means of typical cores drilled from the structure in compliance with ASTM C42 and C39. In the case of cores not indicating adequate strength, the Engineer, in addition to other recourses, may require, at the Contractor's expense, load tests on any one of the slabs, beams, piles, caps, and columns in which such concrete was used. Tests need not be made until concrete has aged 60 days.

C. Should the strength of test cylinders fall below 60 percent of the required minimum 28 day strength, the concrete shall be rejected and shall be removed and replaced.

3.09 PATCHING AND REPAIRS

A. It is the intent of this Section to require quality work including adequate forming, proper mixture and placement of concrete and curing so completed concrete surfaces will require no patching.

B. Defective concrete and honeycombed areas as determined by the Engineer shall be repaired as specified by the Engineer.

C. As soon as the forms have been stripped and the concrete surfaces exposed, fins and other projections shall be removed; recesses left by the removal of form ties shall be filled; and surface defects which do not impair structural strength shall be repaired. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete, to approval of the Engineer.

D. Immediately after removal of forms remove plugs and break off metal ties as required by Section 03100. Promptly fill holes upon stripping as follows: Moisten the hole with water, followed by a 1/16-in brush coat of neat cement slurry mixed to the consistency of a heavy paste. Immediately plug the hole with a 1 to 1.5 mixture of

cement and concrete sand mixed slightly damp to the touch (just short of "balling"). Hammer the grout into the hole until dense, and an excess of paste appears on the surface in the form of a spiderweb. Trowel smooth with heavy pressure. Avoid burnishing.

E. When patching exposed surfaces the same source of cement and sand as used in the parent concrete shall be employed. Adjust color if necessary by addition of proper amounts of white cement. Rub lightly with a fine Carborundum stone at an age of 1 to 5 days if necessary to bring the surface down with the parent concrete. Exercise care to avoid damaging or staining the virgin skin of the surrounding parent concrete. Wash thoroughly to remove all rubbed matter.

3.10 SCHEDULE

A. The following (Table 4) are the general applications for the various concrete classes and design strengths:

TABLE 4

CONCRETE SCHEDULE

Class	Design Strength (psi)	Description
A	2,500	Concrete fill and duct encasement
B	3,000	Concrete overlay slabs and pavements
C	4,000	Walls, slabs on grade, suspended slab and beam systems, columns, grade beams and all other structural concrete
D	5,000	Prestressed concrete

END OF SECTION

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SECTION 03350
CONCRETE FINISHING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and finish cast-in-place concrete surfaces as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Concrete Formwork is included in Section 03100.

B. Cast-In-Place Concrete is included in Section 03300.

C. Grout is included in Section 03600.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, shop drawings and product data showing materials of construction and details of installation for:

1. Concrete sealer. Confirmation that the sealer is compatible with additionally applied coatings shall also be submitted.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM C33 - Standard Specification for Concrete Aggregates.

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

1.05 QUALITY ASSURANCE

A. Finishes

1. For concrete which will receive additional applied finishes or materials, the surface finish specified is required for the proper application of the specified manufacturer's products. Where alternate products are approved for use, determine if changes in finishes are required and provide the proper finishes to receive these products.

2. Changes in finishes made to accommodate products different from those specified shall be performed at no additional cost to the Owner. Submit the proposed new finishes and their construction methods to the Engineer for approval.

3. Services of Manufacturer's Representative

a. Make available at no extra cost to the Owner, upon 72 hours notification, the services of a qualified field representative of the manufacturer of curing compound, sealer or hardener to instruct the

user on the proper application of the product under prevailing job conditions.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Chemical hardener shall be Lapidolith by Sonneborn; Hornolith by A.C. Horn; Penalith by W.R. Meadows or equal fluosilicate base material.

B. Concrete sealer shall be "Kure-N-Seal", by Sonneborn, Minneapolis, MN or equal.

PART 3 - EXECUTION

3.01 FORMED SURFACES

A. Forms shall not be removed before the requirements of Section 03300, have been satisfied.

B. Exercise care to prevent damaging edges or obliterating the lines of chamfers, rustications or corners when removing the forms or performing any other work adjacent thereto.

C. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete.

D. Rough-Form Finish

1. Immediately after stripping forms and before concrete has changed color, carefully remove all fins and projections.

2. Promptly fill holes left by tie cones and defects as specified in Section 03300.

E. Rubbed Finish

1. Immediately upon stripping forms and before concrete has changed color, carefully remove all fins. While the wall is still damp apply a thin coat of medium consistency neat cement slurry by means of bristle brushes to provide a bonding coat within all pits, air holes or blemishes in the parent concrete. Avoid coating large areas with the slurry at one time.

2. Before the slurry has dried or changed color, apply a dry (almost crumbly) grout proportioned by volume and consisting of 1 part cement to 1-1/2 parts of clean masonry sand having a fineness modulus of approximately 2.3 and complying with the gradation requirements of ASTM C33 for such a material. Grout shall be uniformly applied by means of damp pads of coarse burlap approximately 6-in square used as a float. Scrub grout into the pits and air holes to provide a dense mortar in all imperfections.

3. Allow the mortar to partially harden for 1 or 2 hours depending upon the weather. If the air is hot and dry, keep the wall damp during this period using a fine, fog spray. When the grout has hardened sufficiently so it can be scraped from the surface with the edge of a steel trowel without damaging the grout in the small pits or holes, cut off all that can be removed with a trowel.

(Note: Grout allowed to remain on the wall too long will harden and will be difficult to remove.)

4. Allow the surface to dry thoroughly and rub it vigorously with clean dry burlap to completely remove any dried grout. No visible film of grout shall remain after this rubbing. The entire cleaning operation for any area must be completed the day it is started. Do not leave grout on surfaces overnight. Allow sufficient time for grout to dry after it has been cutoff with the trowel so it can be wiped off clean with the burlap.

5. On the day following the repair of pits, air holes and blemishes, the walls shall again be wiped off clean with dry, used pieces of burlap containing old hardened mortar which will act as a mild abrasive. After this treatment, there shall be no built-up film remaining on the parent surface. If, however, such a film is present, a fine abrasive stone shall be used to remove all such material without breaking through the surface film of the original concrete. Such scrubbing shall be light and sufficient only to remove excess material without changing the texture of the concrete.

6. A thorough wash-down with stiff bristle brushes shall follow the final bagging or stoning operation. No extraneous materials shall remain on the surface of the wall. The wall shall be sprayed with a fine fog spray periodically to maintain a continually damp condition for at least 3 days after the application of the repair grout.

F. Abrasive Blast Finish

1. Coordinate with Rubbed Finish application. Do not begin until Rubbed Finish operation is complete or before concrete has reached minimum 7-day strength. The Rubbed Finish application may be deleted by the Engineer if the unfinished concrete surface is of superior quality. Apply the abrasive blast finish only where indicated on Drawings.

2. Prepare a sample area of minimum 4-ft high by 16-ft wide Blast Finish as directed by Engineer on a portion of new wall construction which will not be exposed in the final work. Sample area shall contain a variety of finishes obtained with different nozzles, nozzle pressures, grit materials and blasting techniques for selection by Engineer. Final accepted sample shall remain exposed until completion of all Blast Finish operations.

3. Blast finish operation shall meet all regulatory agency requirements. Blast Finish contractor shall be responsible for obtaining all required permits and/or licenses.

4. Perform abrasive blast finishing in as continuous an operation as possible, utilizing the same work crew to maintain continuity of finish on each surface or area of work. Maintain patterns or variances in depths of blast as present on the accepted sample.

5. Use an abrasive grit of proper type and gradation as well as equipment and technique to expose aggregate and surrounding matrix surfaces as follows:

   a. Medium: Generally expose coarse aggregate - 1/4-in to 3/8-in reveal.

6. Abrasive blast corners and edge of patterns carefully, using back-up boards, to maintain uniform corner or edge line. Determine type of nozzle, nozzle pressure and blasting techniques required to match Architect's samples.

7. Upon completion of the Blast Finish operation, thoroughly flush finished surfaces with clean clear water to remove residual dust and grit. Allow to air dry until curing of concrete is complete.

8. After the concrete has cured for a minimum of 28 days, apply a clear acrylic sealer as directed by manufacturer.

3.02 FLOORS AND SLABS

A. Floated Finish

1. Hand Floating

a. In lieu of power floating, small areas may be compacted by hand floating. The dry cement/sand shake previously specified shall be used unless specifically eliminated by the Engineer. Screed the floors and slabs with straightedges to the established grades shown on the Drawings. While the concrete is still green, but sufficiently hardened to support a finisher and kneeboards with no more than 1/4-in indentation, wood float to a true, even plane with no coarse aggregate visible. Use sufficient pressure on the wood floats to bring moisture to the surface.

2. Finishing Tolerances

a. Level floors and slabs to a tolerance of plus or minus 1/8-in when checked with a 10-ft straightedge placed anywhere on the slab in any direction. Where drains occur, pitch floors to drains such that there are no low spots left undrained. Failure to meet either of the above requirements shall be cause for removal, grinding, or other correction as directed by the Engineer.

B. Broom Finish

1. Screed slabs with straightedges to the established grades indicated on the Drawings. When the concrete has stiffened sufficiently to maintain small surface indentations, draw a stiff bristle broom lightly across the surface in the direction of drainage, or, in the case of walks and stairs, perpendicular to the direction of traffic to provide a non-slip surface.

C. Steel Trowel Finish

1. Finish concrete as specified in Paragraph 3.03 and 3.04. Then, hand steel trowel to a perfectly smooth hard even finish free from high or low spots or other defects.

3.03 APPROVAL OF FINISHES

A. All concrete surfaces, when finished, will be inspected by the Engineer.

B. Surfaces which, in the opinion of the Engineer, are unsatisfactory shall be refinished or reworked.

C. After finishing horizontal surfaces, regardless of the finishing procedure specified, the concrete shall be cured in compliance with Section 03300 unless otherwise directed by the Engineer.

3.04 SCHEDULE OF FINISHES

A. Concrete shall be finished as specified either to remain as natural concrete to receive an additional applied finish or material under another section.

B. Concrete for the following conditions shall be finished as noted on the Drawings and as further specified herein:

1. Concrete Not Exposed to View and Not Scheduled to Receive an Additional Applied Finish or Material: Rough-form finish. See Paragraph 3.01D above.

2. Exterior Vertical Concrete Above Grade Exposed to View: Rubbed finish. See Paragraph 3.01E above.

3. Interior Vertical Concrete Exposed to View Except in Water Containment Areas: Rubbed finish. See Paragraph 3.01E above.

4. Interior and Exterior Underside of Concrete Exposed to View: Rubbed finish. See Paragraph 3.01E above.

5. Interior or Exterior Horizontal Concrete not Requiring Floor Hardener or Sealer: Floated finish. See Paragraph 3.02A above.

6. Concrete for Exterior Walks, Interior and Exterior Stairs: Broomed finish perpendicular to direction of traffic. See Paragraph 3.02B above.

7. Concrete Slabs On Which Process Liquids Flow or In Contact with Sludge: Steel trowel finish. See Paragraph 3.02C above.

END OF SECTION

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SECTION 03600
GROUT

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install grout complete as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Formwork is included in Section 03100.

B. Concrete Reinforcement is included in Section 03200.

C. Concrete Joints and Joint Accessories are included in Section 03350.

D. Cast-in-Place Concrete is included in Section 03300.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, shop drawings and product data showing materials of construction and details of installation for:

1. Commercially manufactured nonshrink cementitous grout. The submittal shall include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to required ASTM standards and Material Safety Data Sheet.

2. Commercially manufactured nonshrink epoxy grout. The submittal shall include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to required ASTM standards and Material Safety Data Sheet.

3. Cement grout. The submittal shall include the type and brand of the cement, the gradation of the fine aggregate, product data on any proposed admixtures and the proposed mix of the grout.

4. Concrete grout. The submittal shall include data as required for concrete as delineated in Section 03300 and for fiber reinforcement as delineated in Section 03200. This includes the mix design, constituent quantities per cubic yard and the water/cement ratio.

B. Laboratory Test Reports

1. Submit laboratory test data as required under Section 03300 for concrete to be used as concrete grout.

C. Certifications

1. Certify that commercially manufactured grout products and concrete grout admixtures are suitable for use in contact with potable water after 30 days curing.

D. Qualifications

1. Grout manufacturers shall submit documentation that they have at least 10 years experience in the production and use of the proposed grouts which they will supply.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM C531 - Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical Resistant Mortars, Grouts and Monolithic Surfacings and Polymer Concretes

2. ASTM C579 - Standard Test Method for Compressive Strength of Chemical Resistant Mortars, Grouts and Monolithic Surfacings and Polymer Concretes

3. ASTM C827 - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures

4. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

B. U.S. Army Corps of Engineers Standard (CRD)

1. CRD C-621 - Corps of Engineers Specification for Nonshrink Grout

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

1.05 QUALITY ASSURANCE

A. Qualifications

1. Grout manufacturer shall have a minimum of 10 years experience in the production and use of the type of grout proposed for the work.

B. Pre-installation Conference

1. Well in advance of grouting, hold a pre-installation meeting to review the requirements for surface preparation, mixing, placing and curing procedures for each product proposed for use. Parties concerned with grouting shall be notified of the meeting at least 10 days prior to its scheduled date.

C. Services of Manufacturer's Representative

1. A qualified field technician of the nonshrink grout manufacturer, specifically trained in the installation of the products, shall attend the pre-installation conference and shall be present for the initial installation of each type of nonshrink grout. Additional services shall also be provided, as required, to correct installation problems.

D. Field Testing

1. All field testing and inspection services required shall be provided by the Owner. The Contractor shall assist in the sampling of materials and shall provide any ladders, platforms, etc, for access to the work. The methods of testing shall comply in detail with the applicable ASTM Standards.

2. The field testing of Concrete Grout shall be as specified for concrete in Section 03300.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the jobsite in original, unopened packages, clearly labeled with the manufacturer's name, product identification, batch numbers and printed instructions.

B. Store materials in full compliance with the manufacturer's recommendations. Total storage time from date of manufacture to date of installation shall be limited to 6 months or the manufacturer's recommended storage time, whichever is less.

C. Material which becomes damp or otherwise unacceptable shall be immediately removed from the site and replaced with acceptable material at no additional expense to the Owner.

D. Nonshrink cement-based grouts shall be delivered as preblended, prepackaged mixes requiring only the addition of water.

E. Nonshrink epoxy grouts shall be delivered as premeasured, prepackaged, three component systems requiring only blending as directed by the manufacturer.

1.07 DEFINITIONS

A. Nonshrink Grout: A commercially manufactured product that does not shrink in either the plastic or hardened state, is dimensionally stable in the hardened state and bonds to a clean base plate.

PART 2 - PRODUCTS

2.01 GENERAL

A. The use of a manufacturer's name and product or catalog number is for the purpose of establishing the standard of quality desired.

B. Like materials shall be the products of one manufacturer or supplier in order to provide standardization of appearance.

2.02 MATERIALS

A. Nonshrink Cementitious Grout

1. Nonshrink cementitious grouts shall meet or exceed the requirements of ASTM C1107, Grades B or C and CRD C-621. Grouts shall be portland cement based, contain a pre-proportioned blend of selected aggregates and shrinkage compensating agents and shall require only the addition of water. Nonshrink cementitious grouts shall not contain expansive cement or metallic particles. The grouts shall exhibit no shrinkage when tested in conformity with ASTM C827.

a. General purpose nonshrink cementitious grout shall conform to the standards stated above and shall be SikaGrout 212 by Sika Corp.; Set Grout by Master Builders, Inc.; Gilco Construction Grout by Gifford

Hill & Co.; Euco NS by The Euclid Chemical Co.; NBEC Grout by U. S. Grout Corp. or equal.

b. Flowable (Precision) nonshrink cementitious grout shall conform to the standards stated above and shall be Masterflow 928 by Master Builders, Inc.; Hi-Flow Grout by the Euclid Chemical Co.; SikaGrout 212 by Sika Corp.; Supreme Grout by Gifford Hill & Co.; Five Star Grout by U. S. Grout Corp. or equal.

B. Nonshrink Epoxy Grout

1. Nonshrink epoxy-based grout shall be a pre-proportioned, three component, 100 percent solids system consisting of epoxy resin, hardener, and blended aggregate. It shall have a compressive strength of 14,000 psi in 7 days when tested in conformity with ASTM D695 and have a maximum thermal expansion of 30×10^{-6} when tested in conformity with ASTM C531. The grout shall be Ceilcote 648 CP by Master Builders Inc.; Five Star Epoxy Grout by U.S. Grout Corp.; Sikadur 42 Grout-Pak by Sika Corp.; High Strength Epoxy Grout by the Euclid Chemical Co. or equal.

C. Cement Grout

1. Cement grouts shall be a mixture of one part portland cement conforming to ASTM C150, Types I, II, or III and 1 to 2 parts sand conforming to ASTM C33 with sufficient water to place the grout. The water content shall be sufficient to impart workability to the grout but not to the degree that it will allow the grout to flow.

D. Concrete Grout

1. Concrete grout shall conform to the requirements of Section 03300 except as specified herein. It shall be proportioned with cement, coarse and fine aggregates, water, water reducer and air entraining agent to produce a mix having an average strength of 2900 psi at 28 days, or 2500 psi nominal strength. Coarse aggregate size shall be 1/2-in maximum. Slump should not exceed 5-in and should be as low as practical yet still retain sufficient workability.

2. Synthetic reinforcing fibers as specified in Section 03200 shall be added to the concrete grout mix at the rate of 1.5 lbs of fibers per cubic yard of grout. Fibers shall be added from the manufacturer's premeasured bags and according to the manufacturer's recommendations in a manner which will ensure complete dispersion of the fiber bundles as single monofilaments within the concrete grout.

E. Water

1. Potable water, free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

PART 3 - EXECUTION

3.01 PREPARATION

A. Grout shall be placed over cured concrete which has attained its full design strength unless otherwise approved by the Engineer.

B. Concrete surfaces to receive grout shall be clean and sound; free of ice, frost, dirt, grease, oil, curing compounds, laitance and paints and free of all loose material or foreign matter which may effect the bond or performance of the grout.

C. Roughen concrete surfaces by chipping, sandblasting, or other mechanical means to a minimum of ¼" amplitude or provide a raked finish in order to ensure bond of the grout to the concrete. Remove loose or broken concrete. Irregular voids or projecting coarse aggregate need not be removed if they are sound, free of laitance and firmly embedded into the parent concrete.

1. Air compressors used to clean surfaces in contact with grout shall be the oilless type or equipped with an oil trap in the air line to prevent oil from being blown onto the surface.

D. Remove all loose rust, oil or other deleterious substances from metal embedments or bottom of baseplates prior to the installation of the grout.

E. Concrete surfaces shall be washed clean and then kept moist for at least 24 hours prior to the placement of cementitious or cement grout. Saturation may be achieved by covering the concrete with saturated burlap bags, use of a soaker hose, flooding the surface, or other method acceptable to the Engineer. Upon completion of the 24 hour period, visible water shall be removed from the surface prior to grouting. The use of an adhesive bonding agent in lieu of surface saturation shall only be used when approved by the Engineer for each specific location of grout installation.

F. Epoxy-based grouts do not require the saturation of the concrete substrate. Surfaces in contact with epoxy grout shall be completely dry before grouting.

G. Construct grout forms or other leakproof containment as required. Forms shall be lined or coated with release agents recommended by the grout manufacturer. Forms shall be of adequate strength, securely anchored in place and shored to resist the forces imposed by the grout and its placement.

1. Forms for epoxy grout shall be designed to allow the formation of a hydraulic head and shall have chamfer strips built into forms.

H. Level and align the structural or equipment bearing plates in accordance with the structural requirements and the recommendations of the equipment manufacturer.

I. Equipment shall be supported during alignment and installation of grout by shims, wedges, blocks or other approved means. The shims, wedges and blocking devices shall be prevented from bonding to the grout by appropriate bond breaking coatings and removed after grouting unless otherwise approved by the Engineer.

3.02 INSTALLATION – GENERAL

A. Mix, apply and cure products in strict compliance with the manufacturer's recommendations and this Section.

B. Have sufficient manpower and equipment available for rapid and continuous mixing and placing. Keep all necessary tools and materials ready and close at hand.

C. Maintain temperatures of the foundation plate, supporting concrete, and grout between 40 and 90 degrees F during grouting and for at least 24 hours thereafter or as recommended by the grout manufacturer, whichever is longer. Take precautions to minimize differential heating or cooling of baseplates and grout during the curing period.

D. Take special precautions for hot weather or cold weather grouting as recommended by the manufacturer when ambient temperatures and/or the temperature of the materials in contact with the grout are outside of the 60 and 90 degrees F range.

E. Install grout in a manner which will preserve the isolation between the elements on either side of the joint where grout is placed in the vicinity of an expansion or control joint.

F. Reflect all existing underlying expansion, control and construction joints through the grout.

3.03 INSTALLATION - CEMENT GROUTS AND NONSHRINK CEMENTITIOUS GROUTS

A. Mix in accordance with manufacturer's recommendations. Do not add cement, sand, pea gravel or admixtures without prior approval by the Engineer.

B. Avoid mixing by hand. Mixing in a mortar mixer (with moving blades) is recommended. Pre-wet the mixer and empty excess water. Add premeasured amount of water for mixing, followed by the grout. Begin with the minimum amount of water recommended by the manufacturer and then add the minimum additional water required to obtain workability. Do not exceed the manufacturer's maximum recommended water content.

C. Placements greater than 3-in in depth shall include the addition of clean, washed pea gravel to the grout mix when approved by the manufacturer. Comply with the manufacturer's recommendations for the size and amount of aggregate to be added.

D. Place grout into the designated areas in a manner which will avoid segregation or entrapment of air. Do not vibrate grout to release air or to consolidate the material. Placement should proceed in a manner which will ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.

E. Place grout rapidly and continuously to avoid cold joints. Do not place cement grouts in layers. Do not add additional water to the mix (retemper) after initial stiffening.

F. Just before the grout reaches its final set, cut back the grout to the substrate at a 45 degree angle from the lower edge of bearing plate unless otherwise approved by the Engineer. Finish this surface with a wood float (brush) finish.

G. Begin curing immediately after form removal, cutback, and finishing. Keep grout moist and within its recommended placement temperature range for at least 24 hours after placement or longer if recommended by the manufacturer. Saturate the grout surface by use of wet burlap, soaker hoses, ponding or other approved means.

Provide sunshades as necessary. If drying winds inhibit the ability of a given curing method to keep grout moist, erect wind breaks until wind is no longer a problem or curing is finished.

3.04 INSTALLATION - NONSHRINK EPOXY GROUTS

A. Mix in accordance with the procedures recommended by the manufacturer. Do not vary the ratio of components or add solvent to change the consistency of the grout mix. Do not overmix. Mix full batches only to maintain proper proportions of resin, hardener and aggregate.

B. Monitor ambient weather conditions and contact the grout manufacturer for special placement procedures to be used for temperatures below 60 or above 90 degrees F.

C. Place grout into the designated areas in a manner which will avoid trapping air. Placement methods shall ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.

D. Minimize "shoulder" length (extension of grout horizontally beyond base plate). In no case shall the shoulder length of the grout be greater than the grout thickness.

E. Finish grout by puddling to cover all aggregate and provide a smooth finish. Break bubbles and smooth the top surface of the grout in conformity with the manufacturer's recommendations.

F. Epoxy grouts are self curing and do not require the application of water. Maintain the formed grout within its recommended placement temperature range for at least 24 hours after placing, or longer if recommended by the manufacturer.

3.05 INSTALLATION - CONCRETE GROUT

A. Screed underlying concrete to the grade shown on the Drawings. Prepare the surface according to 3.01B. Protect and keep the surface clean until placement of concrete grout.

B. Remove the debris and clean the surface by sweeping and vacuuming of all dirt and other foreign materials. Wash the tank slab using a strong jet of water. Flushing of debris into tank drain lines will not be permitted.

C. Saturate the concrete surface for at least 24 hours prior to placement of the concrete grout. Saturation may be maintained by ponding, by the use or soaker hoses, or by other methods acceptable to the Engineer. Remove excess water just prior to placement of the concrete grout. Place a cement slurry immediately ahead of the concrete grout so that the slurry is moist when the grout is placed. Work the slurry over the surface with a broom until it is coated with approximately 1/16 to 1/8-in thick cement paste. (A bonding grout composed of 1 part portland cement, 1.5 parts fine sand, an approved bonding admixture and water, mixed to achieve the consistency of thick paint, may be substituted for the cement slurry.)

D. Place concrete grout to final grade using the scraper mechanism as a guide for surface elevation and to ensure high and low spots are eliminated. Unless specifically approved by the equipment manufacturer, mechanical scraper mechanisms shall not be used as a finishing machine or screed.

E. Provide grout control joints as indicated on the Drawings.

F. Finish and cure the concrete grout as specified for cast-in-place concrete.

3.06 SCHEDULE

A. The following list indicates where the particular types of grout are to be used:

B. General purpose nonshrink cementitious grout: Use at all locations where non shrink grout is called for on the plans except for base plates greater in area than 3-ft wide by 3-ft long and except for the setting of anchor rods, anchor bolts or reinforcing steel in concrete.

C. Flowable nonshrink cementitious grout: Use under all base plates greater in area than 3-ft by 3-ft. Use at all locations indicated to receive flowable nonshrink grout by the Drawings. The Contractor, at his/her option and convenience, may also substitute flowable nonshrink grout for general purpose nonshrink cementitious grout..

D. Nonshrink epoxy grout: Use for the setting of anchor rods, anchor bolts and reinforcing steel in concrete and for all locations specifically indicated to receive epoxy grout.

E. Cement grout: Cement grout may be used for grouting of incidental base plates for structural and miscellaneous steel such as post base plates for platforms, base plates for beams, etc. It shall not be used when nonshrink grout is specifically called for on the Drawings or for grouting of primary structural steel members such as columns and girders.

END OF SECTION

SECTION 05500
MISCELLANEOUS METAL

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install all miscellaneous metal complete as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Concrete joint accessories are included in Section 03350.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, shop drawings and product data showing materials of construction and details of installation for:

1. Shop drawings, showing sizes of members, method of assembly, anchorage and connection to other members.

B. Samples

1. Submit samples as requested by the Engineer during the course of construction.

C. Test Reports

1. Certified copy of mill test reports on each aluminum proposed for use showing the physical properties and chemical analysis.

D. Certificates

1. Certify that welders have been qualified under AWS, within the previous 12 months, to perform the welds required under this Section.

1.04 REFERENCE STANDARDS

A. Aluminum Association (AA)

1. ABH-21 Aluminum Brazing Handbook
2. ASD-1 Aluminum Standards and Data
3. DAF-45 Designation System for Aluminum Finishes
4. SAA-46 Standards for Anodized Architectural Aluminum

B. American Society for Testing and Materials (ASTM)

1. ASTM A36 - Standard Specification for Carbon Structural Steel.
2. ASTM A48 - Standard Specification for Gray Iron Castings.
3. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
4. ASTM A108 - Standard Specification for Steel Bars, Carbon, Cold Finished, Standard Quality.
5. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
6. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
7. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
8. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.
9. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 Psi Tensile Strength.
10. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
11. ASTM A366 - Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.
12. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
13. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
14. ASTM A536 - Standard Specification for Ductile Iron Castings.
15. ASTM A570 - Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality.
16. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
17. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
18. ASTM B429 - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.

C. American Iron and Steel Institute (AISI).

1. Specification for Structural Steel Buildings.

D. American Welding Society (AWS)

1. AWS D1.1 - Structural Welding Code Steel.

2. AWS D1.2 - Structural Welding Code Aluminum.

E. Federal Specifications

1. FS-FF-B-575C - Bolts, Hexagonal and Square

F. Occupational Safety and Health Administration (OSHA)

G. 2010 Florida Building Code. (FBC)

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

1.05 QUALITY ASSURANCE

A. The work of this Section shall be completely coordinated with the work of other Sections. Verify, at the site, both the dimensions and work of other trades adjoining items of work in this Section before fabrication and installation of items herein specified.

B. Furnish to the pertinent trades all items included under this Section that are to be built into the work of other Sections.

C. All welding shall be performed by qualified welders and shall conform to the applicable AWS welding code. Welding of steel shall conform to AWS D1.1 and welding of aluminum shall conform to AWS D1.2.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver items to be incorporated into the work of other trades in sufficient time to be checked prior to installation.

B. Repair items which have become damage or corroded to the satisfaction of the Engineer prior to incorporating them into the work.

1.07 PROJECT/SITE REQUIREMENTS

A. Field measurements shall be taken at the site, prior to fabrication of items, to verify or supplement indicated dimensions and to ensure proper fitting of all items.

PART 2 - PRODUCTS

2.01 GENERAL

A. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

B. Like items of materials shall be the end products of one manufacturer in order to provide standardization for appearance, maintenance and manufacturer's service.

2.02 MATERIALS

A. Unless otherwise noted, materials for miscellaneous metals shall conform to the following standards:

1.	Structural Steel	ASTM A36
2.	Structural Steel Tubing	ASTM A500, Grade B
3.	Welded and Seamless Steel Pipe	ASTM A501 or ASTM A53, Type E or S, Grade B Schedule 40. Use standard malleable iron fittings, galvanized for exterior work
4.	Steel Sheets	ASTM A366
5.	Aluminum Extruded Pipe	ASTM B429, Alloy 6063 T6
6.	Aluminum Extruded Shapes	ASTM B221, Alloy 6061 T6
7.	Aluminum Sheet and Plate	ASTM B209, Alloy 6061 T6
8.	Stainless Steel Plates, Sheets, and Structural Shapes	
	a. Exterior, Submerged or Industrial Use	ASTM A167, Type 316 (Type 316L for welded)
	b. Interior and Architectural Use	ASTM A167, Type 304
9.	Stainless Steel Bolts, Nuts, and Washers	ASTM A276, Type 316
10.	Galvanizing	ASTM A123, Zn w/0.5 percent minimum Ni
11.	Galvanizing, hardware	ASTM A153, Zn w/0.5 percent minimum Ni

2.03 ANCHOR BOLTS AND FASTENING DEVICES

A. Unless otherwise noted, all expansion anchor bolts and fasteners shall be type 316 stainless steel, wedge type anchors. When the length or embedment of the bolt is not noted on the Drawings, provide length sufficient to place the wedge and expansion sleeve portion of the bolt at least 1-in behind the concrete reinforcing steel. Expansion anchors shall be Hilti, Kwick-bolt III; ITW Ramset; Redhead trubolt, or equal.

B. Adhesive capsule anchors shall be a two-part stud and capsule chemical resin anchoring system. Capsules shall contain premeasured amounts of polyester or vinyl ester resin, aggregate and a hardener contained in a separate vial within the capsule. Stud assemblies shall consist of type 316 stainless steel all-thread anchor rod with nut and washer. Adhesive capsule anchor type shall be as specified in the design drawings.

2.04 MISCELLANEOUS ALUMINUM

A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Holes shall be drilled or punched. Edges shall be smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close fitting and jointed where least conspicuous. Threaded connections shall have the threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of welds shall be dressed flush and smooth. Welding shall be on the unexposed side as much as possible in order to prevent pitting or discoloration of the aluminum exposed surface. Grind smooth continuous welds that will be exposed. Provide holes for temporary field connections and for attachment of the work of other trades.

C. Miscellaneous aluminum items shall include: beams, angles, closure angles, grates, hatches, floor plates, stop plates, stair nosings, and any other miscellaneous aluminum called for on the Drawings and not otherwise specified.

D. Angle frames for hatches, beams, grates, etc, shall be complete with welded strap anchors attached.

E. Aluminum diamond plate and floor plate shall have a minimum thickness of 3/8-in. Frames and supports shall be of aluminum construction. Fastening devices and hardware shall be Type 316 stainless steel. Plates shall have a mill finish.

F. Miscellaneous aluminum items shall have a cleaned and degreased mill finish.

2.05 MISCELLANEOUS STEEL

A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Holes shall be drilled or punched. Edges shall be smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close fitting and jointed where least conspicuous. Threaded connections shall have the

threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of welds shall be dressed flush and smooth. Grind smooth continuous welds that will be exposed. Provide holes for temporary field connections and for attachment of the work of other trades.

C. Miscellaneous steel items shall include: beams, angles, lintels, metal stairs, support brackets, base plates for other than structural steel or equipment, closure angles, bridge crane rails, monorail hoist beams, holddown straps and lugs, door frames, splice plates, subframing at roof openings and any other miscellaneous steel called for on the Drawings and not otherwise specified.

D. Steel pipe pieces for sleeves, lifting attachments and other functions shall be Schedule 40 pipe unless otherwise shown on the Drawings. Wall and floor sleeves, of steel pipe, shall have welded circumferential steel waterstops at mid-length.

E. All steel finish work shall be thoroughly cleaned, by effective means, of all loose mill scale, rust and foreign matter and shall be given one shop coat of primer compatible with the finish coat after fabrication but before shipment. Paint shall be omitted within 3-in of proposed field welds. Paint shall be applied to dry surfaces and shall be thoroughly and evenly spread and well worked into joints and other open spaces.

F. Galvanizing, where required, shall be the hot-dip zinc process after fabrication. Coating shall be not less than 2 oz/sq ft of surface.

2.06 MISCELLANEOUS STAINLESS STEEL

A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Holes shall be drilled or punched. Edges shall be smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close fitting and jointed where least conspicuous. Threaded connections shall have the threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of welds shall be dressed flush and smooth. Grind smooth continuous welds that will be exposed. Provide holes for temporary field connections and for attachment of the work of other trades.

C. Miscellaneous stainless steel items shall include: beams, angles, bar racks and any other miscellaneous stainless steel called for on the Drawings and not otherwise specified.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install all items except those to be embedded in concrete or other masonry which shall be installed under Division 3 and Division 4 respectively. Items to be attached to concrete or masonry after such work is completed shall be installed in accordance with the details shown. Fastening to wood plugs in masonry will not be permitted.

B. Abrasions in the shop primer shall be touched up immediately after erection. Areas left unprimed for welding shall be painted with primer after welding.

C. Zinc coating which has been burned by welding, abraded, or otherwise damaged shall be cleaned and repaired after installation. The damage area shall be thoroughly cleaned by wire brushing and all traces of welding flux and loose or cracked zinc coating removed prior to painting. The cleaned area shall be painted with two coats of zinc oxide-zinc dust paint conforming to the requirements of Military Specifications MIL-P-15145. The paint shall be properly compounded with a suitable vehicle in the ratio of one part zinc oxide to four parts zinc dust by weight.

D. Specialty products shall be installed in accordance with the manufacturer's recommendations.

E. Expansion bolts shall be checked for tightness a minimum of 24 hours after initial installation.

F. Install adhesive capsule anchors using manufacture's recommended drive units and adapters and in compliance with the manufacturer's recommendations.

G. Headed anchor studs shall be welded in accordance with manufacturer's recommendations.

H. Touch-up all anchor bolts and fasteners following final installation with coating system specified above.

I. All steel surfaces that come into contact with exposed concrete or masonry shall receive a protective coating of an approved heavy bitumastic troweling mastic applied in accordance with the manufacturer's instructions prior to installation.

J. Where aluminum contacts a dissimilar metal, apply a heavy brush coat of zinc-chromate primer followed by two coats of aluminum metal and masonry paint to the dissimilar metal.

K. Where aluminum contacts masonry or concrete, apply a heavy coat of approved alkali resistant paint to the masonry or concrete.

END OF SECTION

SECTION 09900
PAINTING AND COATING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials; equipment and incidentals required to provide a protective or aesthetic coating system for the surfaces listed herein and not otherwise excluded. All surfaces described, whether new or existing, shall be included within the scope of this section.

B. The work includes painting and finishing of interior and exterior process related items and surfaces. The omission of minor items in the schedule of work shall not relieve the Contractor of his obligation to include such items where they come within the general intent of the Specifications as stated herein.

C. The following major process items shall be painted:

1. Any exposed surfaces of ferrous metal or galvanized components of process equipment. This excludes stainless steel components.

2. Any exposed surfaces of PVC components of pipe, fittings, valves, electrical conduits, or equipment.

3. Any exterior surfaces of exposed metallic piping, fittings, and valves located in either the interior or exterior of the process building. This excludes stainless steel components.

4. Any embedded aluminum, or aluminum in contact with dissimilar metals.

D. The following items of the Project shall not be painted:

1. Any code-required labels, equipment identification, performance rating, name, or nomenclature plates, or signage.

2. Any moving parts of operating units, mechanical and electrical parts unless otherwise indicated.

3. Any stainless steel components.

4. Any products with polished chrome, aluminum, nickel, or stainless steel finishes.

5. Any flexible couplings, lubricated bearing surfaces, insulation, or metal and plastic pipe interiors.

6. Any plastic switch or receptacle plates.

7. Any finish hardware.

8. Any galvanized metal components.

1.02 RELATED WORK

A. Section 09905 – Piping, Valve, and Equipment Identification System

B. Section 15100 – Valves and Appurtenances

1.03 DEFINITIONS

A. The term "Paint" as used herein refers to all coating systems, materials, including primers, emulsions, enamels, sealers and fillers, and other applied materials used as prime, intermediate, or finish coats.

1.04 REFERENCES

A. OSHA

1. 1926 Subpart C - General Safety and Health Provisions
2. 1926 Subpart D - Occupational Health and Environmental Controls
3. 1926 Subpart E - Personal Protective and Life Saving Equipment
4. 1926 Subpart F - Fire Protection and Prevention
5. 1926 Subpart H - Materials Handling, Storage, Use, and Disposal
6. 1926 Subpart Z - Toxic and Hazardous Substances

B. The Society for Protective Coatings

1. SSPC-SP 1 - Solvent Cleaning

1.05 QUALITY ASSURANCE

A. Provide the best quality grade of the various types of coatings as regularly manufactured by approved paint materials manufacturers. Materials not displaying the manufacturer's identification as a standard, best-grade product will not be acceptable.

B. Provide undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer, and use only within recommended limits.

C. Undercoat and finish coat paints shall be compatible.

D. Painting shall be accomplished by experienced painters specializing in industrial painting and familiar with all aspects of surface preparations and applications required for this project.

E. All surface preparation, coating, and materials shall comply with the SSPC recognized standards.

1.06 SUBMITTALS

A. Submittals shall include manufacturer's data and samples as indicated below and shall be prepared and submitted in time to provide adequate review by the Engineer.

B. Samples:

1. Paint colors will be selected by the Engineer with final approval by the Owner. Compliance with all other requirements is the exclusive responsibility of the Contractor.

2. Samples of each finish and color shall be submitted to the Engineer for approval before any work is started.

3. Samples shall be prepared so that an area of each sample indicates the appearance of the various coats. For example, where three coat work is specified, the sample shall be divided into three areas: one showing application of one coat only, one showing the application of two coats, and the third showing the application of three coats.

4. Such samples when approved in writing shall constitute a standard, as to color and finish only, of acceptance or rejection of the finish work.

5. For piping, valves, equipment, and miscellaneous metal work, provide sample chips or color charts of all paint selected showing color, finish, and general characteristics.

6. Rejected samples shall be resubmitted until approved.

1.07 DELIVERY, HANDLING, AND STORAGE

A. Deliver all materials to the job site in original, unopened packages and containers bearing the manufacturer's name and label.

1. Provide labels on each container with the following information:

a. Name or title of material

b. Fed. Spec. number if applicable

c. Manufacturer's stock number and date of manufacture

d. Manufacturer's formula or specification number

e. Manufacturer's batch number

f. Manufacturer's name

g. Generic type

h. Contents by volume, for major pigment and vehicle constituents

i. Thinning instructions

j. Application instructions

k. Color name and number

2. Containers shall be clearly marked to indicate any hazards connected with the use of the paint and steps which should be taken to prevent injury to those handling the product.

B. All containers shall be handled and stored in such a manner as to prevent damage or loss of labels or containers.

C. The Engineer shall designate areas for storage and mixing of all painting materials.

D. Contractor must comply with the requirements of the pertinent codes and fire regulations when handling all materials. Proper containers outside of the building shall be provided by the Contractor and used for painting wastes. No plumbing fixtures shall be used for this purpose.

E. All used rags shall be removed from buildings every night and every precaution shall be taken to prevent spontaneous combustion of flammable materials.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All paint used shall be manufactured by one of the following:

1. Tnemec Company, Inc.,

2. Carboline, or

3. PPG/Ameron.

B. All paint used shall be of the highest grade regularly manufactured.

C. Coating systems included in this specification are identified by name in order to establish a standard of quality. Other products of the same generic type may be submitted to the Engineer for review. When a coating system other than that specified herein is proposed, the Contractor shall submit a typed list giving the proposed coatings, brand, trade name, generic type, and catalog number of the proposed system for the Engineer's review.

D. Paint used in successive field coats shall be produced by the same manufacturer. Paint used in the first field coat over shop painted or previously painted surfaces shall cause no wrinkling, lifting, or other damage to the underlying paint.

E. Emulsion and alkyd paints shall contain a mildewcide and both the paint and mildewcide shall conform to OSHA and Federal requirements, including Federal Specification TT-P-19.

F. All rags associated with this work shall be clean painters' rags, and be completely sterilized.

2.02 COATING SYSTEMS

A. Metals, Non-Immersion, Interior/Exterior

1. Surfaces shall include interior and exterior metal surfaces that do not come in direct contact with corrosive materials or atmospheres and shall include the following:

a. Aboveground piping, fittings, valves, and metal electrical conduit.
b. Miscellaneous steel plates, shapes, hardware, etc.

c. Galvanized steel surfaces.
d. Other surfaces obviously requiring field coating, including equipment where equipment specification requires coating, or as specified to be field coated in Section 09905: Piping, Valve, and Equipment Identification System.

2. Surfaces shall be prepared as specified in Paragraph 3.02 herein and, in addition, the following:

a. All bare metals or areas that were shop primed that have been damaged shall be abrasive blast cleaned to SSPC-SP6, commercial blast cleaning standards.
b. Shop primed items, stored on site for a prolonged period prior to coating, shall be prepared for coating following the coating manufacturer's recommendations prior to applying touch-up and subsequent coats. Surface preparation may include brush-off abrasive blasting or spot blasting to SSPC-SP6, commercial blast cleaning standards, for areas where the primer has been damaged and bare metal is showing.
c. Non-ferrous metals shall be degreased and cleaned in compliance with SSPC-SP1 for solvent cleaning.

3. The prime coat for metals shall be a two-part epoxy polyamide primer, 3 - 5 mils DFT; Series 66 – 1211 manufactured by Tnemec, or equal by Carboline or PPG Amercoat.

4. The intermediate coat shall be a two-part epoxy polyamide, 4 - 6 mils DFT; manufactured by Tnemec, or equal by Carboline or PPG Amercoat.

5. The finish coats shall be a two-part aliphatic acrylic polyurethane 2.5 – 4 mils DFT; manufactured by Tnemec, or equal by Carboline or PPG Amercoat.

6. Total minimum system finish coating thickness shall be 10 - 15 mils DFT.

B. Plastic Piping, Valves, Fittings, and Conduit

7. Surfaces include the following:

a. PVC piping, fittings, valves, and electrical conduits requiring color coding in accordance with Section 09905.
b. Exposed exterior plastic piping, valve, and fitting components subject to UV degradation and weathering by the elements. Coat all above grade PVC piping.

8. The surfaces shall be prepared as specified in Paragraph 3.02 herein, including cleaning and washing with detergent to remove all dirt and foreign material, and light surface abrasion using medium grade sandpaper. Remove dust, dirt and debris with clean rags prior to coating.

9. The finish coats shall be Series 1028 by Tnemec, or equal by Carboline or PPG Amercoat, two (2) coats, 2 - 3 mils DFT per coat.

10. Total minimum system finish coating thickness shall be 4 - 6 mils DFT.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

A. In addition to the aforementioned preparations, all dirt, rust, scale, splinters, loose particles, disintegrated paint, grease, oil, and other deleterious substances shall be removed from all surfaces which are to be coated.

B. Hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in contact with painted surfaces and not to be painted shall be removed, masked, or otherwise protected prior to surface preparation and painting operations.

C. Before commencing work, the painter must make certain that the surfaces to be covered are in perfect condition. Should the painter find such surfaces unacceptable, he shall report the condition to the Engineer. The application of paint shall be held as an acceptance of the surfaces and working conditions and the painter will be held responsible for the results reasonably expected from the materials and processes specified.

D. Program the cleaning and painting so contaminants from the cleaning process will not fall onto wet, newly-painted surfaces.

E. Clean ferrous substances, which are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale, and other foreign substances by solvent or mechanical cleaning. All welds, blisters, etc. shall be ground and sanded smooth. All pits and dents shall be filled and all imperfections shall be corrected so as to provide a smooth surface for painting.

F. Surface profile as obtained from sandblasting shall be as recommended by the coating manufacturer.

3.02 MATERIALS PREPARATION

A. Mix and prepare painting materials in strict accordance with the manufacturer's recommendations and directions. Materials should be stirred prior to and during application to maintain a mixture of uniform density, free of film, dirt, and other foreign materials.

B. No thinners shall be used except those specifically mentioned by the manufacturer, and only in such quantities as directed by the manufacturer's instructions. If thinning is used, sufficient additional coats shall be applied to assure the required dry film thickness is achieved. The manufacturer's recommended thinner or clean-up solvent shall be used for all clean-up.

3.03 APPLICATIONS

A. Application by brush, spray, airless spray, or roller shall be as recommended by the manufacturer for optimum performance and appearance.

B. Color Selection for Color Coding:

1. Color Coding of Piping: All exposed piping shall be identified as specified in Section 09905. Pipe identification system shall include color coding or banding, legends, and arrows.

2. Color Coding of Conduit: All exposed electrical conduit with conductors over 120 volts shall be color banded as specified in and Section 09905.

C. All painting shall be done by skilled and experienced craftsmen and shall be of the highest quality workmanship.

D. Apply paint in accordance with the manufacturer's directions. Use applications and techniques best suited for the type of material being applied.

E. All paint shall be at room temperature and the surfaces to be painted shall be dry and clean.

F. Apply a prime coat to material which is required to be painted or finished, and which has not been prime coated by others.

G. Recoat primed and sealed walls and ceilings where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

H. Apply additional coats when undercoats, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color, and appearance.

I. Paint shall be applied in a neat manner with finished surfaces free of runs, sags, ridges, laps, and brush marks. Each coat shall be applied in a manner that will produce an even film of uniform and proper thickness.

J. Paint surfaces behind moveable equipment and furniture the same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only.

K. Sand lightly between each succeeding enamel or varnish coat.

L. Omit the first coat (primer) on metal surfaces which have been shop-primed and touch-up painted, unless otherwise specified.

M. The prime and intermediate coats as specified for the various coating systems may be applied in the shop by the manufacturer. The shop coats shall be of the type specified and shall be compatible with the field coat or coats. Such shop-painted items as pumps, motors, equipment, etc. shall be given at least one touch-up coat with the intermediate coat material and one complete finish coat in the field.

3.04 APPLICATIONS RESTRICTIONS.

A. Application of materials shall be done only on properly prepared surfaces as herein specified, and all exterior painting shall be done only in dry weather. Any surface coating damaged by moisture or rain shall be removed and redone as directed by the Engineer.

B. Under no circumstances shall paint be applied to surfaces which show a moisture content greater than 15 percent.

3.05 MINIMUM COATING THICKNESS

A. Coatings shall be applied in accordance with the manufacturer's recommendations. Minimum coating millage shall be as specified above.

3.06 FINISHES

A. Pigmented (Opaque) Finishes: Completely cover to provide opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks runs, sags, ropiness, or other surface imperfections will not be acceptable.

B. Complete Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specific requirements.

3.07 FIELD QUALITY CONTROL

A. All completed surfaces will be checked by the Engineer, and the Contractor shall provide the necessary properly calibrated gauges. All non-ferrous surfaces shall be checked for film thickness by use of a Tooke gauge. All ferrous surfaces shall be checked for film thickness by use of an Elcometer or Micro-Test magnetic dry film gauge, properly calibrated. In addition, submerged tank linings and metals shall be tested for freedom from holidays and pinholes by use of a Tinker-Rason or K-D Bird Dog Holiday Detector.

B. The presence of moisture shall be determined prior to coating by testing with a moisture detection device such as a Delmhors Model DB.

C. All defects shall be corrected to the satisfaction of the Engineer.

3.08 PROTECTION

A. All other surfaces shall be protected while painting equipment, piping, etc.

B. Protection of furniture and other movable objects, equipment, fittings, and accessories shall be provided throughout the painting operation. Remove all electrical plates, surface hardware, etc. before painting. Protect and replace such items when painting is completed.

C. Mask all machinery nameplates and all machined parts not to receive paint prior to coating.

D. Lay drop cloths in all areas where painting is being done to adequately protect structures, flooring, piping, equipment, and other work from all damage.

3.09 CLEANING

A. The Contractor shall perform the work under this Section while keeping the premises free from accumulation of debris and rubbish, and shall remove all scaffolding, paint cloths, paint, and brushes from buildings and project site when painting is completed.

B. All paint brushed, splattered, spilled, or splashed on any surface not specifies to be painted shall be removed.

3.10 EXTRA STOCK

A. Upon completion of painting work, the Owner shall be furnished at no additional cost, one gallon of each type and color of finish paint for touching up. Paint container labels shall be complete with the manufacturer's name, generic type, number, color, and location in which the paint was applied.

END OF SECTION

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SECTION 09905
PIPING, VALVE, AND EQUIPMENT IDENTIFICATION SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. The work included under this Section consists of providing an identification system for piping systems and related equipment.

B. General Design

1. Piping color codes, and code labels for pipe identification shall conform to Table 09905-1 included in this section.
2. Pipelines, equipment, or other items which are not listed here shall be assigned a color by the Owner and shall be treated as an integral part of the Contract.
3. Color coding shall consist of color code painting and identification of all exposed conduits, through lines and pipelines for the transport of gases, liquids, or semi-liquids including all accessories such as valves, insulated pipe coverings, fittings, junction boxes, bus bars, connectors and any operating accessories which are integral to a whole functional mechanical pipe and electrical conduit systems.
4. All moving parts, drive assemblies, and covers for moving parts which are potential hazards shall be Safety Red.
5. All safety equipment shall be painted in accordance with OSHA standards.
6. All inline equipment and appurtenances not assigned another color shall be painted the same base color as the piping. If the equipment and/or appurtenances have been assigned another color, the pipe system shall be painted with the pipe color up to, but not including, the flanges attached to pumps and mechanical equipment assigned another color.
7. All hangers and pipe support floor and accessories stands shall be painted to match their piping. The system shall be painted up to, but not including, the face of flanges or the flexible conduit connected to electrical equipment. Structural members used solely for pipe hangars or supports shall be painted to match their piping. Where the contact of dissimilar metals may cause electrolysis and where aluminum will contact concrete, mortar or plaster, the contact surface of the metals shall be coated in accordance with Section 09900.

8. All systems which are an integral part of the equipment, that is originating from the equipment and returning to the same piece of equipment, shall be painted between and up to, but not including, the face of flanges or connections on the equipment.

9. System code lettering and arrows shall conform to the requirements of ANSI A 13.1 marked on piping as follows:

   a. Legends shall be of the following color for the respective pipe color:

Key to Classification of Predominant Colors For Piping		Color of Letters, if not otherwise specified
(D) Dangerous:	Yellow	Black
	Orange	Black
(S) Safe:	Green	Black
	White	Black
	Black	White
	Light Grey	Black
	Dark Grey	White
	Aluminum	Black
(P) Protective:	Blue	White

1.02 QUALITY ASSURANCE

A. All work shall be in accordance with ANSI Standard A13.1, Scheme for the Identification of Piping Systems.

1.03 SUBMITTALS

A. Submit manufacturer's descriptive literature, illustrations, specifications, and other pertinent data.

B. Schedules:

1. Provide a typewritten list of all tagged valves giving tag color, shape, letter code and number, the valve size, type, use, and general location.

2. Provide a complete list of materials to be furnished and surfaces on which they will be used.

C. Samples:

1. Provide a sample of each type valve tag supplied.

2. Provide a sample of each type of identification tape supplied.

3. Provide manufacturer's color charts for color selection by Engineer.

1.04 DELIVERY, STORAGE, AND HANDING

A. Except for locally mixed custom colors, deliver sealed containers with labels legible and intact.

B. Materials shall be stored as follows:

1. Store only acceptable project materials on project site.
2. Store in suitable location.
3. Restrict storage to paint materials and related equipment.
4. Comply with health and fire regulations.

PART 2 - PRODUCTS

2.01 PIPING AND VALVE IDENTIFICATION

A. Above ground piping shall be identified by stenciled, painted pipe labels.

1. Markers shall be of wording and color as shown in Table 09905 - 1 included in this Section.
2. Lettering shall be:
   a. 2 1/4-inches high for pipes 3 inches diameter and larger.
   b. 1 1/8-inches high for pipes less than 3 inches diameter.
3. Flow arrows shall be:
   a. 2 1/4-inches by 6 inches for pipes 3 inches diameter and larger.
   b. 1 1/8-inches by 3 inches for pipes less than 3 inches diameter.

B. A coded and numbered tag attached with SS 316 chain and/or SS 316 "S" hooks shall be provided on all valves.

1. Tags for valves on pipe shall be SS 316 or anodized aluminum. Colors for aluminum tags shall, where possible, match the color code of the pipe line on which installed.
2. In addition to the color coding, each tag shall be stamped or engraved with wording or abbreviations to indicate the valve service and number. All color and letter coding shall be approved by the Engineer. Valve service shall either be as listed in Table 09905 - 1 included in this Section, or by equipment abbreviation if associated with a particular piece of equipment. Valve numbering, if required, shall be as approved by the Engineer and/or Owner.

2.02 EQUIPMENT IDENTIFICATION

A. All equipment shall have nametags in accordance with Section 15000.

PART 3 - EXECUTION

3.01 PREPARATION

A. Unless otherwise indicated or specifically approved, all fabricated equipment shall be shop primed and finished.

B. The Contractor shall be responsible for and take whatever steps are necessary to properly protect the shop prime and finish coats against damage from weather or any other cause.

C. Where specified in other sections of these specifications for mechanical equipment, the Contractor shall apply field coat or coats of paint in accordance with Section 09900. If shop finish coat is unsatisfactory due to poor adhesion or other problems with primer or finish coats, coatings shall be removed and replaced by sandblasting, priming and finishing in accordance with Section 09900 and this Section.

D. Wherever fabricated equipment is required to be sandblasted, the Contractor shall protect all motors, drives, bearings, gears, etc., from the entry of grit. Any equipment found to contain grit shall be promptly and thoroughly cleaned. Equipment contaminated by grit in critical areas, such as bearings, gears, seals, etc., shall be replaced at no cost to the Owner.

3.02 INSTALLATION

A. Markers and flow arrows shall be placed at every change in direction and at a minimum of every 10 feet.

TABLE 9905 – 1 COLOR CODES AND ABBREVIATIONS

Service	Mark	Conduit, Pipe, and Valve Color Code	Letter and Flow Arrow Color
Potable Water	PW	Safety White	Black
Electrical Conduit	--	Interior: Match adjacent wall or equipment color. Exterior: Grey	--
Air	AIR	Safety White	Black
Drain	DR	Safety White	Black

NOTE: Other piping shall be painted as directed by the Engineer.

END OF SECTION

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SECTION 11530
BIOTOWER ODOR CONTROL SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This section includes materials, equipment, installation, and testing of a biologically based air treatment system for treating odorous air produced from raw sewage.

B. The installation shall be in complete conformity with the drawings and specifications and the instructions and recommendations of the equipment manufacturer, as approved by the Engineer.

1.02 QUALITY ASSURANCE

A. Qualifications:

1. The biologically based air treatment shall include a filter vessel with foul air inlet and treated air outlet, two media chambers, all vessel internals, media bed spray irrigation assemblies and vessel media. System components including, but not limited to a system blower, accessories connecting the blower outlet to the inlet of the biotower odor control system filter vessel, recirculation/irrigation/nutrient supply system consisting of a plant water inlet strainer, a water control panel fully assembled, a nutrient feed tank, recirculation pump and all system piping, valves and instrumentation, and an electrical control panel necessary to provide a complete and operational system shall be supplied by one supplier for total system.

2. Each component and ancillary equipment item furnished under this specification shall be new and unused, and the product of a manufacturer having a successful record of operation, manufacturing and servicing the equipment for a minimum of five (5) years.

B. Standards: biotower odor control system shall be designed in accordance with OSHA, NFPA, NEMA, ASTM.

C. Equipment Manufacturer:

Biotower Odor Control System shall be manufactured by Evoqua Water Technologies, LLC, BioAir, or Envirogen, without exception.

1.03 SUBMITTALS

A. Materials and Shop Drawings:

All materials required to establish compliance with the Specification shall be submitted in accordance with the provisions of the General Conditions and Section 01300. Submittals shall include at least the following:

1. Shop drawings showing a complete biological based air treatment system including the biological tower with media and injection spray system, fan, piping, fittings, valves, and controls.
2. Tower layout drawings showing dimensions, wall thickness, mounting brackets, knuckle radii, media, nozzle location and orientation, and nozzle construction, piping layout and conduit placement.
3. Tower manufacturer's recommended bolt torques for flanges.
4. Certificate listing the type of resin to be used, describing the manufacturer's brand name or designation, composition, chemical resistance, and characteristics.
5. Design calculations for structural design of towers and duct walls and design of tie-down lugs (number, size, and embedment length of anchor bolts) signed and stamped by a structural or civil engineer registered in the state of Florida.
6. Anticipated set points for operating pH, water use and chemical addition. Operation and maintenance manuals shall be updated after start-up to reflect actual field determined set points.
7. Annual utility and chemical storage calculations.
8. List of materials of construction with ASTM reference.
9. Electrical/control diagrams detailing the requirements and features of the control system, including interlocks, terminals, wiring, controls, disconnects, and panel layouts.
10. List of spare parts that are to be supplied with the project in accordance with this specification.
11. Warranty as indicated in Part 1.05.

B. Operating Instructions:

1. Five (5) copies of an operating and maintenance manual shall be furnished and one (1) CD. The manual shall be prepared specifically for this installation and shall include
    a. Information on any known hazards associated with the system and appropriate safety precautions
    b. Equipment installation instructions
    c. Equipment start-up instructions

d. Troubleshooting guide
e. Cut sheets, drawings, and equipment list
f. Operation and maintenance information on major system components. descriptions
g. Information necessary to instruct operating and maintenance personnel unfamiliar with such equipment

2. A factory representative with complete knowledge of proper operation and maintenance shall be provided for one (1) day to certify proper installation and one (1) day to instruct representatives of the Owner on proper operation and maintenance. The latter work may be conducted in conjunction with the inspection of the installation and test run as provided under PART 3. If there are difficulties in operation of the equipment due to the manufacturer's design or fabrication, additional service shall be provided at no cost to the Owner.

3. Submit six copies of a written report prepared by the manufacturer certifying that the equipment has been properly installed, lubricated, and test run.

4. The Biotower Odor Control System filter start-up representative shall insure that all control functions are properly carried out by the control panel as part of the start-up procedure.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the equipment is ready for continuous operation. The manufacturer's representative shall visit job site to certify proper installation.

B. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Owner.

C. Finished surfaces of all exposed openings shall be protected by wooden blanks, strongly built and securely bolted thereto.

D. Any iron or steel components shall be finished as SS 316 of suitable dimensions to provide equivalent strength.

E. Each box or package shall be properly marked to show its net weight in addition to its contents.

1.05 WARRANTY AND GUARANTEES

A. The equipment shall be warranted against defects in material and workmanship for three (3) years from date of substantial completion except for the following:

1. The Manufacturer shall warrant the suitability of the biological support media for a period of ten (10) years from the date of delivery.

2. Further, the Manufacturer shall warrant the integrity of the FRP exterior shells of the reactors for a period of ten (10) years.

PART 2 - PRODUCTS

2.01 GENERAL

A. The Biotower Odor Control System unit required under this section shall be complete, including metering/feed tank, metering pump, recirculation pump, piping, valves, controls for exterior installation. 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.

B. Stainless steel nameplates giving the name of the manufacturer, and all other pertinent data shall be attached to the unit.

2.02 MATERIAL AND EQUIPMENT

A. Reactor Vessel (s)

1. System shall be designed to treat odorous air as specified in the "Service Conditions" and herein.

2. One (1) vessel for a two-stage system of treatment.

3. The reactor vessel(s) shall be constructed of corrosion resistant FRP.

4. The vessel(s) shall be designed to support the required number of media layers and treatment stages. All materials of construction shall be corrosion resistant. The exterior of the vessel(s) shall incorporate a UV resistant coating. Vessels shall comply with ASTM D4097 for contact molded tanks, or with ASTM D3299 for filament wound tanks.

5. Resin shall be Ashland Derakane 411, Hetron 922, Reichhold 9800, Interplastic Corp CoREZYN CORVE8401or equal. Resin shall be suitable for continuous immersion in the liquid described in the subsection herein on "Service Conditions" and shall be resistant to those fluids as defined by ASTM C581.

6. Biotower Odor Control System manufacturer shall coordinate tank dimensions, nozzle sizes, and nozzle orientation for construction.

7. Felt friction tank pad shall be provided for the vessel.

B. Service Conditions

Biotower Odor Control System design data shall be as shown below:

Parameter	Design Criteria
Flow Rate, cfm	9,000
1st Stage Empty Bed Residence Time (EBRT), seconds	minimum of 9
2nd Stage EBRT, seconds	minimum of 4.5
Ambient Air Temperature, °F	30 to 100
Inlet H2S Concentration (average / peak), ppm / v	100 / 200
H2S Performance	99% removal, or 0.2 ppm/V, whichever results in the higher removal
VOC Performance	80% removal, or less than 600 odor units (D/T), whichever results in the higher removal.
Pressure Drop, inches W.C.	9 maximum
Material of Construction	FRP, Vinyl Ester with white exterior coating with UV inhibitors.
Configuration	Vertical
Footprint Dimensions (max diameter), feet	14
Nutrient Feed System, Potable Water Makeup System, Recirculation Pump	Mixing/Feed Tank, Metering Pumps, Recirculation Pump, Piping, Valves, Controls for exterior installation
Electrical, volts- phase	480 - 3 phase
Structural and anchoring requirements	Wind loading up to 150 mph

C. Laminate Construction

1. Provide at least three inner laminated layers as a corrosion barrier on the tank interior and an exterior reinforcement layer. The inner surface layer shall be resin rich, shall consist of organic fiber, and shall be a minimum of 0.254 mm thick. Glass content in the inner layer shall be 20% ±5% by weight.

2. The remaining two layers (interior layer) shall be composed of chopped strand mat having glass content by weight of 25% +/- 5% applied at a rate of 3 ounces per square foot. The interior layer shall be formed, not sprayed. Chopped roving fibers shall be ½ to 2 inches in length.

3. The average glass content of the inner three layers shall be 27% +/- 5% by weight. The total thickness of the inner surface layer and interior layers should be no less than 2.5 mm.

4. The exterior layer shall be compromised of 1.5 ounces per square foot chopped strand mat or equivalent weight of chopped roving.

5. The total tank wall thickness (excluding additional thickness provided for knuckle reinforcement) shall have average glass content by weight of 55% +/- 5% per ASTM D2584.

D. Quality Control

Construction shall comply with ASTM D2563, Level II, except that maximum frequency of air bubble in liner portion of laminate shall be 10 per square inch of laminate with maximum bubble size of 1/6 inch. Wall hardness shall be at least 90% of the resin manufacturer's recommended Barcol hardness, with a minimum Barcol hardness of 35, with the resin fully cured. Maximum strain in the laminate shall be 0.001 inch/inch. Appearance of the tank interior and exterior shall comply with ASTM D3299, Section 9. In addition a 90 piece Craftsman tool kit shall be provided

E. Ultraviolet Protection

Provide ultraviolet protection in the form of a surface coating of a permanent resin-rich exterior layer, pigmented white. Surfaces shall be smooth, hard, and glossy.

F. Wall Thickness

Wall thickness shall be sufficient to support its own weight in an upright position with any exterior supports. Wall thickness shall be determined based on structural design calculations in accordance with ASTM D4097 or ASTM D3299.

G. Structural Design

Design tower, baseplate, anchor bolts, and top flange, stack and fan support per the following requirements:

1. Design the tower and anchorage system per the 2010 Florida Building Code (FBC) requirements supplemented by ASCE 7-10 for wind loading requirements:

   Basic Wind Speed, mph: 150

   Risk Category: 3

   Exposure: B

2. An unreinforced concrete housekeeping pad above the reinforced concrete structural slab shall not be considered to have structural value in the design of the anchor bolts. Tension and shear values for drilled or epoxied anchor shall be FBC approved. Maximum hoop stress shall not exceed 1/10 of the ultimate hoop strength of the laminate.

3. Provide with the Certificate of Unit Responsibility, certification for all equipment signed by a structural engineer, registered in the State of Florida, stating that computations were performed and that all components have been sized for the wind load specified and indicated.

H. Bolts

Tie-down lugs and anchor bolts shall be Type 316 stainless steel. Bolts shall conform to ASTM A 193, Grade B8M or ASTM F 593, Type 316. Nuts shall conform to ASTM A 194, Grade 8M or ASTM F 594, Type 316. Use ASTM A 194 nuts with ASTM A 193 bolts; use ASTM F 594 nuts with ASTM F 593 bolts. Lugs shall be integrally molded into the tank walls or bases or tank shell. Do not use cable restraint systems. Provide washers (minimum 1/8 inch thick) of the same materials as the nuts.

I. Fittings – General Requirements

1. Place fittings at least 6 inches away from tank knuckle radius' and flange lines.

2. Orientation of flange fittings shall have bolt holes straddling the principal centerline of the tank in accordance with ANSI/ASME B16.5.

3. Flange dimensions to conform to ANSI B16.5, Class 150. Flanges shall be flat faced. The flange face shall be 4 to 6 inches from the tank shell.

4. Maximum wall thickness for each flange fitting size shall be determined in accordance with ASTM D4097 or ASTM D3299.

J. Bolts and Nuts for Flanged Nozzles

Bolts shall be Type 316 stainless steel, per ASTM A 193, Grade B8M. Nuts shall conform to ASTM A 194, Grade 8M. Provide washer for each nut and bolt head. Washers shall be of the same material as the nuts.

K. Media

1. The media material shall be synthetic and resistant to the corrosive attack of acids. The media configuration shall promote thorough mixing and good contact between the gas and irrigation solution. Organic material, clay, or mineral media shall not be allowed.

2. When operated in accordance with system Operation and Maintenance manual, the biologically active media may be expected to maintain performance within the parameters listed in Table 1: Design criteria for period of ten (10) years.

3. Durability: The media must be capable of being handled with mechanical equipment without physical damage or compaction.

L. Fiberglass Centrifugal Fan

1. General Description: Belt-drive, non-sparking centrifugal fans consisting of housing, wheel, impeller fan shaft, bearings, motor and disconnect switch, drive assembly, belts, belt guards and accessories. Fan shall be equipped with drain connection at bottom of fan scroll. Fan motor shall be suitable for Class 1 Division 2.

2. Housing: Solid fiberglass reinforced plastic.

3. Impeller: Backwardly inclined blades, non-overloading, made of fiberglass reinforced polypropylene (FRP) per ASTM4167.

   a. Shaft Bearings: Grease lubricated, self-aligning pillow block.
   b. Fan Shaft: fan shaft to be 316 SST.
   c. Motor: Totally enclosed fan cooled, corrosion duty, explosion-proof.
   d. SS 316 hardware.

4. Accessories: The following items are required as indicated:

   a. Shaft Guards: FRP sleeve.
   b. Belt Guards: FRP construction to OSHA standards.
   c. Bases: Double epoxy coated angle steel and plates.
   d. Shaft seal: Teflon

5. Fan Discharge Flexible Connector

   a. All interconnecting ductwork and fittings between the blower and the Biotower Odor Control System filter vessel shall be provided by the odor control manufacturer. Ductwork assembly and design shall be compatible with the fan and vessels. Ductwork shall be of FRP construction and coated for U.V. protection.
   b. An expansion joint shall be included in the ductwork and installed at the outlet of the exhaust fan. The expansion joint shall dampen axial, lateral, and vibrational duct movement.

c. Provide a flanged expansion joint between the fan discharge flange and the FRP inlet transition piece. The flange drilling shall be coordinated with the fan and transition.

d. Type: Rectangular configuration with integral flanges with molded corners suitable for service with FRP duct. Rated for 300 deg F and pressure rating of +/- 5 psig.

e. The properties of the flexible connectors shall be as follows: Material shall be ¼" thick EPDM reinforced with fiberglass cloth. Material shall be resistant to ultraviolet light degradation and shall be suitable for contact with odorous air as specified herein. The backing rings shall be 1/4-inch thick, 2" wide, type 304 stainless steel. The length from flange-to-flange shall be 6" unless shown otherwise. The allowable movements shall be: axial extension- 0.5 inch, axial compression- 2 inches, lateral offset-1 inch.

f. Manufacturer shall be Holz Rubber or approved equal.

g. A manual control damper shall be installed at the inlet to the Biotower Odor Control System. Dampers shall be constructed of FRP or PVC. Dampers shall be heavy duty industrial type with an external damper position indicator, manual adjustment and position locking arrangement. Damper blade and hardware shall be constructed of stainless steel.

M. Recirculation Pumps

1. Materials of Construction: The liquid end components shall be plastic for corrosion resistance and the pump should not have any shaft seal or require seal water for cooling. The pump shall be Iwaki magnetic drive model MX with wetted parts Glass filled reinforced Polypropylene and FKM O-ring.

2. Each pump shall be capable of handling solids to reduce the chance of clogging and required maintenance time.

3. Motor: The drive motor shall be non-overloading, premium efficiency, inverter duty, severe duty, class "F" insulation, 1.15 service factor with TEFC enclosure, 230/460V 3-phase, 60 Hz, 3,600 rpm rated for continuous duty, suitable for Class 1 Division 2.

N. Liquid Distributors

1. Liquid distributor shall be of the spray nozzle type. Distributor shall be removable through the tower access through a separate port.

2. The Biotower Odor Control System filter tower shall include an integral chevron type mist eliminator to prevent excess mist from being discharged from the tower exhaust. The mist eliminator shall be fabricated from Polypropylene and designed to remove 99% of all mist particles 20 microns and larger and 90% of all mist particles 10 microns and larger. The mist eliminator shall have an intermittent fresh water spray to flush the demister packing.

O. Motors

Motors for nutrient system mixers (if required by the manufacturer) and recirculation pumps shall be provided in accordance with Section 16150, suitable for suitable for Class 1 Division 2.

P. Control Panel

1. The Manufacturer shall provide a NEMA 4X control panel of Stainless Steel 316 construction, 480VAC control panel meeting the requirements of Section 13300.
2. Solid state motor control or variable frequency drive is acceptable. If this is provided, single phase protection is inherent and the phase monitor is not required.
3. PLC control is allowed rather than the relay control specified in 16100, but the PLC must conform to the Division 13 requirements and an internal UPS in accordance with Division 13 shall be required. Internal PLC wiring shall be allowed to be 18 AWG but shall be rated 600 volts. Internal dividers or barriers shall be provided to allow instrumentation technicians to access the PLC components without being exposed to 480 volts.
4. Control panel shall be UL listed, FM approved.
5. Provide the enclosure with a full size, aluminum, swing- out, dead-front panel for mounting of selector's switches and indicating lamps.
6. The instrumentation and controls system, specified herein, shall operate using single phase, 120 V, 60 Hz AC electrical power, unless otherwise noted.
7. Operator Interface: Provide and install the following selector switches and indicating lamps, mounted on the swing-out panel.
    a. Selector Switches:
        i. FRP Centrifugal Fan START/STOP
        ii. Water Solenoid OPEN/CLOSE/AUTO
        iii. Nutrient Feed Pump START/STOP/AUTO
        iv. Recirculation Pump START/STOP/AUTO
    b. Indicating Lamps:
        i. Control Power ON/OFF
        ii. FRP Centrifugal Fan ON/OFF/FAULT
        iii. Water Solenoid OPEN/CLOSED
        iv. Nutrient Feed Pump ON/OFF
        v. Recirculation Pump ON/OFF
8. External Interfaces:

a. Provide isolating relays and terminal blocks for field wiring of the following status and alarm signals

i. Control Power ON
ii. System ON
iii. System FAIL
iv. Nutrient Feed System
v. Recirculation Pump ON

9. Functional Requirements:

a. Continuously operate the FRP Centrifugal Fan whenever the START/STOP selector is in the START mode. Stop motor operation whenever the START/STOP selector is in the STOP mode.
b. When in AUTOMATIC mode, operate the water motorized (OPEN/CLOSED) using a repeat cycle timer.
c. When in AUTOMATIC mode, START the nutrient feed pump whenever the water motorized valve is OPEN, and STOP the feed pump when the motorized valve is CLOSED.
d. Provide a System ON status whenever the FRP Centrifugal Fan is ON.
e. Provide a System FAIL status whenever the FRP Centrifugal Fan VFD is faulted.
f. Provide a Nutrient Feed System ON status whenever both the water motorized is OPEN and the nutrient feed pump is on.
g. Two stage operation: normal operation will include running the recirculation pump over the lower stage continuously. The upper bed will be wetted by the intermittent spray potable water. This is accomplished using the timer relay and motorized valve. The system shall also have the capability to recirculate over both beds through adjustment of manual ball valves.

10. Special requirements:

a. Provide and install a control power transformer to provide 120 VAC, single phased electrical power for the control logic.
b. Provide and install a Repeat Cycle Timer.

Q. Water Cabinet

1. Provide a single 316 STAINLESS STEEL, NEMA 4X panel to house the following:

a. One (1) Nutrient feed pump
b. Two (2) Water solenoid valves
c. Water flow rotameter
d. Piping and valves (water and nutrient)
e. Water pressure regulating valve.

i. Isolation valves shall be PVC ball valves as specified in Section 15100.

ii. Pressure regulating valves shall be the spring-actuated type. Regulators 2 inches and smaller shall automatically convert high, varying inlet water pressure to a lower, constant outlet pressure. Provide a valve design consisting of a spring in chamber acting on a diaphragm that transmits motion to the valve. Outlet pressure shall be adjustable by turning an adjusting screw to vary spring tension. Body shall be bronze. Diaphragm shall be nitrile. Maximum inlet pressure shall be at least 200 psi.

f. Rotameter

i. Type: High Flow Variable-Area Flowmeter.

I. Accuracy: ±5 percent of maximum flow.
II. Range: per odor control manufacturer.
III. Max pressure drop 16-inch wc at max flow, 6-inch wc at 50% max flow
IV. Float: Conventional, stainless steel.
V. Frame: Type 316 stainless steel.
VI. Tube: Borosilicate glass.
VII. End Fittings: 316 stainless steel.
VIII. Service: Water flow.
IX. Built-in flow control valve for flow adjustments

ii. Product and Manufacturer: Provide one of the following:

I. ABB Instruments, Series FAM 3200
II. King Instrument Co., Series 7460
III. Wallace & Tiernan

g. Solenoid valves shall be as specified in Section 15100.

R. Nutrient Feed System

1. The nutrient feed system stores and delivers biological nutrients to the tower sump where the solution is circulated through the packing media. The nutrient feed system shall include a nutrient pump, reservoir and all piping and equipment necessary to deliver nutrients from the reservoir to the tower sump.

2. The nutrient feed mixture cannot be proprietary, and performance of the system cannot be dependent upon a proprietary mixture.

3. The nutrient tank shall be constructed of polypropylene with cover and sized to hold one-month supply of nutrient. The tank shall be furnished for the

containment of biological nutrients and be suitable for storage in direct sunlight.

4. The reservoir shall be provided with bulkhead pipe connections for outlet, low level indicator, and vent. Flanged connections shall be of the same materials as the reservoir wall. Threaded connections shall be of standard NPT.

5. The Nutrient Pump shall be solenoid driven, rated for 1.25 GPH, Premia 75 a manufactured by Wallace & Tiernan.

6. All nutrient feed piping and accessories shall be Sch. 80 PVC or polypropylene and provided by the Biotower Odor Control System Manufacturer. All external piping shall be insulated and heat traced by the Contractor.

S. Labeling and Marking

The Contractor shall provide labels on the tower per section 09905.

T. System Drain

The Contractor shall provide a system drain pipe made of Schedule 80 PVC for the reactor vessel drain designed for the maximum pressure of the reactor vessel. The manufacturer shall provide a separate drain pipe for condensate. A drain pipe shall slope from the fan to the drain.

2.03 TOOLS AND SPARE PARTS

A. All special tools required for normal operation and maintenance of the equipment shall be furnished with the equipment by the manufacturer.

B. Spare Parts: Spare parts shall be furnished to assure normal running and maintenance for a period of one year as recommended by the manufacturer of equipment under this Section.

C. The equipment Manufacturer shall recommend and supply all spare parts. Spare parts shall be marked with part numbers and equipment and shall be packed in suitable containers which are also marked with the part numbers and equipment for which it is used.

1. The manufacturer's recommended spare parts and tools shall also include:

   a. Provide a 90 piece Craftsman tool kit
   b. One (1) spare belts and set of bearings for the fan
   c. Two (2) spray nozzles for the biotower
   d. Two (2) sets of pH and ORP controllers

D. All special tools and spare parts shall be furnished in containers clearly identified with indelible markings as to their contents. Each container shall be packed with its contents protected for storage.

PART 3 - EXECUTION

3.01 GENERAL

A. 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 for a period of not less than one (1) day to inspect the installed equipment, supervise the initial test run, and to provide instructions to the plant personnel. The final copies of operation and maintenance manuals must have been delivered to the Engineer prior to scheduling the instruction period with the Owner.

3.02 SHIPPING AND INSTALLATION

A. Ship per ASTM D 1998 and the following. Wrap tanks with protective polyethylene sheet and protective tarpaulins to prevent deposition of road salts, fuel residue, and other contaminants in transit. Cover or plug fittings and flange faces with weatherproof metal covers.

B. Install tanks level as shown in the drawings. Provide layers of roofing felt, between the tank bottom and the underlying slab as recommended by the manufacturer.

C. Fill the reactor vessel with water and allow to settle for 7 days. Do not attach connecting piping and ductwork until after this period to allow for any differential settlement. Check for leaks and correct any repair and leaking areas

D. Ductwork modifications: Tie-in to existing ductwork to send to proposed odor control. Disconnect existing odor control from existing ductwork, Electrical and I&C/SCADA tie-ins.

3.03 INSPECTION AND TESTING

A. The manufacturer shall startup and operate the unit with plant potable water. During this startup the manufacturer shall provide all necessary equipment and start-up nutrients to allow biological growth within the reactor vessel.

B. Once the manufacturer indicates the reactor is operational, operate Biotower Odor Control System initially for a period of 15 continuous days. During this time, confirm that all system components have been installed correctly, are operating properly, and are performing their intended function.

C. Performance testing to occur no sooner than 4 weeks or later than 8 weeks from start-up. Performance test to consist of measurement of inlet and outlet H_2S readings for a period of not less than 4 continuous hours.

D. Performance Testing:

1. Provide the complete testing apparatus necessary to determine the performance of the Biotower Odor Control System and differential pressure drop across each stage. Apparatus shall include H_2S detectors, a manometer, and a pH analyzer.

2. Test results shall demonstrate the specified percentage removal of H_2S from the airstream by taking two field samples.

3. In addition to meeting performance, all equipment shall show evidence of mechanical soundness with no liquid or gas leaks and no undue vibration.

4. If system fails for any reason, make changes or alterations and reconduct the test described above at no cost to the Owner until system is acceptable.

E. Contract Closeout

Provide in accordance with Section 01700.

F. Certification

Provide a written certification from the equipment manufacturer that the equipment has been properly installed according to the plans, specifications and manufacturer's specifications, and that the equipment is operating normally. Make all necessary corrections and adjustments at no additional cost to the County.

3.04 SERVICE PROGRAM

A. The manufacturer shall furnish all labor, materials, equipment, accessories, tools, and nutrient required to operate and maintain the biological odor control system in accordance with the design criteria shown above for a period of one year. The manufacturer shall not be responsible for proper operation of the system at loading conditions above the peak shown.

B. These services shall be supplied by factory trained employees of the equipment Manufacturer. Subcontracting of these services shall not be acceptable.

C. The Manufacturer shall visit the site as often as necessary to maintain acceptable operation as described under Section 2.2 of these Specifications. This frequency shall be no less than once per month.

D. The Manufacturer shall provide continuous hydrogen sulfide monitoring of the Biotower Odor Control System discharge for the duration of the service program. The monitor shall record hydrogen sulfide level at least once every 5 minutes and shall

automatically upload all recorded data to a website at least once every 24 hours. The website shall be accessible to the Owner at any time. The monitor shall have a user-adjustable alarm setpoint for hydrogen sulfide level. In the event of an alarm condition the monitor shall provide alerts to Owner and Manufacturer personnel via email, and/or SMS text, and/or voice call.

E. The Manufacturer shall at each visit perform the following tasks, at a minimum:

1. Measure and record inlet and outlet H2S levels. Troubleshoot system as necessary to correct high discharge levels.
2. Measure and record blowdown solution pH. Adjust operating parameters as necessary to achieve target pH.
3. Inspect and record make-up water flowrate. Adjust as necessary.
4. Visually inspect spray nozzles and media for scaling or fouling. Perform cleaning procedure(s) as necessary.
5. Inspect all pumps and blowers for leaks and vibration. Correct as necessary.
6. Perform any other tasks/repairs necessary to achieve proper operation of the systems.

F. In addition to the tasks described above, any and all calibration, lubrication, or other maintenance shall be performed in accordance with the methods and frequency specified by the Operation and Maintenance Manual.

G. The Manufacturer shall provide response to any emergency repair need or odor complaint within 24 hours.

H. The services described in these specifications shall be included with the equipment.

END OF SECTION

SECTION 13300
PROCESS INSTRUMENTATION AND CONTROL SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Work includes engineering, furnishing, installing, programming, testing, documenting and modification of the existing Plant Control System to incorporate the new Odor Control Panel as defined in specification section 11530.

B. It is the ultimate responsibility of the CONTRACTOR to furnish a complete and fully operable system that reliably performs the specified functions. However, it is the intent of these Contract Documents that a single entity (henceforth referred to as the SYSTEM SUPPLIER) be retained by the CONTRACTOR to have overall responsibility for designing, furnishing, interfacing, adjusting, testing, documenting, and starting-up the equipment described in the Contract Documents.

C. The work defined in this Specification Section shall be performed by the following listed below and henceforth referred to as the SYSTEM SUPPLIER.

1. Curry Controls, Lakeland, Florida
2. Revere Control Systems
3. Controls Instrument, Inc.
4. Approved equal

D. The CONTRACTOR shall be responsible for:

1. Equipment storage and protection until installed following the storage and handling instructions recommended by the SYSTEM SUPPLIER. Anti-static and winterization requirements shall be per the SYSTEM SUPPLIER's instructions and the SYSTEM SUPPLIER shall periodically verify that these instructions are followed.
2. Including within the electrical subcontractor's scope the provision, installation and termination of field and power wiring to the PCP. Termination shall be made in accordance with final accepted interconnection diagrams developed by the SYSTEM SUPPLIER. The electrical subcontractor shall mark on the interconnect diagram the field wire numbers used for each termination point. The SYSTEM SUPPLIER shall finalize the interconnect diagrams by including these field wire numbers in the final as built version.

E. All engineering development required by the SYSTEM SUPPLIER will be in accordance with the Conditions of this Contract.

F. Equipment found to be defective prior to system acceptance shall be replaced and installed at no additional cost to the OWNER.

G. In the bid price, the SYSTEM SUPPLIER shall provide for obtaining the services of authorized field personnel from the manufacturers of components or systems provided under this section but not manufactured by the SYSTEM SUPPLIER. Should these personnel be required during installation, start-up and checkout of the PCP, such services shall be provided at no additional cost to the OWNER.

1.02 RELATED WORK

A. All conduits, power and field wiring and cables are provided and installed under Division 16.

1.03 SUBMITTALS

A. Furnish, as prescribed under the General Requirements, all required submittals covering the items included under this section.

B. Submit complete, neat, orderly, and indexed submittal packages. Handwritten diagrams are not acceptable and all documentation submittals shall be made using CADD generated utilities.

C. Partial submittals or submittals that do not contain sufficient information for complete review or are unclear will not be reviewed and will be returned by the ENGINEER as not approved.

D. Provide all shop drawing submittals on disk in PDF format.

E. Provide a single shop drawing submittal containing the following:

1. Loop diagrams, consisting of complete wiring and/or plumbing diagrams for each control loop showing all terminal numbers, the location of the dc power supply, the location of any booster relays or common dropping resistors, surge arrestors, etc. The loop diagrams shall meet the minimum requirements of ISA S5.4 plus divide each loop diagram into four areas for identification of element locations: PLC I/O point(s), panel face, back-of-panel, and field, respectively.

2. System interconnect diagram that shows all connections required between component parts of the items covered in this section and between the various other systems specified in this Contract. Number all electrical terminal blocks and field wiring. Identify each line at each termination point with the same number. Do not use this number again for any other purpose in the complete control scheme.

3. Bill of Materials: A list of all components, including all 3rd party software. Group components by type and include component model number and part number, component description, quantity supplied, and reference to component catalog information.

4. Descriptive Information: Catalog information, descriptive literature, performance specifications, internal wiring diagrams, power and grounding requirements, power consumption, and heat dissipation of all elements. Clearly mark all options and features proposed for this project.

5. Installation Details. Equipment installation drawings showing external dimensions, enclosure material and spacing, mounting connections, and installation requirements.

6. A list of, and descriptive literature for, spares, expendables, and test equipment.

F. Test Procedures: Submit the procedures proposed to be followed during all system testing. Procedures shall include test descriptions, forms, and check lists to be used to control and document the required tests.

G. Test Reports: Upon completion of each required test, document the test by submitting a copy of the signed off test procedures to the ENGINEER.

1.04 FINAL DOCUMENTATION

A. After the demonstration tests have been completed and as a part of the final acceptance requirements, submit the system record drawings. Record drawings shall include, corrected for any changes that may have been made up through Substantial Completion:

1. instrument loop wiring diagrams

2. panel wiring diagrams

3. panel elevations

4. interconnection diagrams showing terminal numbers at each wiring termination

B. Record drawings shall be developed or converted to the latest version of AutoCAD. Provide two copies of all AutoCAD files on separate Compact Disks.

C. Operating and Maintenance (O&M) Manuals: Provide the specified number of complete sets of three-ring bound O&M manuals in accordance with Division 1. Include descriptive material, drawings, and figures bound in appropriate places. Include:

1. Cross references to any 3rd party O&M manuals.

2. Additional operating and maintenance instructions in sufficient detail to facilitate the operation, removal, installation, adjustment, calibration and maintenance of each component provided.

3. All the submittal data for each component from the approved shop drawing submittals with corrections made on approved as noted items.

4. A Compact Disk containing the shop drawing data in PDF format in the binder sleeve.

D. Provide the following additional final documentation:

1. licenses in the OWNER's name for all software supplied including software used for programming.

2. final copies of all programming files on Compact Disk

1.05 QUALITY CONTROL

A. The SYSTEM SUPPLIER shall be subcontracted by and paid by the CONTRACTOR.

B. The SYSTEM SUPPLIER shall meet all of the requirements of these specifications, and, unless specifically stated otherwise, no prior acceptance of any subsystem, equipment, or materials has been made.

C. All equipment furnished by the SYSTEM SUPPLIER shall be of the latest and most recent design and shall have overall accuracy as guaranteed by the manufacturer.

D. Materials and equipment used shall be U.L. approved wherever such approved equipment and materials are available.

E. Component equipment shall be as supplied by one of the manufacturers named or approved equal. The design of the system is based on the first-named manufacturer's equipment if there is a difference.

F. To facilitate the OWNER's operation and maintenance, products shall be of the same major MANUFACTURER, with panel mounted devices of the same type and model as far as possible.

G. In order to insure the interchangeability of parts and the maintenance of quality, strict compliance with the above requirements shall be maintained.

H. The SYSTEM SUPPLIER shall designate a single point of contact for interface with the ENGINEER on this project. The ENGINEER reserves the sole right to approve or reject this point of contact.

I. The SYSTEM SUPPLIER shall provide experienced personnel on-site to coordinate and/or perform installation, termination, and adjustment; on-site testing; OWNER training; and startup assistance for the system.

1.06 STANDARDS

A. The design, testing, assembly, and methods of installation of the wiring materials, electrical equipment and accessories proposed under this Contract shall conform to the National Electrical Code and to applicable state and local requirements. UL listing and labeling shall be adhered to under this Contract.

B. Instrument Society of America (ISA) and National Electrical Manufacturers Association (NEMA) standards shall be used where applicable in the design of the system.

C. Any equipment that does not have a UL, FM CSA, or other approved testing laboratory label shall be furnished with a notarized letter signed by the supplier stating that the equipment famished has been manufactured in accordance with the National Electric Code and OSHA requirements.

D. Any additional work needed resulting from any deviation from codes or local requirements shall be at no additional cost to the OWNER.

1.07 WARRANTY AND GUARANTEES

A. In accordance with Division 1, the SYSTEM SUPPLIER shall furnish to the OWNER a written three year guarantee commencing with substantial completion, that all equipment and parts thereof, material and/or workmanship are of top quality and free from defects.

B. The SYSTEM SUPPLIER shall guarantee all equipment whether or not of his own manufacture.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Equipment to be installed in a hazardous area shall meet Class, Group, and Division classification as shown on the Contract Electrical Drawings, or comply with the local or National Electrical Code, whichever is the most stringent requirement.

B. All components supplied shall be of the MANUFACTURER's latest design and shall produce or be activated by signals, which are established standards for the water and wastewater industries.

C. Electronic equipment shall utilize printed circuitry suitably coated to prevent contamination by dust, moisture and fungus. Solid-state components shall be conservatively rated for their purpose, to assure optimum long-term performance and dependability over ambient atmosphere fluctuations and 0 to 100 percent relative humidity. The field mounted equipment and system components shall be designed for installation in dusty, humid, and slightly corrosive service conditions.

D. All equipment shall be designed to operate on a 60-Hertz alternating current power source at a normal 120 volts, plus or minus 10 percent, except where specifically noted. All regulators and power supplies required for compliance with the above shall be provided between power supply and interconnected instrument loop. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.

E. All equipment, cabinets and devices furnished hereunder shall be heavy-duty type, designed for continuous industrial service. The system shall contain products of a single MANUFACTURER, insofar as possible, and shall consist of equipment models which are currently in production. All equipment provided shall be of modular construction and shall be capable of field expansion through the installation of plug-in circuit cards or additional cabinets.

F. The equipment furnished shall be designed to operate satisfactorily between 0 degrees C and 40 degrees C at up to 95 percent Relative Humidity (non condensing).

G. All switches shall have double-pole, double-throw contacts rated at a minimum of 600 volts-amperes (VA), unless specifically noted otherwise.

H. All equipment shall be designed and constructed so that in the event of a power interruption, the equipment specified hereunder shall resume normal operation without manual resetting when power is restored.

2.02 ODOR CONTROL PANEL

A. The Odor Control Panel and associated Water Panels furnished under Division 11 shall conform to the standards listed below.

B. General:

1. All conduit entry shall be from the top and/or bottom only.

2. The panel shall be provided with an isolated copper grounding bus to ground all signal shield connections.

3. The panel shall be a ventilated NEMA 3R, Type 316 stainless steel enclosure with 30% spare mounting space for future, additional equipment. The enclosure shall have provisions for padlocking the door and a dead front inner door unit for mounting controls. All exterior hardware and hinges shall be stainless steel

4. The panel shall be equipped with an internal, hand-switch controlled, 40-watt fluorescent light and 120V, 15 amp, duplex utility receptacle. These shall be serviced through a dedicated breaker.

5. The panel shall be protected from internal corrosion by the use of corrosion – inhibiting vapor capsules. Provide:

a. Northern Instruments Model Zerust VC-6-2
b. Hoffman, model A-HC15E
c. Approved equal.

C. Finish:

1. All front panel openings for panel-mounted equipment shall be cut with counter-boring and provided with trim strips as required to give a neat finished appearance.

2. All steel panel surfaces shall be treated with phosphatized treatment inside and out, and then finished on the exterior with two coats of baked enamel of the approved color. Interiors of panels shall be white, ANSI No. 51.

D. Doors:

1. All control panels shall have a continuous piano hinge door for ease of access. A minimum of 80% of the panel interior shall be exposed by doors.

2. The inside of each door shall be equipped with a print pocket.

3. Two-door enclosures shall have a removable center post.

E. Nameplates:

1. All front-face panel mounted controls shall be equipped with screw mounted laminated plastic nameplates to completely define their use.

2. All internal components shall be equipped with identification tags

F. Power Supplies.

1. An Uninterruptible Power Supply (UPS) shall be provided as follows:

   a. Size the UPS for all internal equipment.
   b. Provide 15 minutes battery back-up capability at full load.
   c. Provide Invensys Powerware Ferrups or approved equal.

2. Provide isolated 24 Volt DC power supplies as follows:

   a. Redundant supplies with separately fused connections to power the PLC and miscellaneous field instruments as shown in the Contract Drawings.
   b. A wetting supply for interposing relay contacts that provide discrete inputs to the PLC, separately fused for each input group. An additional, separately fused connection, from this supply shall also power the discrete output isolation relay coils.
   c. A loop power supply for analog inputs, with each analog input separately fused.

G. Electrical:

1. Main circuit breaker and branch circuit breaker for each branch circuit as required to distribute power from the main power feed.

2. All breakers accessible when the panel door is open.

3. No more than 20 devices on any single circuit.

4. No more than 12 amps for any branch circuit.

5. Panel (or site) lighting, receptacles, heaters, controls, telemetry and fans on separate branch circuits.

H. Wiring:

1. Power wiring shall be 300 volt, type THWN stranded copper, No. 14 AWG size, for 120V service.

2. Discrete wiring shall be 300-volt type THWN stranded copper, sized for the current carried, but not smaller than No. 16 AWG.

3. Analog signal wiring shall be 300 volt, stranded copper in twisted shield pairs, no smaller than No. 16 AWG.

4. Panel wiring shall be routed within wire troughs or panduits.

5. Hinge wiring shall be secured at each end with the bend portion protected by a plastic sleeve.

6. Analog or dc wiring shall be separated from any ac power or control wiring by at least six inches.

7. Each wire shall be uniquely identified at all terminations using machine printed plastic sleeves

I. Construction:

1. Minimum metal thickness: 14-gauge.

2. Stiffeners as required to prevent deflection under instrument loading and permit lifting without racking or distortion.

3. When required, removable lifting rings and fill plugs to replace rings after installation.

4. All components and terminals shall be accessible without removing other components except for covers.

J. The panel shall be a manufactured item, Hoffman Engineering, or equal.

K. All panel devices provided shall be as listed in Orange County Utilities Standards – Appendix D - List of approved products.

L. Programmable Logic Controller

1. Monitoring and control of the new equipment shall be accomplished within the PLC. All control strategies specified in Part 3 of this Specification Section shall be implemented within the PLC.

2. PLC shall be implemented using Siemens S7 series components. The use of other manufacturer's products will not be acceptable.

3. The PLC shall comprise the following modules:

a. Power Supply Module. The power supply module shall convert 120 VAC power into the DC voltages necessary to power the rest of the rack. Siemens model PS 307.

b. Central Processing Unit (CPU) Module. The CPU module shall contain the user program and be equipped with the battery back-up option to protect the program in the event of a power loss. It shall contain dual RS-485 integral ports to communicate with the Operator Interface Terminal and RTU Transceiver. Siemens model S7 315.

c. Interface Module. The Interface Module shall function as the send (master) connection with the expansion racks. Siemens model IM 360.

d. Input/Output (I/O) Modules. Provide sufficient I/O modules to accommodate the signals shown on the Contract drawings plus an additional 15% fully wired spares of each type. Use the following modules:

e. Analog Input Module. Eight, optically isolated analog input channels. Siemens model S7 331.

f. Analog Output Module. Four, isolated analog output channels. Siemens model S7 332.

g. Discrete Input Module. Sixteen 120 VAC input channels. Siemens model S7 321.

h. Output Module. Eight 120 VAC, 2A rated relay outputs in two groups of four. Siemens model S7 322.

4. All PLC input/output modules shall be fully wired to field wiring termination blocks together with all required surge protection, etc.

5. Provide the following spare parts:

a. One spare CPU module

b. One spare Power Supply Module.

c. One spare I/O module of each type provided.

d. One spare d.c. power supply of each type provided.

e. Five percent (rounded up) spare relays of each type provided.

f. Five percent (rounded up) spare surge suppressors of each type provided.

6. Provide the following expendables:

a. Two year supply of corrosion inhibitor capsules

b. Ten percent (rounded up) spare fuses (minimum of 10) of each type and rating supplied.

c. Provide licensed copy of programming software needed in addition to a dedicated laptop.

PART 3 - EXECUTION

3.01 GENERAL

A. Prerequisite Activities and Lead Times: Do not start the following key project activities until the listed prerequisite activities have been completed and lead times have been satisfied:

1. Hardware Purchasing, Fabrication, and Assembly: Associated design related submittals completed (no exceptions, or approved as noted).

2. Shipment: Completion and approval of all design related submittals.

3. Startup: Operational Checkout Tests.

4. OWNER Training: Owner Training Plan completed and O&M manuals delivered.

5. Demonstration Tests: Operational Check-out Tests, Startup, OWNER Training, and Demonstration Test Procedures must be complete. Give 4 weeks' notice prior to the planned test start date.

B. Substantial Completion: Substantial Completion for the project is as defined in the General Conditions. However, the following requirements must be fulfilled before consideration will be given for Substantial Completion of the system:

1. All system submittals have been completed.

2. The system has successfully completed the Demonstration Tests.

3. The required OWNER training has been completed.

4. All spares, expendables, and test equipment have been received by OWNER.

C. Final Acceptance: system final acceptance is defined as the date when the ENGINEER issues a written notice of final acceptance. For this Section, the following must have been completed before consideration will be given to the issuance of notice of final acceptance:

1. All punch-list items have been checked off.

2. Revisions to the system O&M Manuals have been made (that may have resulted from the Demonstration Tests).

3.02 PRODUCT HANDLING

A. Adequately pack manufactured material to prevent damage during shipping, handling, storage and erection. Pack all material shipped to the project site in a container properly marked for identification. Use blocks and padding to prevent movement.

B. Ship materials that must be handled with the aid of mechanical tools in wood-framed crates.

C. Ship all materials to the project site with at least one layer of plastic wrapping or other approved means to make it weatherproof. Anti-stat protection shall be provided for all sensitive equipment.

D. Inspect the material prior to removing it from the carrier. Do not unwrap equipment until it is ready to be installed. If any damage is observed, immediately notify the carrier so that a claim can be made. If no such notice is given, the material shall be assumed to be in undamaged condition, and any subsequent damage that is discovered shall be repaired and replaced at no additional expense to the OWNER.

E. Store and protect equipment until installation following the storage and handling instructions recommended by the equipment manufacturers. Place special emphasis on proper anti-static protection of sensitive equipment.

F. ESD Protection: Provide for the proper handling, storage, and environmental conditions required for the system components deemed static sensitive by the equipment manufacturer. Utilize anti-stat wrist straps and matting during installation of these items to prevent component degradation.

G. Protection During Construction: Throughout this Contract, provide protection for materials and equipment against loss or damage and from the effects of weather. Prior to installation, store items in indoor, dry locations. Provide heating in storage areas for items subject to corrosion under damp conditions. Provide covers for panels and other elements that may be exposed to dusty construction environments. Specific storage requirements shall be in accordance with the SYSTEM SUPPLIER's recommendations.

H. Corrosion Protection: Protect all consoles, panels, enclosures, and other equipment containing electrical or instrumentation and control devices, including spare parts, from corrosion through the use of corrosion-inhibiting vapor capsules. Prior to shipment, include capsules in the shipping containers, and equipment as recommended by the capsule manufacturer. During the construction period, periodically replace the capsules in accordance with the capsule manufacturer's recommendations. Replace all capsules just prior to Final Acceptance.

I. The CONTRACTOR shall be responsible for any damage charges resulting from the handling of the materials.

3.03 INSTALLATION

A. Keep the premises free from accumulation of waste material or rubbish. Upon completion of work, remove materials, scraps, and debris from premises and from interior and exterior of all devices and equipment. Touch-up scratches, scrapes, or chips in interior and exterior surfaces of devices and equipment with finishes matching as nearly as possible the type, color, consistency, and type of surface of the original finish. Clean and polish the exterior of all panels and enclosures upon the completion of the demonstration tests.

B. Install materials and equipment in a workmanlike manner utilizing craftsmen skilled in the particular trade. Provide work which has a neat and finished appearance. Coordinate I&C work with the OWNER and work of other trades to avoid conflicts, errors, delays, and unnecessary interference with operation of the existing plant during construction.

3.04 TRAINING

A. The cost of training programs to be conducted with OWNER's personnel shall be included in the Contract price.

B. All training schedules shall be coordinated with, and at the convenience of the OWNER. Shift training may be required to correspond to the OWNER's working schedule.

C. Provide a minimum of one day training for up to three of the OWNER’s personnel in the maintenance of the hardware which shall include:

1. Training in standard hardware maintenance for the equipment provided.
2. Specific training for the actual hardware configuration to provide a detailed understanding of how the equipment and components are arranged, connected, and set up.
3. Test, adjustment, and calibration procedures.
4. Troubleshooting and diagnosis.
5. Component removal and replacement.
6. Periodic maintenance.

D. Provide a minimum of one day training for up to six of the OWNER's personnel in the use of the operator graphic screens.

3.05 TESTING - GENERAL

A. All elements of the system, both hardware and software, shall be tested to demonstrate that the total system satisfies all of the requirements of the Contract Documents

B. As a minimum, the testing shall include shop tests, operational check-out tests, and Demonstration Tests.

C. Each test shall be in the cause and effect format. The person conducting the test shall initiate an input (cause) and, upon the system producing the correct result (effect), the specific test requirements will have been satisfied.

D. All tests shall be conducted in accordance with, and documented on, prior approved procedures, forms, and checklists. Each specific test to be performed shall be described and a space provided after it for signoff by the appropriate party after its satisfactory completion. Copies of these signoff test procedures, forms, and checklists will constitute the required test documentation.

E. Provide all special testing materials and equipment. Wherever possible, perform tests using actual process variables, equipment, and data. Where it is not practical to test with real process variables, equipment, and data, provide suitable means of simulation. Define these simulation techniques in the test procedures.

F. The SYSTEM SUPPLIER shall coordinate all of their testing with the CONTRACTOR, the ENGINEER, all affected suppliers, and the OWNER.

G. The ENGINEER reserves the right to test or retest any and all specified functions whether or not explicitly stated in the approved test procedures. The ENGINEER's decision shall be final regarding the acceptability and completeness of all testing.

3.06 OPERATIONAL READINESS TEST (ORT)

A. Prior to startup and demonstration testing, certify that the system (inspected, tested and documented) is ready for operation. These inspections and tests shall include Loop/Component inspections and tests. The SYSTEM SUPPLIER shall fully debug problems in the system as a whole. Final approval of control software will not be

based on written descriptions of software functions alone, but on actual performance in the field.

B. Check the entire system for proper installation, calibration and adjustment on a loop-by-loop and component-by-component basis to ensure that it is in conformance with related submittals and the Specifications.

C. The Loop/Component Inspections and Tests shall be implemented using approved forms and checklists. These shall be developed by the SYSTEM SUPPLIER and submitted for approval.

D. Loop Status Report: Each control loop shall have a Loop Status Report to organize and track its inspection, adjustment, and calibration. These reports shall include the following information and check-off items with spaces for sign-off by the SYSTEM SUPPLIER:

1. Project Name
2. Control Loop Number or description
3. Tag Number or description for each component of the control loop
4. Check-offs/sign-offs for each component for proper installation, termination, and calibration/adjustment
5. Check-offs/sign-offs for the control loop for proper panel interface terminations, I/O interface terminations, I/O signal operation relative to the computer network, and total loop operation ready
6. Space for comments

E. Component Calibration Sheet: Each field instrument element and each PLC I/O module shall have a Component Calibration Sheet. These sheets shall have the following information, spaces for data entry, and a space for signoff by the SYSTEM SUPPLIER:

1. Project Name
2. Component Identification or I/O Module Number
3. Manufacturer, Model Number/Serial Number of field element
4. Summary of Functional Requirements (scale, range, computing equation, control action, etc.)
5. Calibrations of span, setpoints, and preset adjustable parameters
6. Space for comments

F. Maintain the Loop Status Reports and Component Calibration Sheets at the jobsite and make them available to the ENGINEER at any time.

G. Witnessing: These inspections and tests do not require witnessing. However, the ENGINEER will review the Loop Status Sheets and Component Calibration Sheets and spot-check their entries periodically and upon completion of the Operational Check-out Tests. Correct any deficiencies found.

3.07 FIELD ACCEPTANCE TEST (FAT)

A. Once the system has passed the ORT, the SYSTEM SUPPLIER shall perform a witnessed Field Acceptance Test (FAT) on the complete system. The FAT shall demonstrate that the system is operating and in compliance with the Contract requirements. Each specified function shall be demonstrated on a paragraph-by-paragraph, and site-by-site basis.

B. Prior to the FAT, the entire installed system shall be certified in writing by the CONTRACTOR that it is ready for operation.

C. The system shall operate for a continuous 100 hours without failure before this test will be considered successful.

D. The FAT shall cover the entire system, including control functions, alarms, and status monitoring. Test procedures used for shop tests may be adopted for these tests if modified as required.

3.08 30-DAY SITE ACCEPTANCE TEST (SAT)

A. After completion of the Field Acceptance Test, the entire system shall operate for a period of 30 consecutive days, under conditions of full plant process operation, without a single non-field repairable malfunction.

B. Provide complete O&M Manuals for the system at the jobsite at least two weeks prior to the SAT.

C. During this test, plant operating and SYSTEM SUPPLIER personnel shall be present as required. The SYSTEM SUPPLIER is expected to provide personnel for this test who have an intimate knowledge of the hardware and software of the system.

D. While this test is proceeding, the OWNER shall have full use of the system. Only plant operating personnel shall be allowed to operate equipment associated with live plant processes.

E. Any malfunction during the tests shall be analyzed and corrections made by the SYSTEM SUPPLIER. The ENGINEER and/or OWNER will determine whether any such malfunctions are sufficiently serious to warrant a repeat of this test.

F. Any malfunction, during this 30 consecutive day test period, which cannot be corrected within 24 hours of occurrence by the SYSTEM SUPPLIER's personnel, or more than two similar failures of any duration, will be considered as a non-field-repairable malfunction.

G. Upon completion of repairs, by the SYSTEM SUPPLIER, the test shall be repeated as specified herein.

H. In the event of rejection of any part or function, the SYSTEM SUPPLIER shall perform repairs or replacement within 90 days.

I. All data base errors must be corrected prior to the start of each test period. The 30-day test will not be considered successful until all databases are correct.

J. The total availability of the system shall be greater than 99.5 percent during this test period.

1. Availability is given by “(Total Time-Down Time) / Total Time".

2. Down times due to power outages or other factors outside the normal protection devices or back-up power supplies provided, shall not contribute to the availability test times above.

K. Upon successful completion of the 30-day Site Acceptance Test and subsequent review and approval of complete system final documentation, the system shall be considered substantially complete and the warranty period shall commence.

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SECTION 15000
GENERAL MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Furnish all labor, materials, services, supplies, tools, equipment, transportation and facilities necessary to install complete and operable all mechanical equipment as shown on the Drawings and specified in this Division.

B. Drawings and Specifications: The Drawings and Specifications shall be considered as complementary, one to the other, so that materials and work indicated, called for, or implied by the one and not by the other shall be supplied and installed as though specifically called for by both. The Drawings are to be considered diagrammatic, not necessarily shown in the detail or to scale all of the equipment or minor items. In the event of discrepancies between the Drawings and the Specifications, or between either of these and any regulations or ordinances governing work of this Division, the Bidder shall notify the Engineer in ample time to permit revisions.

C. Safety Requirements: In addition to the components specified and shown on the Drawings and necessary for the specified performance, the Contractor shall incorporate in the design and show on the shop drawings all the safety features required by the current codes and regulations, including, but not limiting to, those of the Occupational Safety and Health Act of 1970, and Amendments thereto.

1.02 QUALITY ASSURANCE

A. All equipment and materials used in this installation shall be new, of the best quality and unless otherwise noted, shall be standard catalog items of the various manufacturers.

B. Equipment and appurtenances shall be designed in conformity with ANSI (formerly ASA), ASME, IEEE, NEMA, OSHA, AGMA, and other generally acceptable applicable standards. They shall be of rugged construction and of sufficient strength to withstand all stresses which may occur during fabrication, testing, transportation, installation, and all conditions or operations. All bearings and moving parts shall be adequately protected against wear by bushings or other approved means. Provisions shall be made for adequate lubrication with readily accessible devices.

C. Machinery parts shall conform to the dimensions shown on the working drawings within allowable tolerances. The corresponding parts of identical machines shall be made interchangeable. Protruding members such as joints, corners and gear covers

shall be finished in appearance. All exposed welds shall be ground smooth and the corners of structural shapes shall be rounded or chamfered.

D. Clearances and Access: Ample clearance shall be provided for inspection and adjustment. All equipment shall fit the allotted space and shall leave reasonable access room for servicing and repairs. Greater space and room required by substituted equipment shall be provided by the Contractor and at his expense. Provide access panels at walls or ceilings for access to valves, dampers, equipment or any part requiring maintenance or service. Provide minimum sizes of 12 inches by 12 inches for hand access or 24 inches by 24 inches for personnel access.

E. Safety Requirement:

1. All machinery and equipment shall be safeguarded in accordance with the safety codes of the ANSI, OSHA, and local industrial codes.

2. The Contractor shall provide for each V-belt drive or rotating shaft a protective guard which shall be securely bolted to the floor or apparatus. The guard shall completely enclose drives and pulleys and be constructed to comply with all safety requirements.

3. For fans, the belt guard shall be arranged so as not to restrict the air flow into the fan inlet. Guards shall not interfere with lubrication of equipment.

1.03 PROTECTIVE COATINGS

A. All machined surfaces and shafting shall be cleaned and protected form corrosion by the proper type and amount of coating necessary to assure protection during shipment and prior to installation.

B. Oil lubricated gearing, bearings, etc. are to be shipped with an oil soluble protective coating as recommended by the equipment manufacturer.

C. Motors, reducers and electric controls shall have the standard factory finish prior to delivery.

D. Refer to Section 09900 for painting.

1.04 PREPARATION FOR SHIPMENT

A. Fabricated sub-assemblies, if any, shall be shipped in convenient sections as permitted by carrier regulations and shall be properly match-marked for ease of field erection.

1.05 INSTALLATION OF EQUIPMENT

A. Precision gauges and levels shall be used in setting all equipment. All piping and equipment shall be perfectly aligned, horizontally and vertically. Tolerances for

piping and equipment installation shall be 1/2- inch in 30 ft. horizontal and vertically. All valves and operators shall be installed in the position shown on the plans or as directed by the Engineer if not shown.

B. The Contractor shall have on site sufficient proper construction equipment and machinery of ample capacity to facilitate the work and to handle all emergencies normally encountered in work of this character. To minimize field erection problems, mechanical units shall be factory assembled when practical.

C. Equipment shall be erected in a neat and workmanlike manner on the foundations and supports at the locations and elevations shown on the Drawings, unless otherwise directed by the Engineer during installation.

D. The equipment shall be brought to proper level by shims (1/4-inch maximum). After the machine has been leveled and aligned, the nuts on the anchor bolts shall be tightened to bind the machine firmly into place against the wedges or shims. Grout shall be as specified in Division 3.

E. The grout shall be tamped into position with a board, steel bar or other tool. Tamping should not be so hard as to raise or otherwise displace the plate.

F. All equipment shall be installed in such a manner as to provide access for routine maintenance including lubrication.

G. For equipment such as pumping units, which require field alignment and connections, the Contractor shall provide the services of the equipment manufacturer's qualified mechanic, millwright, machinist, or authorized representative, to align the pump and motor prior to making piping connections or anchoring the pump base.

H. All rotating equipment shall be statically and dynamically balanced. Unless otherwise specified, the vibration allowance in the units shall not exceed the upper limits as established by the manufacturer.

I. Equipment of a portable nature which requires no installation shall be delivered to a location designated by the Owner.

J. All cutting and patching necessary for the work shall be performed by the Contractor. Where interferences occur, and departures from indicated arrangements are required, the Contractor shall coordinate the mechanical work with the other trades involved and make a determination as to changed locations and elevations of ductwork and/or piping and shall obtain approval from the Engineer for the proposed changes.

K. Where the contact of dissimilar metals may cause electrolysis and where aluminum will contact concrete, mortar or plaster, the contact surface of the metals shall be coated, according to Section 09900.

1.06 EQUIPMENT FOUNDATION AND SUPPORTS

A. All foundations, platforms and hangers required for the proper installation of equipment shall be furnished and installed by the Contractor.

B. All floor mounted equipment shall be mounted on a reinforced concrete pad of four inches in height as a minimum or as required by the Drawings.

C. The Contractor shall furnish, install, and protect all necessary guides, bearing plates, anchor and attachment bolts, and all other appurtenances required for the installation of equipment. These shall be of ample size and strength for the purpose intended.

D. Anchor bolts required or indicated by the Drawings shall be furnished and built into the concrete foundations.

E. Structural steel supports and miscellaneous steel required for supporting and/or hanging equipment and piping furnished under this Division shall be provided and installed by Contractor.

F. All foundations, anchor pads, piers, pipe supports, and structural steel supports shall be built to template and reinforced as required for loads imposed on them.

G. The Contractor shall assume all responsibility for sizes, locations and design of all foundations, anchor pads, piers, pipe supports, curbs and structural steel supports.

1.07 VIBRATION ISOLATION

A. All rotating or reciprocating equipment unless otherwise directed shall be mounted on vibration isolators and provided with flexible connections to isolate the equipment from the structure and/or installation.

B. Isolators shall produce uniform loading and deflections, regardless of equipment weight distribution, and shall be the product of a manufacturer regularly engaged in the production of such items and who publishes engineering and selection data.

1.08 LUBRICATION

A. The Contractor shall thoroughly lubricate all equipment in accordance with the equipment manufacturer's instructions. Lubricating oils and greases shall be of type and viscosity as recommended by the equipment manufacturer.

B. All lubricants shall be furnished by the Contractor.

C. All systems requiring oil lubrication for gearing, bearings, etc., are to be flushed with flushing oils as recommended by the equipment manufacturer. This includes all

gearings, bearings, etc., regardless of whether they have been shipped with or without oil soluble protective coatings.

D. Following flushing, oil lubricated systems shall be filled with "run-in" oil as recommended by the equipment manufacturer. The equipment will be "run-in" at the no-load condition for a minimum period of 2 hours. Following "run-in" and inspection, the equipment is to be drained and flushed again with flushing oil as recommended by the equipment manufacturer.

E. The schedule for the above procedures is to be submitted for review by the Engineer at least two (2) weeks prior to the selected procedure starting date. At this time inspection details can be worked out.

F. The Contractor shall provide a one-year supply of all types of lubricants required for the various types of equipment furnished and installed under this Contract. Lubricants shall be in metal containers suitably labeled.

1.09 TEST OPERATION

A. When equipment is required to be factory tested, the results of the tests shall be submitted to the Engineer and approval of the test results shall be obtained before shipment of the equipment.

B. When an item of equipment, including controls and instrumentation, has been completely erected, the Contractor shall notify the Engineer, who will designate a time to make such tests as required, and operate the item to the satisfaction of the Engineer. All testing shall be done in the presence of the Engineer. "Completely erected" shall mean that the installation is erected, all necessary adjustments have been made, all required utility connections have been made, required lubricants and hydraulic fluid have been added and the unit has been cleaned up.

C. Contractor shall furnish labor, lubricants, and all other materials, equipment and instruments necessary for all tests.

1.10 FAILURE OF TESTS

A. Any defects in the equipment, or deviations from the guarantees or requirements of the Specifications, shall be promptly corrected by the Contractor by replacements or otherwise. The decision of the Engineer as to whether or not the Contractor has fulfilled his obligations under the Contract shall be final and conclusive. If the Contractor fails to correct any defects or deviations, or if the replaced equipment when tested shall fail again to meet the guarantees or specified requirements, the Owner, notwithstanding his having made partial payment for such equipment, may reject that equipment and order the Contractor to remove it from the premises at the Contractor's expense.

B. In case the Owner rejects a particular item of equipment, then the Contractor hereby agrees to repay the Owner all sums of money paid to him and the Owner agrees to deliver to the Contractor a bill of sale of all his rights, title, and interest in and to the rejected equipment provided, however, that the equipment shall not be removed from the premises until the Owner obtains from other sources other equipment to take the place of that rejected. The bill of sale shall not abrogate the Owner's right to recover damages for delays, losses or other conditions arising out of the basic Contract. The Owner hereby agrees to obtain the alternate equipment within a reasonable time and the Contractor agrees that the Owner may use the original equipment furnished by him without rental or other charge until the other equipment is obtained.

1.11 RESPONSIBILITY DURING TESTS

A. The Contractor shall be fully responsible for the proper operation of equipment during tests and instruction periods and shall neither have nor make any claim for damage which may occur to equipment prior to the time when the Owner formally takes over the operation thereof.

1.12 EQUIPMENT MANUFACTURER'S SERVICE REPRESENTATIVE

A. Equipment which will require any manufacturer's service representative for the purpose of assisting and directing and installation and adjustment of equipment is noted in the applicable sections of this Division. All costs relative to services by equipment manufacturer's service representatives shall be borne by the Contractor.

B. A letter of certification (check-out memo) shall be submitted to the Engineer from the manufacturer's representative upon completion of project visit indicating that the equipment has been checked out and is in proper working order and that the project personnel have been instructed in the proper use of the equipment.

1.13 NAMEPLATES

A. Provide identification nameplates for all equipment, controls, and apparatus where nameplates and/or data plates are not specified elsewhere.

1. Equipment and apparatus nameplates shall be fabricated from 1 1/2-inch high black laminated plastic with 1 inch high cut-in white letters, permanently secured with stainless steel screws.

2. Controls and switches shall be labeled with 1 inch high black laminated plastic with 1/2-inch white letters to designate functions.

3. Nameplates schedule and sample shall be submitted to the Engineer for approval.

B. Each piece of equipment shall be provided with stainless steel data plate securely fastened in a conspicuous place and clearly inscribed with the equipment

manufacturer's name, year of manufacture, serial number and principal rating data. These data plates shall not be painted.

1.14 PIPE AND VALVE IDENTIFICATION

A. Pipe Identification:

1. All exposed pipe shall have code letters and flow arrows painted as per specification Section 09905. The mechanical contractor shall ensure that the pipes are properly marked.

B. Valve identification: On all valves, the Contractor shall provide a coded and numbered identification tag as per specification Section 09905.

1.15 EQUIPMENT CLEANING

A. All equipment, piping, and other work provided under this Division and to receive finish painting by the General Contractor shall be thoroughly cleaned and ready for finish painting.

B. Thoroughly inspect all items of equipment and any items dented, scratched or otherwise damaged in any manner shall be replaced or repaired and painted to match original finish. All items so repaired and refinished shall be brought to the attention of the Engineer for inspection and approval.

1.16 SYSTEM CLEANING

A. Each system of piping shall be blown through, washed out and/or flushed after completion to remove grit, dirt, sand, etc., from coils and piping for as long a time as required to thoroughly clean the apparatus.

B. All elements within the system that may be damaged by the cleaning operation shall be removed or otherwise protected during the operation.

C. Repair or replace any control valves or other system components which do not function properly due to damage during the cleaning operation or because of imperfect cleaning of any piping system.

1.17 PRESSURE TESTS

A. After installation, all piping shall be pressure tested. Piping shall be tested in accordance with Section 15044.

B. All tests shall be made in the presence of and to the satisfaction of the Owner's representative and also, to the satisfaction of any local or state inspector having jurisdiction.

1. Provide not less than three days notice to the Engineer and the authority having jurisdiction when it is proposed to make the tests.

2. Any piping or equipment that has been left unprotected and subject to mechanical or other injury in the opinion of the Engineer shall be retested in part or in whole as directed by the Engineer.

3. The piping systems may be tested in sections as the work progresses but no joint or portion of the system shall be left untested.

C. All elements within the system that may be damaged by the testing operation shall be removed or otherwise protected during the operation.

D. All defects and leaks observed during the tests shall be corrected and made tight in an approved manner and the tests repeated until the system is proven tight.

E. Repair all damage done to existing or adjacent work or materials due to or on account of the tests.

F. Provide test pumps, and other instruments and equipment required for the performance of all tests. Provide all temporary bracing, test plugs, and additional restraint which may be required for test pressures above normal working pressures.

G. All tests shall be maintained for as long a time as required to detect all defects and leaks but not less than the duration specified for each type of pipe or piping system in this Division.

1.18 PROTECTION OF PIPING AND APPURTENANCES

A. All piping, appurtenances, and openings furnished and installed under this Division shall be protected from dirt, foreign objects, and damage during the construction period. Damaged piping or other appurtenances shall be replaced without additional cost to the Owner, should the damage occur prior to final acceptance of the work by the Owner. As soon as installed, all metal plated or polished fixture trimmings shall be thoroughly covered with noncorrosive grease which shall be maintained until all construction work is completed.

B. Suitable precautions against freezing shall be taken during cold weather.

C. All open ends of piping shall be closed by suitable cap or plug fitting to prevent obstruction and damage.

D. The Contractor shall also be responsible for the work of other trades that may be damaged or disturbed in the course of this work and he shall restore it to the condition existing prior to damage without additional cost to the Owner.

1.19 FIRE HAZARD RATING

A. All piping and equipment insulation, fastener, and jacketing materials shall have a fire hazard rating not to exceed 25 for flame spread, 50 for fuel contributed, and 50 for smoke developed. Rating shall be determined by ASTM Designation E84, "Surface Burning Characteristics of Building Materials". Corresponding ratings determined by Underwriters' Laboratories, Inc., UL-723, "Test Method for Fire Hazard Classification of Building Materials", will also be acceptable.

B. Fire hazard ratings for materials proposed for use shall be substantiated by test results from the National Bureau of Standards, a certified report from an approved testing laboratory, or a UL label or listing.

C. Flameproofing treatments will not be accepted.

PART 2 - PRODUCTS

2.01 PIPE MATERIALS SCHEDULE:

SERVICE	ABBREVIATION	ALLOWABLE MATERIALS
Air	Air	PVC
Potable Water	PW	PVC
Drain	DR	PVC

2.02 PIPE MATERIAL ABBREVIATIONS

ABBREVIATION	DESCRIPTION	SPEC. SECTION
PVC	Polyvinyl Chloride, SCH 80, unless otherwise noted	15064

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 15044
PRESSURE TESTING OF PIPING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Furnish all labor, materials, and equipment required for the pressure testing of all air ductwork, drain piping, and all other equipment per these specifications.

B. Related Work Described Elsewhere

1.02 TEST PRESSURES

A. Test pressures for the various services and types of piping are shown at the end of this section in Table 15044.

1.03 SUBMITTALS

A. Test Report

1. The Contractor shall submit a test report which includes the following information:

   a. Date and time of tests.
   b. Name(s) of person(s) conducting tests and company name.
   c. Test locations.
   d. All pressure gauge locations and pressures at time of tests.
   e. Allowable leakage for test sections per Specifications.
   f. Actual leakage during tests with the time and pressure at the end of the test.

2. Submit five (5) copies and one (1) original copy of the test reports to the Engineer upon completion of the testing.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL

A. Hydrostatic testing of solution lines shall be performed using potable water at 150 PSI for a period of not less than 2 hours. The test pressures of other piping systems are specified in Table 15044.

B. Verification that the pipes have been cleaned and properly isolated shall be made.

C. The maximum length of line to be tested as one section shall be 2,500 linear feet.

D. The Contractor is responsible for providing all equipment required to perform the cleaning and testing of the piping and for performing the work.

E. Pressure testing of chemical solution lines shall be in accordance with AWWA C900.

3.02 TESTING PREPARATION

A. Pipes shall be in place and anchored before performing the pressure testing.

B. Conduct hydrostatic and pneumatic tests on exposed and above ground piping after the piping has been installed and attached to the pipe supports, hangers, anchors, expansion joints, valves, and meters.

C. Before conducting hydrostatic tests, the pipes must be cleaned. Mains smaller than 8" in diameter may be cleaned by the flushing required prior to disinfection of the piping, using potable water at a minimum velocity of 2.5 feet per second to remove the dirt and debris. Prior to any flushing operations, the Contractor shall notify the Owner and the Engineer for coordination. Flushing and/or cleaning of mains smaller than 10" requires a minimum of 48 hours advance notice and flushing and/or cleaning of mains 10" and larger requires a minimum advance notice of 1 week. An Owner's representative and/or an Engineer's representative shall be present during all flushing and all flushing shall take place during off-peak demand periods.

D. Test new pipelines which are to be connected to existing pipelines by isolating the new line from the existing line by means of pipe caps, special flanges, or blind flanges. After the new line has been successfully tested, remove caps or flanges and connect to the existing piping.

E. Conduct hydrostatic tests on buried pipe after the trench has been completely backfilled. The pipe may be partially backfilled and the joints left exposed for inspection for an initial leakage test. Perform the final test, however, after completely backfilling and compacting the trench.

3.03 TESTING

A. Air Ductwork and Drain Piping:

1. The allowable leakage for pressure piping is zero. If the leakage exceeds the allowable amount or the test pressure varies more than plus or minus 5 psi, the test is considered failed. Should the test fail, the Contractor shall determine the reason(s) the test failed, correct the problems, and repeat the testing until the test passes.

TABLE 15044
PIPING PRESSURE TEST SCHEDULE

Type of Piping	Identification	Test Pressure (in psig)
PVC	Air, drain	10
PVC	PW	150

END OF SECTION

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SECTION 15064

POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Furnish all labor, materials, equipment and incidentals required and install and test all polyvinyl chloride (PVC) piping, fittings and appurtenances as shown on the Drawings and specified herein.

B. General Design: The equipment and materials specified herein are intended to be standard types of PVC pipe and ductile iron fittings for non-pressurized pipe for use in transporting odorous air from wastewater application and drains.

1.02 QUALITY ASSURANCE

A. Qualifications: All of the PVC pipe and ductile iron fittings shall be furnished by manufacturers who are fully experienced, reputable, and qualified in the manufacture of the materials to be furnished. The pipe and fittings shall be designed, constructed, installed in accordance with the best practices and methods and shall comply with these specifications as applicable.

B. Standards:
   1. AWWA C900/C905
   2. ASTM D1784 / D1785 / D2241 / D2466 / D2564 / D2729 / D2774 / D3034 / D3139 / D3212
   3. NSF 14
   4. UNI-B-1 through 5

C. Factory Tests: The manufacturer shall perform the factory tests described in Section 3 - AWWA C900/C905.

D. Quality Control:
   1. The manufacturer shall establish the necessary quality control and inspection practice to ensure compliance with the referenced standards.
   2. In addition to the manufacturer's quality control procedures, the County may select an independent testing laboratory to inspect the material at the production facility for compliance with these specifications. The County will pay for the cost of facility inspection requested by the County.

1.03 SHOP DRAWINGS AND SUBMITTALS

A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."

B. Materials and Shop Drawings

C. Manufacturer's Certification
   1. Submit sworn certification of factory tests and their results.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery and Storage: Delivery and storage of the materials shall be in accordance with the manufacturer's recommendations. PVC pipe shall be covered with black plastic with a minimum thickness of 15-mil. Joint gaskets shall be stored in a clean, dark and dry location until use.

B. Handling: Care shall be taken in loading, transporting and unloading to prevent damage to the pipe or fittings and their respective coatings. Pipe or fittings shall not be rolled off the carrier or dropped. Pipe shall be unloaded by lifting with a forklift or crane. All pipe or fittings shall be examined before installation and no piece shall be installed which is found to be defective. Pipe shall be handled to prevent damage to the pipe or coating. Accidental damage to pipe or coating shall be repaired to the satisfaction of County or it shall be removed from the job. When not being handled, the pipe shall be supported on timber cradles or on level ground, graded to eliminate all rock points and to provide uniform support along the full pipe length. When being transported, the pipe shall be supported at all times in a manner to prevent distortion or damage to the lining or coating. Any unit of pipe that, in the opinion of the County, is damaged beyond repair by the Contractor shall be removed from the site.

C. The Contractor shall be responsible for all materials furnished and stored until the date of project completion. The Contractor shall replace, at his expense, all materials found to be defective or damaged in handling or storage. The Contractor shall, if requested by the County, furnish certificates, affidavits of compliance, test reports, samples or check analysis for any of the materials specified herein. All pipe delivered to project site for installation is subject to random testing for compliance with the designated specifications.

PART 2 - PRODUCTS

2.01 GENERAL

A. All material supplied shall be one of the products specified in Appendix D "List of

Approved Products" appended to these technical specifications.

2.02 MATERIALS

A. Polyvinyl Chloride (PVC) Pipe
   1. Standards: ASTM D1784/D1785/
   2. Compounds: Class 12454-A or Class 12454-B
   3. PVC Pipe and Fittings: 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.
   4. PVC Schedule 40 pipe shall be Iron Pipe Size (IPS) conforming to ASTM D 1785 and ASTM D 2665. Injection molded PVC DWV fittings shall conform to ASTM D 2665. Fabricated PVC DWV fittings shall conform to ASTM F 1866. Pipe and fittings shall be manufactured as a system and be the product of one manufacturer. 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 National Sanitation Foundation Standard 14
   5. Dimension Ratio/Thickness: (unless otherwise shown on the Drawings)
      a. Ductwork or Drain Piping: Schedule 40
   6. Joints:
      a. Solvent weld (nominal diameter up to 12-inch):
         (1) Standards: ASTM D2466/D2564
         (2) Type: Slip Fitting Socket (tapered)
         (3) Exclusions: Plastic saddle and flange joints will not be used.
         (4) Solvent cement joints shall be made in a two-step process with primer manufactured for thermoplastic piping systems and solvent cement conforming to ASTM D 2564. The system shall be protected from chemical agents, fire stopping materials, thread sealant, plasticized vinyl products, or other aggressive chemical agents not compatible with PVC compounds. Systems shall be hydrostatically tested after installation.
         (5) Primer shall be Weld-On P-68 Industrial Grade primer manufactured by IPS Corporation, or approved equal.
         (6) Solvent cement shall be Weld-On 711 Industrial Grade manufactured by IPS Corporation, or approved equal.
      b. Solvent weld (nominal diameter 12-inch to 30-inch):
         (1) Standards: ASTM D2466/D2564
         (2) Type: Slip Fitting Socket (tapered)
         (3) Exclusions: Plastic saddle and flange joints will not be used.
         (4) Solvent cement joints shall be made in a two-step process with primer manufactured for thermoplastic piping systems and solvent cement conforming to ASTM D 2564. The system shall be protected from chemical agents, fire stopping materials, thread sealant, plasticized vinyl products, or

other aggressive chemical agents not compatible with PVC compounds. Systems shall be hydrostatically tested after installation.

(5) Primer shall be Weld-On P-70 industrial grade primer manufactured by IPS Corporation, or approved equal.

(6) Solvent cement shall be Weld-On 719 industrial grade manufactured by IPS Corporation, or approved equal.

c. Pipe Length:

(1) Pressure systems: 20-feet maximum nominal length

(2) Gravity systems: 13-feet minimum nominal length

PART 3 - EXECUTION

3.01 INSTALLATION

A. Polyvinyl Chloride (PVC) Pipe and Fittings

1. Placement/Alignment:

a. Installation shall be in accordance with lines and grades shown on the Drawings.

b. All pipe and fittings shall be inspected prior to insure no cracked, broken or otherwise defective materials are being used. All homing marks shall be checked for the proper length so as to not allow a separation or over homing of connected pipe. Homing marks incorrectly marked on pipe shall result in rejection of pipe and removal from site. The Contractor shall clean ends of pipe thoroughly and remove foreign matter and dirt from inside of pipe and keep clean during and after installation.

c. Proper implements, tools and facilities shall be used for the safe and proper protection of the Work. Pipe shall be installed in such a manner as to avoid any physical damage to the pipe.

d. Field Cutting: PVC pipe can be cut with a handsaw or power driven abrasive disc making a square cut. The end shall be beveled with a beveling tool, wood rasp or power sander to the same angle as provided on the factory-finished pipe. The insertion line on the spigot shall be remarked to the same dimensions as the factory-marked spigot.

e. Contractor should follow solvent cement and primer manufacturers guidelines for proper PVC pipe jointing and installation.

3.02 CLEANING AND FIELD TESTING

A. At the conclusion of the Work, the Contractor shall provide all associated cleaning and field testing as specified in associated sections of these specifications.

END OF SECTION

SECTION 15100
VALVES AND PIPING APPURTENANCES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The scope of work includes the furnishing of all labor, materials, equipment and appurtenances required for the complete installation of all valves and associated appurtenances as shown on the Drawings and as specified herein.

B. Related Work Described Elsewhere.

1. Piping, Valve, and Equipment Identification System is included in Section 09905.
2. Pipe Hangers and Supports are included in Section 15126
3. Pressure Testing of Piping is included in Section 15044.

C. General Design

1. All of the equipment and materials specified herein are intended to be standard for use in controlling the flow of water, chemicals, etc., depending on the application.
2. The equipment includes, but is not limited to the following:
    a. PVC Ball Valves
    b. PVC Blastgate Valves
    c. Joint Restraints
    d. Expansion Joints
    e. Curb Stops
    f. Hose Bibbs
    g. Backflow Prevention Assemblies
    h. Pipe and Valve Identification

1.02 QUALITY ASSURANCE

A. All of the valves and appurtenances specified herein shall be products of well established reputable firms who are fully experienced and qualified in the manufacture of the particular equipment to be furnished. The equipment shall be designed, constructed and installed in accordance with standard practices and methods and shall comply with these specifications as applicable.

1.03 SHOP DRAWINGS AND SUBMITTALS

A. Submittals shall be submitted to the County for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."

1.04 DELIVERY, STORAGE, AND HANDLING

A. The equipment provided under this section shall be shipped, handled and stored in accordance with the Manufacturer's written instructions and in accordance with Section 01600: Material and Equipment.

1.05 WARRANTY AND GUARANTEES

A. Provide equipment warranties in accordance with Section 01740.

PART 2 - PRODUCTS

2.01 GENERAL

A. Valves shall include the required accessories such as operators, operating nuts, valve boxes, handwheels, chain wheels, extension stems, etc. necessary for proper operation.

B. All valves and appurtenances shall be of the size shown on the Drawings. All similar type valves shall be from the same manufacturer.

C. All valves, appurtenances, and ancillary equipment shall be as specified in Appendix D "List of Approved Products" appended to these technical specifications.

D. All valves and appurtenances shall have the name of the manufacturer and the working pressure for which they are rated cast in raised letters upon the body.

E. All bolts, washers and nuts shall be Type 304 stainless steel, unless specified otherwise.

F. Factory Finishing:

1. Epoxy Lining and Coating:

a. Linings and coatings shall be in accordance with AWWA C550, as applicable, unless otherwise specified.

b. Linings and coatings shall be either two-part liquid material or heat-activated (fusion) material. Only heat-activated material is acceptable if specified as "fusion" or "fusion bonded" epoxy.

c. Linings and coatings shall be a minimum of 7-mil dry film thickness except where limited by valve operating tolerances.

G. Materials

1. All wetted materials shall be NSF 61 approved. Manufacturer's shall submit an affidavit with the product literature indicating NSF 61 approval, in accordance with Rule 62-555.320(3) Florida Administrative Code.

2. Brass and bronze valve components and accessories that have surfaces in contact with water to be alloys containing less than 16 percent zinc and 2 percent aluminum.

3. Approved alloys are of the following ASTM designations:

a. B61, B62, B98 (Alloy UNS No. C65100, C65500, or C66100), B139 (Alloy UNS No. C51000), B584 (Alloy UNS No. C90300 or C94700), B164, B194, and B127.
b. Stainless steel Alloy 18-8 may be substituted for bronze.

2.02 MATERIAL AND EQUIPMENT

A. PVC Ball Valves

1. PVC ball valves shall be of one piece capsule type manufactured of Type 1, Grade 1 PVC. Ball valves shall be true union design with two-way blocking capability and shall have solvent welded socket or NPT threaded ends.

2. Ball valves shall have Teflon seats with Viton backing cushions and Viton O-ring seals, and shall be designed for a 150 psi working pressure at 120°F. Valves shall be supplied with ABS lever operating handles.

3. PVC ball valves shall be manufactured by Asahi/America, Allis-Chalmers, Pratt, Mueller, or an equal approved by the Engineer.

B. Blast Gate Damper Valves

1. PVC material compounds conform to PVC 1120, ASTM D-1784, Type 1, Grade 1, Cell Class 12454-B.

2. Dampers furnished with a three position locking pin (open, half open, and closed). Gate is 3/16" thick and socket depth is 2.5".

3. Fittings shall be triple bead welded, color is gray.

4. Blast gate valves shall be manufactured by Asahi/America, Harrison Machine and Plastic, or US Plastic Corp.

C. Curb Stops

1. Curb stops shall be bronze, ball type, B44-444W by The Ford Meter Box Co., 6100 W-22 by A.Y. McDonald, or P25146 by Mueller.

D. Hose Bibbs

1. Hose bibs shall be brass, heavy duty, 2002 HD with 72001 vacuum breaker by A.Y. McDonald or equal.

E. Backflow Prevention Assemblies

1. Backflow prevention assemblies shall consist of reduced pressure principle devices and isolation valves manufactured in accordance with AWWA C506, latest revision, American Society of Sanitary Engineering Standards, and the University of Southern California Foundation for Cross Connection Control and Hydraulic Research "Manual of Cross Connection Control," Sixth Edition.

2. The backflow prevention devices shall include an integral sensing system that will automatically open a relief valve whenever the differential pressure between the inlet supply and the reduced pressure zone drops to 2 psi. The relief valve shall remain open until a positive pressure differential of 2 psi is reestablished. If pressure upstream of the first check valve drops to atmospheric or below, the relief valve shall remain fully open providing an internal air gap between the first check valve and the water level in the reduced pressure zone. The unit shall also be constructed such that any minor leakage of the second check valve will result in visible flow from the relief valve, even if the first check valve is totally disabled.

3. The backflow prevention devices shall have bronze bodies for sizes 2 1/2-inches and smaller and ductile iron bodies for sizes 3 inches and larger. Ductile iron bodies shall be coated with a fusion bonded thermosetting epoxy coating in accordance with AWWA C550 with a minimum, holiday-free, coating thickness of 12 mils. The reduced pressure back flow preventer shall consist of two independently operated, spring loaded, wye pattern, poppet type check valves designed for installation in a normal horizontal flow attitude. An independent spring loaded relief valve shall be located between the two check valves. Check valve assemblies, springs and seats, and all other internal parts shall be constructed of Type 316 stainless steel. Relief valve body and trim shall be constructed of bronze. Check valve and relief valve seats shall be field replaceable without removing the device from the service line. Back flow preventers shall be designed for a working pressure of 200 psi and a temperature range of 32°F to 140°F. The back flow preventer shall be manufactured as a complete unit including test cocks and upstream and downstream isolation gate valves. The test cocks shall be manufactured of bronze and shall be arranged such that the unit can be tested without removing the unit from the line.

4. The backflow prevention assemblies shall be furnished with isolation valves factory assembled. For sizes 2 1/2-inches and smaller, the isolation valves shall be all bronze ball valves with Buna N O-rings and valve seats, and a lever operating handle. Ball valves shall be in accordance with AWWA C800, latest revision. For sizes larger than 3 inches, the isolation valves shall be resilient seated gate valves with flanged ends and OS&Y handwheel operators. Gate valves shall be as specified in this section.

5. The backflow prevention devices shall be coated similar to gate valves specified in this section.

6. Backflow prevention assemblies shall be Model 825Y assemblies manufactured by Febco, Model 975XL assemblies as manufactured by Wilkins, or approved equal.

F. Pipe and Valve Identification

1. Identification systems for above-ground and below-ground valves shall be as specified in Section 09905.

2.03 INSTALLATION

A. General:

1. All valves and appurtenances shall be installed in the locations shown, true to alignment and rigidly supported. Valves shall be installed in accordance with manufacturer's installation instructions and with the details shown on the Drawings. Any damage to the above items shall be repaired to the satisfaction of the Engineer before they are installed.

2. Valves shall be installed such that they are supported properly in their respective positions, free from distortion and strain. Valves shall be installed such that their weight is not borne by pumps and equipment that are not designed to support the weight of the valve.

3. Valves shall be carefully inspected during installation; they shall be opened wide and then tightly closed and the various nuts and bolts shall be tested for tightness. Special care shall be taken to prevent any foreign matter from becoming lodged in the valve seat: Check and adjust all valves for smooth operation.

4. 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.

5. 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 these structures. In addition, install hangers or supports at all changes in direction at the spacing requirements stated in Section 15126 Pipe Hangers and Supports.

6. Pipe for use with flexible couplings shall have plain ends as specified in the respective pipe sections in Division 15.

7. Flanged joints shall be made with 316 stainless steel bolts, nuts and washers, unless otherwise noted.

8. Clean threaded joints by wirebrushing or swabbing. Apply Teflon joint compound or Teflon tape to pipe threads before installing threaded valves. Joints shall be watertight.

9. Pressure gauges shall not be installed until after the substantial completion date unless otherwise requested by the Engineer.

10. Valve Orientation:

    a. Install operating stem vertical when valve is installed in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above finished floor, unless otherwise shown.
    b. Install operating stem horizontal in horizontal runs of pipe having centerline elevations between 4 feet 6 inches and 6 feet 9 inches above finished floor, unless otherwise shown.

11. Locate valve to provide accessibility for control and maintenance. Install access doors in finished walls or plaster ceilings for valve access.

12. Floor Box and Stem: Steel extension length shall locate operating nut in floor box.

13. Valves shall be tested hydrostatically, concurrently with the pipeline in which they are installed. Protect or isolate any parts of valves, operators, or control and instrumentation systems whose pressure rating is less than the pressure used for the pressure test(s). If valve joints leak during pressure testing, loosen or remove the nuts and bolts, reseat or replace the gasket, reinstall or retighten the bolts and nuts, and hydrostatically retest the joints.

14. Following installation, all above-ground valves shall be painted in accordance with the painting system specified in Section 09900. Following installation of buried valves or valves installed in valve vaults, repair any scratches, marks and other types of surface damage, etc., with a coating equal to the original coating supplied by the manufacturer. Prior to backfilling, all nuts, bolts, and other parts of the valve joints shall be coated with two coats, 10 mils DFT per coat, of bituminous paint, Tnemec Series 46 – 465, Carboline Bitumastic 50, or equal.

15. Expansion and Contraction Provisions

a. Rigidly support all piping with adequate provisions for expansion and contraction.
b. Firmly anchor horizontal runs over 50 feet in length at the midpoint of the runs to force expansion equally toward the ends.

16. Support valves in accordance with Section 15126.

17. Pipe sleeves and wall castings shall be provided at the locations called for on the Drawings. These units shall be as detailed and of the material as noted on the Drawings. They shall be accurately set in the concrete or masonry to the elevations shown. All wall sleeves and castings required in the walls shall be in place when the wails are poured. Ends of all wall castings and wall sleeves shall be of a type consistent with the piping to be connected to them.

18. Link seals for wall sleeves shall be installed in strict accordance with the manufacturer's printed installation instructions. For watertight applications in tanks or treatment units, the link seal installation shall be tested hydrostatically for leaks at the same time as the tank or treatment unit. Any leaks that occur during the test period shall be repaired by checking the link seals for proper installation and replacement of unit(s) found to be defective at no additional cost to the Owner.

19. Pipe couplings shall be installed in strict accordance with the manufacturer's published instructions and recommendations.

20. Tie rods shall be installed in strict accordance with the manufacturer's written installation requirements. Unless otherwise indicated on the Drawings, the size and number of tie rods for a joint or installation shall be as recommended by the manufacturer's design chart for a working pressure of 150 psi.

21. Backflow preventions assemblies shall be installed at the locations shown on the Drawings and shall be installed in accordance with the manufacturer's installation instructions, local codes, and as shown on the Drawings. Assemblies shall be tested by a certified tester and the appropriate report submitted to the City utilities department.

22. Reduced pressure principle back flow preventers shall be installed horizontally with an 18-inch minimum clearance between the finished grade and the lowest point on the bottom of the unit. Reduced pressure back flow preventers shall be installed with provisions for a suitable drain arrangement to drain off discharges from the relief valve, so that discharges are not objectionable. Back flow preventers shall be installed such that they are easily accessible for testing, maintenance, and repair.

23. Piping, fittings, and the air release valves shall be installed as shown on the Drawings. The air release valve assemblies shall be installed so that they are properly supported and such that they will function properly and freely and no parts shall be strained. Air release valve testing shall be performed during the testing of pipeline which air release is attached.

END OF SECTION

SECTION 15126
PIPE HANGERS AND SUPPORTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Furnish and install all pipe supports as indicated and as specified herein.

B. Related Work Described Elsewhere:

1. Schedule 80 Polyvinyl Chloride (PVC) Pipe and Fittings is included in Section 15070.

C. General Design:

1. The Drawings depict only minimum pipe support locations. Adequate pipe supports shall be supplied for all piping systems to provide a rigid overall installation and additional support for pipe ends when equipment is disconnected.

1.02 QUALITY ASSURANCE

A. Hangers and supports shall be of approved standard design where possible and shall be adequate to maintain the supported load in proper position under all operating conditions. The minimum working factor of safety for pipe supports shall be five (5) times the ultimate tensile strength of the material, assuming 10 feet of water filled pipe being supported.

B. All pipe and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall not be transmitted to their equipment, the Contractor shall submit a certification stating that such requirements have been compiled with.

1.03 SUBMITTALS

A. Submit manufacturer's descriptive literature for all pipe support devices and materials demonstrating compliance with this Specification and the support details shown on the Drawings.

1.04 DELIVERY STORAGE AND HANDLING

A. The equipment provided under this section shall be shipped, handled and stored in accordance with the Manufacturer's written instructions, and in accordance with Section 01600: Material and Equipment.

1.05 WARRANTY AND GUARANTEES

A. Provide equipment warranty in accordance with Section 01740: Warranties and Bonds.

PART 2 - PRODUCTS

2.01 GENERAL

A. All pipe and tubing shall be supported as required to prevent significant stresses in the pipe or tubing material, valves, and fittings and to support and cure the pipe in the intended position and alignment. All supports shall be designed to adequately secure the pipe, and personal contact. All pipe supports shall be approved prior to installation.

B. The Contractor shall select and design all piping support systems with the specified spans and component requirements. Structural design and selection of support system components shall withstand the dead loads imposed by the weight of the pipes filled with water, plus any insulation. Commercial pipe supports and hangers shall have a minimum safety factor of 5.

C. No attempt has been made to show all required pipe supports in all locations, either on the Drawings or the details. The absence of pipe supports and details on any drawings shall not relieve the Contractor of the responsibility for providing them through the project.

D. All support anchoring devices, including anchor bolts, inserts and other devices used to anchor the support onto a concrete base, roof, wall or structural steel works, shall be of the proper size, strength, and spacing to withstand the shear and pullout loads imposed by loading and spacing on each particular support.

E. All materials used in manufacturing hangers and supports shall be capable of meeting the respective ASTM Standard Specifications with regard to tests and physical and chemical properties, and be in accordance with MSS SP-58.

F. Hangers and support shall be spaced in accordance with ANSI B31.1.0 except that the maximum unsupported span shall not exceed 4 feet unless otherwise specified herein.

G. Unless otherwise specified herein, all pipe hangers, supports, and hardware shall be SS 316 and manufactured by ITT Grinnel Co., Inc., Carpenter and Patterson, Inc., or equal. Any reference to a specific figure number of a specific manufacturer is for the

purpose of establishing a type and quality of product, and shall not be considered as propriety. Any item comparable in type, style, quality, design, and performance will be considered for approval; however, SS 316 must be supplied.

2.02 MATERIALS AND EQUIPMENT

A. Pipe Hangers and Supports for Plastic Pipe:

1. Single plastic pipes shall be supported by pipe supports as previously specified herein.

2. Individual clamps, hangers, and supports in contact with plastic pipe shall provide firm support but not so firm as to prevent longitudinal movement due to thermal expansion and contraction.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All pipes, horizontal and vertical, shall be rigidly supported from the building structure by approved supports. Supports shall be provided at changes in direction and elsewhere as shown in the Drawings or specified herein. No piping shall be supported from other piping or from metal stairs, ladders, and walkways, unless it is so indicated on the Drawings, or specifically directed or authorized by the Engineer.

B. All pipe supports shall be designed with liberal strength and stiffness to support the respective pipes under the maximum combination of peak loading conditions to include pipe weight, liquid weight, liquid movement, and pressure forces, thermal expansion and contraction, vibrations, and all probable externally applied forces. Prior to installation, all pipe supports shall be approved by the Engineer.

C. Pipe supports shall be provided to minimize lateral forces through valves, both sides of split type couplings, and sleeve type couplings and to minimize all pipe forces on pump housings. Pump housings shall not be utilized to support connecting pipes.

D. Effects of thermal expansion and contraction of the pipe shall be accounted for in pipe support selection and installation.

E. Standard Pipe Supports:

1. Horizontal Suspended Piping:

a. Single Pipes: Adjustable swivel-ring, split-ring, or clevis hangers.
b. Grouped Pipes: Trapeze hanger systems.

2. Horizontal Piping Supported from Walls:

a. Single pipes shall use wall brackets or wall clips attached to wall with anchors. Clips attached to wall mounted framing also acceptable.
b. Stacked Piping

i. Wall mounted framing system and clips acceptable for piping smaller than 3-inch minimal diameter.
ii. Piping clamps which resist axial movement of pipe through support not acceptable.

c. Wall mounted piping clips not acceptable for insulated piping.

3. Horizontal Piping Supported From Floors:

a. Floor Mounted Channel Supports:

i. Use for piping smaller than 3 inch nominal diameter running along floors and in trenches at piping elevations lower thank can be accommodated using pedestal pipe supports.
ii. Attach channel framing to floors with anchor bolts.
iii. Attach pipe to channel with clips or pipe clamps.

3.02 PAINTING

A. All fabricated SS 316 pipe supports, saddles, brackets, rolls, clevises and the like shall be galvanized painted, primed, and after installation, as specified in Section 09900.

END OF SECTION

SECTION 15800
POWER VENTILATORS

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:

1. Propeller fans constructed of suitable material in a wastewater facility exposed to corrosive environment. All materials shall be aluminum or stainless steel. Hardware shall be SS 316.

1.03 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on sea level.

B. Operating Limits: Classify according to AMCA 99.

C. High wind resistant construction that meets Florida Building Code and Miami-Dade NOA 12-0120.13.

1.04 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.

B. 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.

2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

C. Coordination Drawings: Reflected ceiling plans and other details, 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. Wall framing and support members relative to duct penetrations.

2. Ceiling suspension assembly members.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.05 QUALITY ASSURANCE

A. 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.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

1.06 WARRANTY AND GUARANTEES

A. Provide equipment warranties in accordance with Section 01740.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.08 COORDINATION

A. Coordinate size and location of structural-steel support members.

PART 2 - PRODUCTS

2.01 PROPELLER FANS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Greenheck.
2. Loren Cook Company.
3. PennBarry.

B. Description: Direct drive propeller fan consisting of fan blades, hub, housing, orifice ring, motor, drive assembly, and accessories.

C. Fan Wheel: Replaceable, cast-aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.

D. Accessories:

1. Gravity Shutters: Aluminum blades in aluminum frame; interlocked blades with nylon bearings.
2. Motor-Side Back Guard: 316 stainless steel, complying with OSHA specifications, removable for maintenance, and coated with a thermal setting polyester urethane.
3. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
4. Dampers
    a. Damper shall prevents outside air from entering back into the building when fan is off.
    b. Damper shall be balanced for minimal resistance to flow.
    c. Aluminum or stainless steel frames shall be prepunched with mounting holes.
5. Weatherhood
    a. Shall shield wall opening and dampers from rain and weather elements
    b. Material type: Aluminum
    c. Turndown angle: 90 degrees
    d. Screen shall include insect screen of 16-18 aluminum mesh.

e. Finish shall be epoxy coated in the factory

6. Housing

a. Mounting arrangement: Flush interior:
b. Constructed of stainless steel with heavy gauge flanges and prepunched mounting holes.
c. Housing shall include OSHA approved motor guard.
d. Reduces installation time and provides maximum installation flexibility.

E. Capacities and Characteristics:

Location	Intake/Exhaust	No. of Units	Min. Flow (CFM)	Direct Driven	Static Pressure	Motor Size (HP)	Propeller/Hub Material
Grit Room	Exhaust	1	5,500	Propeller	0.477 inches WC	1.5	Aluminum/ 316 SS

2.02 MOTORS

A. Enclosure Type: Totally enclosed, fan cooled, suitable for Class 1 Division 2.

B. Design: Corrosive duty with SS 316 hardware.

C. Motor fan speed: 1,750 rpm.

2.03 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

2.04 SPARE PARTS

A. Spare bearings and shaft seals

B. Lubricants

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install power ventilators level and plumb.

B. Support units using restrained spring isolators having a static deflection of 1 inch.

C. Support suspended units from structure using threaded steel rods and spring hangers with vertical-limit stops having a static deflection of 1 inch.

D. Install units with clearances for service and maintenance.

3.02 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan and drive system.
5. Adjust damper linkages for proper damper operation.
6. Verify lubrication for bearings and other moving parts.
7. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.03 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Replace fan as required to achieve design airflow.

C. Lubricate bearings.

END OF SECTION

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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 GENERAL CONDITIONS FOR ALL WORK

A. All Work must closely be coordinated among the electric utility, the construction manager, and the Owner.

1.03 SCOPE OF WORK

A. Provide complete electrical system for the facility including but not limited to:

1. Motor Starter
2. Circuit Breaker
3. Wire and Cable
4. Conduit Drawings
5. Conduit System

B. Provide conduits to serve the electrical system as shown on the drawings:

C. Provide surge suppressors where indicated on the drawings.

D. Provide site grounding.

E. Provide all testing and startup services.

F. Each bidder or his authorized representatives shall, before preparing a bid, visit all areas of the proposed site in which work will take place and be performed to inspect carefully the present conditions. The submission of the bid by this bidder shall be considered evidence that the bidder has visited the project and noted the locations and conditions under which the work will be performed and that the bidder takes full responsibility for a complete knowledge of all factors governing his work.

G. All necessary temporary power, control and instrumentation requirements are the responsibility of the Contractor and shall be furnished at no extra cost to the Owner. Power and controls shall be furnished to all existing equipment at all times.

H. Pay all fees required for permits, inspections, and connections.

1.04 REFERENCES

A. ANSI/NFPA70-National Electrical Code.

1.05 SUBMITTALS

A. Include products specified in the following sections:

1. Section 16100 – Raceways, Boxes and Cabinets
2. Section 16120 – Wires and Cables
3. Section 16195 – Electrical Identification
4. Section 16450 – Grounding System
5. Section 16476 – Miscellaneous Equipment
6. Section 16709 – Surge Protection

B. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal.

C. Mark dimensions and values in units to match those specified.

D. Indicate applicable specification section on each submitted document.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable Building Codes for project location.

B. Electrical: Conform to NFPA 70 - 2011 Edition.

C. Occupational Safety and Health Administration (O.S.H.A.).

D. Obtain permits and request inspections from authority having jurisdiction.

1.08 CONDUIT DRAWINGS

A. In addition to the manufacturer's equipment shop drawings, the CONTRACTOR shall submit for approval, electrical installation working drawings containing the following:

1. Concealed and buried conduit layouts shown on floor plans drawn at not less than 1/4-inch = 1-foot-0-inch scale. The layouts shall include locations of process equipment, panelboards, control panels and equipment, switches, large junction or pull boxes, instruments, and any other electrical devices

connected to concealed or buried conduits.

2. Plans shall be drawn on high quality reproducible, double sided mylar, size 36-inch x 24-inch, and shall be presented in a neat, professional manner.

3. Concrete floors and/or walls containing concealed conduits shall not be poured until conduit layouts are approved.

1.09 OPERATION AND MAINTENANCE DATA

A. Submit complete operations and maintenance data for all equipment furnished under this Division in accordance with Section 01340 manuals shall be prepared specifically for this installation and shall include all required cuts, Drawings, equipment lists, descriptions, complete part lists, etc. that are required to instruct operating and maintenance personnel unfamiliar with such equipment.

1.10 WARRANTY

A. Provide a warranty for all the electrical equipment in accordance with the requirements of other sections, but in no case less than three (3) years from date of substantial completion.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 INSTALLATION

A. Electrical systems shall be complete and operable for the intended purpose in accordance with applicable codes at the time of acceptance.

B. The Contractor shall coordinate all activities with the construction manager and the Owner.

END OF SECTION

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SECTION 16100
RACEWAYS, BOXES, AND CABINETS

PART 1 - GENERAL

1.01 SUBMITTALS

A. Provide submittals for all electrical equipment enclosures.

1.02 REFERENCES

A. Comply with NFPA 70 "National Electrical Code" for components and installation.

B. Comply with NECA "Standard of Installation."

1.03 LISTING AND LABELING

A. Provide products specified in this Section that are UL listed and labeled.

PART 2 - PRODUCTS

2.01 CONDUIT

A. PVC Conduit and Tubing Fittings: NEMA TC 3; Schedule 80, match to conduit or conduit/tubing type and material.

2.02 BOXES

A. Outlet and Device Boxes: Use 1 of the following:

1. Nonmetallic Boxes: NEMA OS2.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Seal all outdoor raceways using duct seal.

B. Use the following wiring methods:

1. PVC Schedule 80.

2. Instrumentation (shielded cable): PVC.

3. Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Liquid tight flexible non-metal conduit.

4. Boxes and Enclosures:

   a. PVC

C. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.

D. Install raceways level and square and at proper elevations. Provide adequate headroom.

E. Complete raceway installation before starting conductor installation.

F. Use temporary closures to prevent foreign matter from entering raceway.

G. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

H. Make bends and offsets so the inside diameter is not reduced. Unless otherwise indicated keep the legs of a bend in the same plane and the straight legs of offsets parallel.

I. Raceways Embedded in Slabs: Install in middle third of the slab thickness where practical, and leave at least 1-inch (25 mm) concrete cover.

1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.

2. Space raceways laterally to prevent voids in the concrete.

3. Run conduit larger than 1-inch trade size parallel to or at right angles to main reinforcement. When at right angles to reinforcement, place conduit close to slab support.

J. Install underground raceways:

1. At least 18" below grade.
2. At least 24" below driveways and roads.
3. All buried ductbanks to be concrete encased 3000 psi color red concrete.

K. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.

1. Run parallel or banked raceways together, on common supports where practical.

2. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where they can be installed parallel; otherwise, provide field bends for parallel raceways.

L. Join raceways with fittings designed and approved for the purpose and make joints tight.

1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.

2. Use insulating bushings to protect conductors.

M. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely, and install the locknuts with dished part against the box. Where terminations cannot be made secure with one locknut, use two locknuts, one inside and one outside the box.

N. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.

O. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line having not less than 200-lb (90kg) tensile strength. Leave not less than 12 inches (300 mm) of slack at each end of the pull wire.

P. Stub-Up Connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling, threaded inside for plugs, and set flush with the finished floor. Where equipment connections are not made under this Contract, install screwdriver-operated threaded flush plugs flush with floor.

Q. Flexible Connections: Use maximum of 6 feet (1830 mm) of flexible conduit for lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquid tight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.

R. Install hinged cover enclosures and cabinets plumb. Support at each corner.

S. Provide grounding connections for raceway, boxes, and components as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

END OF SECTION

SECTION 16120
WIRES AND CABLES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish, install and test all wire, cable, and appurtenances as shown on the Drawings and as hereinafter specified.

1.02 SUBMITTALS

A. Samples of proposed wire and cable shall be submitted for approval. Each sample shall have the size, type of insulation, UL listing and voltage stenciled on the jacket.

B. Approved samples will be sent to the project location for comparison by the Resident Engineer with the wire actually installed.

C. Installed, unapproved wire shall be removed and replaced at no additional cost to the Owner.

1.03 APPLICATIONS

A. Wire for lighting and receptacle circuits above grade shall be type XHWN.

B. Wire for all power motor circuits and below grade lighting and receptacle circuits shall be type XHWN, stranded.

C. Wire for all service conductors shall be type RHW or XHHW, stranded.

D. Single conductor wire for control, indication and metering shall be type MTW No. 14 AWG, 19 strand or type XHHW No. 14 AWG stranded.

E. Multi-conductor control cable shall be No. 14 AWG, 19 strand.

F. Wire for process instrumentation or shielded control cable shall be No. 16 AWG, shielded and stranded.

1.04 MINIMUM SIZES

A. Except for control and signal leads, no conductor smaller than No. 12 AWG shall be used.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All wires and cables shall be of annealed, 98 percent conductivity, soft drawn stranded copper conductors.

2.02 600 VOLT WIRE AND CABLE

A. Type RHW and XHHW shall be cross-linked polyethylene (XLP); as manufactured by the Southwire Co., Collyer Insulated Wire Co., Rome Cable or approved equal.

2.03 INSTRUMENTATION AND CONTROL CABLE

A. Process instrumentation wire shall be twisted pair, 600V, cross-linked polyethylene insulated, aluminum tape shielded, polyvinyl chloride jacketed, type "XLP" as manufactured by the American Insulated Wire Co., Eaton Corp. "Polyset," or approved equal. Multi-conductor cables shall be supplied with individually shielded twisted pairs.

B. Multi-conductor control cable shall be stranded, 600V, cross-linked polyethylene insulated with PVC jacket, type "XLP" as manufactured by the American Insulated Wire Co., Eaton Corp. "Polyset," or approved equal.

2.04 TERMINATIONS AND SPLICES

A. Power Conductors: Terminations shall be die type or set screw type pressure connectors as specified. Splices (where allowed) shall be die type compression connector and waterproof with heat shrink boot or epoxy filling.

B. Control Conductors: Termination on saddle-type terminals shall be wired directly with a maximum of two conductors per termination. Termination on screw type terminals shall be made with a maximum of two spade connectors. Splices (where allowed) shall be made with insulated compression type connectors. Heat shrink boots shall be utilized for all outdoor splices.

C. Instrumentation Signal Conductors (including graphic panel, alarm, low and high level signals): Terminations permitted shall be typical of control conductors. Splices are allowed at instrumentation terminal boxes only.

D. Except where otherwise approved by the Engineer no splices will be allowed in manholes, handholes or other below grade located boxes.

E. Splices <u>shall not</u> be made in push button control stations, control devices (i.e., pressure switches, flow switches, etc.), conduit bodies, etc.

PART 3 – EXECUTION

3.01 INSTALLATION

A. All conductors shall be carefully handled to avoid kinks or damage to insulation.

B. Lubrications shall be used to facilitate wire pulling. Lubricants shall be U.L. listed for use with the insulation specified.

C. Shielded instrumentation wire shall be installed from terminal to terminal with no splicing at any intermediate point.

D. Shielded instrumentation wire shall be installed in rigid steel conduit and pull boxes that contain only shielded instrumentation wire. Instrumentation cables shall be separated from control cables in manholes.

E. Shielding on instrumentation wire shall be grounded at one end only, as directed by supplier of the instrumentation equipment.

F. Wire and cable connections to terminals and taps shall be made with compression connectors. Connections of insulated conductors shall be insulated and covered. All connections shall be made using materials and installation methods in accordance with instructions and recommendations of the manufacturer of the particular item of wire and cable. The conductivity of all completed connections shall be not less than that of the uncut conductor. The insulation resistance of all completed connections of insulated conductors shall be not less than that of the uncut conductor.

G. All wire and cable shall be continuous and without splices between points of connection to equipment terminals, except a splice will be permitted by the Engineer if the length required between the points of connection exceeds the greatest standard shipping length available from the manufacturer specified or approved by the Engineer as the manufacturer of the particular item of wire and cable.

H. Steel fish tapes and/or steel pulling cables shall not be used in PVC conduit runs.

I. All control and instrumentation circuits and wiring shall be clearly and permanently numbered and labeled at each end so as to identify the location of the opposite end and the function of the circuit. Individual wires in a multi-wire circuit shall be identified with wire numbers. Labeling shall be in place prior to turnover of any equipment, system or sub-system to Owner.

3.02 TESTS

A. All 600-volt wire insulation shall be tested with a meg-ohmmeter after installation. Tests shall be made at not less than 1,000 VDC.

END OF SECTION

SECTION 16150
MOTORS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish and install the motors as hereinafter specified and as called for in other sections of these Specifications.

1.02 QUALIFICATIONS

A. Motor shall be sufficient size for the duty to be performed and shall not exceed their full-rated load when the driven equipment is operating at specified capacity. Unless otherwise noted, motors driving pumps shall not be overloaded at any head or discharge condition of the pump.

1.03 SUBMITTALS

A. The motor manufacturer shall submit to the Engineer certified dimension prints showing nameplate data and outline dimensions within three weeks of the date they receive the order.

B. Guarantee: All equipment furnished and installed under this Section shall be guaranteed against defects of workmanship, materials and improper installation for a period of one year from date of acceptance. All such equipment or parts proven defective, due to the above noted causes, shall be replaced in the machines by the Contractor at no expense to the Owner.

C. Provide equipment warranties in accordance with Section 01740.

PART 2 - PRODUCTS

2.01 RATING

A. Unless otherwise noted, all motors shall be of the low voltage type. All motors 1/2 through 100 horsepower shall be rated 230/460 volt, 3 phase, 60 Hertz A.C.; motors 125 horsepower through 500 horsepower shall be rated 460 volt, 3-phase, 60 Hertz, and motors below 1/2 horsepower shall be rated 115/230 volt, 1 phase, 60 Hertz A.C. If any motors are in a Class I, Division 2 space they must meet the requirements to be compatible with that classification.

2.02 THREE PHASE INDUCTION MOTORS

A. Motors 20 HP and larger shall have a 120-volt space heater for moisture control. Thermistors are not acceptable.

B. Unless specifically noted in other sections of these Specifications, all motors shall have a minimum as indicated in the table below. All motors shall be "premium efficiency" type.

C. Motors operating with variable frequency drives shall state that they are suitable for their intended applications. Motor nameplate shall read "Inverter Duty Rated". In addition, Motors operating with Variable Frequency Drives (VFDs) shall meet the requirements of NEMA MG1 Part 31.

TABLE 1

Motor HP	**Min. Eff.**	**Max. dba**	**Motor HP**	**Min. Eff.**	**Max. dba**
1-2	84.0%	74	25-30	92.0%	92
3-5	86.5%	79	40-50	93.0%	97
7.5-10	90.2%	84	60-75	94.0%	100
15-20	91.0%	89	100	94.1%	102
			200	94.3%	105

D. Motors larger than 100 Hp and operating with a VFD shall have imbedded a winding temperature switch.

2.03 CONSTRUCTION

A. General:

1. All drip-proof and weather protected Type I motors shall have epoxy encapsulated windings. Totally enclosed motors shall not be encapsulated. Motors not readily available with encapsulated windings may be standard type. Motors exposed to the outside atmosphere shall be totally enclosed fan cooled (TEFC) unless otherwise specified.

2. Squirrel-cage rotors shall be made from high-grade steel laminations adequately fastened together and to the shaft, or shall be cast aluminum or bar-type construction with brazed end rings.

B. Low Voltage, Three Phase Motors:

1. Motors shall be of the squirrel-cage or wound rotor induction type as noted. Horizontal, vertical solid shaft, vertical hollow shaft, normal thrust and high thrust types shall be furnished as specified herein. All motors shall be built in accordance with current NEMA, IEEE, ANSI and AFBMA standards where applicable. Motors shall be of the type and quality described by these Specifications, fully capable of performing in accordance with manufacturer's nameplate rating, and free from defective material and workmanship.

2. Motors shall have normal or high starting torque (as required), low starting current (not to exceed 600 percent full load current), and low slip.

3. Motors shall be totally enclosed fan-cooled construction with 1.15 service factor unless otherwise noted. Indoor motors shall be WPI unless otherwise noted.

4. Motors shall be suitable for operation in moist air with hydrogen sulphide gas present.

5. The output shaft shall be suitable for direct connection or belt drive as required.

6. Motors shall have a Class B nonhygroscopic insulation system. Class F insulation may be used but shall be limited to Class B temperature rise.

7. All motors shall have a final coating of chemical resistant corrosion and fungus protective epoxy fortified enamel finish sprayed over red primer over all interior and exterior surfaces. Stator bore and rotor of all motors shall be epoxy coated.

8. All fittings, bolts, nuts, and screws shall be 316 stainless steel. Bolts and nuts shall have hex heads.

9. All machine surfaces shall be coated with rust inhibiter for easy disassembly.

10. Conduit boxes shall be gasketed. Lead wires between motor frame and conduit box shall be gasketed.

11. Totally enclosed motors shall be provided with condensate drain hole and epoxy coated motor windings to protect against moisture.

12. Nameplates shall be stainless steel. Lifting lugs or "O" type bolts shall be supplied on all frames 254T and larger. Enclosures will have stainless steel screen and motors shall be protected for corrosion, fungus and insects.

13. Low voltage, three phase motors shall be manufactured by General Electric, U.S. Motors, Westinghouse or Reliance.

14. Fractional Horsepower:

    a. Fractional horsepower motors shall be rigid, welded-steel, designed to maintain accurate alignment of motor components and provide adequate protection. End shields shall be reinforced, lightweight die-cast aluminum. Windings shall be of varnish-insulated wire with slot insulation of polyester film, baked-on bonding treatment to make the stator winding strongly resistant to heat, aging, moisture, electrical stresses and other hazards.

    b. Motor shaft shall be made from high-grade, cold-rolled shaft steel with drive-shaft extensions carefully machined to standard NEMA dimensions for the particular drive connection.

    c. For light to moderate loading, bearings shall be quiet all-angle sleeve type with large oil reservoir that prevents leakage and permits motor operation in any position.

    d. For heavy loading, bearings shall be carefully selected precision ball bearings with extra quality, long-life grease, and large reservoir providing 10 years' normal operation without relubrication.

15. Integral Horsepower:

    a. Motor frames and end shields shall be cast iron or heavy fabricated steel of such design and proportions as to hold all motor components rigidly in proper position and provide adequate protection for the type of enclosure employed.

    b. Windings shall be adequately insulated and securely braced to resist failure due to electrical stresses and vibrations.

    c. The shaft shall be made of high-grade machine steel or steel forging of size and design adequate to withstand the load stresses

normally encountered in motors of the particular rating. Bearing journals shall be ground and polished.

d. Rotors shall be made from high-grade steel laminations adequately fastened together, and to the shaft. Rotor squirrel-cage windings may be cast-aluminum or bar-type construction with brazed end rings.

e. Motors shall be equipped with vacuum-degassed antifriction bearings made to AFBMA Standards, and be of ample capacity for the motor rating. The bearing housing shall be large enough to hold sufficient lubricant to minimize the need for frequent lubrication, but facilities shall be provided for adding new lubricant and draining out old lubricant without motor disassembly. The bearing housing shall have long, tight, running fits or rotating seals to protect against the entrance of foreign matter into the bearings, or leakage of lubricant out of the bearing cavity.

f. Bearings of high thrust motors will be locked for momentary upthrust of 30% downthrust. All bearings shall have a minimum B10 life rating of 100,000 hours in accordance with AFBMA life and thrust values.

g. Vertical hollow-shaft motors will have nonreverse ratchets to prevent backspin.

C. Low Voltage, Single Phase Motors:

1. Single phase motors shall be split-phase and capacitor-start induction types rated for continuous horsepower at the rpm called for on the Drawings. Motors shall be rated 115/230 volts, 60 Hertz, single phase, open drip-proof, or totally enclosed fan cooled as called for on the Drawings, with temperature rise in accordance with NEMA Standards for Class B insulation.

2. Totally enclosed fan cooled motors shall be designed for severe-duty.

3. Motors shall have corrosion and fungus protective finish on internal and external surfaces. All fittings shall have a corrosion protective plating.

4. Mechanical characteristics shall be the same as specified for polyphase fractional horsepower motors.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Motor Connections: All motors shall be connected to the conduit system by means of a short section 18-inch minimum of flexible conduit unless otherwise indicated. For all motor connections, the Contractor shall install a grounding conductor in the conduit and terminate at the motor control center with an approved grounding clamp.

3.02 TESTS AND CHECKS

A. The following tests shall be performed on all motors after installation but before putting motors into service.

1. The Contractor shall megger each motor winding before energizing the motor, and, if insulation resistance is found to be low, shall notify the Engineer and shall not energize the motor. The following table gives minimum acceptable insulation resistance in megohms at various temperatures and for various voltages with readings being taken after one minute of megger test run.

TABLE 2

Degree Winding Temperature		**Voltage**		
^{0}F	**^{0}C**	**115V**	**230V**	**460V**
37	3.9	60	108	210
50	10	32	60	120
68	20	13	26	50
86	30	5.6	11	21
104	45	2.4	4.5	8.8
122	50	1	2	3.7
140	60	.5	.85	1.6

2. The Contractor shall check all motors for correct clearances and alignment and for correct lubrication, and shall lubricate if required in accordance with manufacturer's instructions. The Contractor shall check direction of rotation of all motors and reverse connections if necessary.

B. The following tests shall apply to the medium voltage motors:

1. See Paragraph 2.03 B.2 for test requirements.

2. All motors shall be given the standard short commercial test prior to shipment. This shall consist of no load current, check current balance, winding resistance, air gap measurement, high potential tests, and bearing inspection. Six (6) copies of the certified short commercial test shall be mailed to the Engineer prior to shipment.

END OF SECTION

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SECTION 16195
ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Nameplates and tape labels.

B. Wire and cable markers.

C. Color coding.

1.02 SCOPE

A. Provide engraved nameplates for the following equipment as indicated on the drawings:

1. Label all compartments and cabinets.
2. Label all outdoor junction boxes.
3. Label control system panels.

B. All wires shall be marked and color-coded.

C. All control wiring shall have wire numbers on each end.

D. All exposed conduits to be painted to match color of back wall.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Nameplates: Engraved three-layer laminated plastic, black letters on a white background.

B. Wire and Cable Markers: Pre-printed self-sticking type.

C. Color Coding Tape: Vinyl plastic insulating tape, colors as specified in part 3.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Degrease and clean surfaces to receive nameplates and tape labels.

B. Install nameplates and tape labels parallel to equipment lines.

C. Secure nameplates to equipment fronts using screws, rivets, or adhesive. Secure nameplate to inside face of recessed panelboard doors in finished locations.

3.02 WIRE IDENTIFICATION

A. Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identify with branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on schematic and interconnection diagrams or equipment manufacturer's shop drawings for control wiring.

B. Any color coding schemes used in existing work shall be maintained in new work.

C. Conductor Color Coding: Provide color coding for feeder, and branch circuit conductors throughout the project secondary electrical system as follows:

240/120 Volts	Phase	480 Volts
Black	A	Brown
Blue	B	Orange
-	C	-
White	Neutral	White
Green	Ground	Green

3.03 NAMEPLATE ENGRAVING

A. Provide nameplates to identify all electrical distribution and control equipment and loads served. Letter Height: 1/8 inch for individual switches and loads served for distribution and control equipment identification.

B. Panelboards: 1/4 inch; identify equipment designation. 1/8 inch; identify voltage rating and source.

C. Individual Circuit Breakers, Switches, and in Panelboards: 1/8 inch; identify circuit and load served, including location.

D. All labels shall include current, voltage, power, source, locations, and panel name.

END OF SECTION

SECTION 16450
GROUNDING SYSTEM

PART 1 - GENERAL

1.01 Scope of Work

A. Furnish and install a complete grounding system in strict accordance with Article 250 of the National Electrical Code and as hereinafter specified and shown on the Drawings.

1.02 Related Work

A. Conduit shall be as specified under Section 16100.

B. Wire shall be as specified under Section 16120.

PART 2 - PRODUCTS

2.01 Materials

A. Ground rods: Ground rods shall be copperclad steel 5/8-inch x 20 foot. Ground rods shall be Copperweld or be an approved equal product.

PART 3 - EXECUTION

3.01 General

A. Tie into existing grounding system.

B. Grounding electrodes shall be driven as required. Where rock is encountered, grounding plates may be used in lieu of grounding rods.

C. All equipment enclosures, motor and transformer frames, conduits systems, cable armor, exposed structural steel and similar items shall be grounded.

D. Exposed connections shall be made by means of approved grounding clamps. Exposed connections between different metals shall be sealed with No-Oxide Paint Grade A or approved equal. All buried connections shall be made by welding process equal to Cadweld.

E. The grounding grid conductors shall be embedded in backfill material around the structures.

F. All underground conductors shall be laid slack and where exposed to mechanical injury shall be protected by pipes or other substantial guards. If guards are iron pipe or other magnetic material, conductors shall be electrically connected to both ends of the guard.

G. The Contractor shall exercise care to insure good ground continuity, in particular between the conduit system and equipment frames and enclosures. Where necessary, jumper wires shall be installed.

3.02 Tests

A. The Contractor shall test the ground resistance of the system. The Engineer shall be notified forty-eight (48) hours before tests are made to enable the Owner to have designated personnel present. All test equipment shall be provided by the Contractor and approved by the Engineer. Dry season resistance of the system shall not exceed 5 ohms. If such resistance cannot be obtained with the system as shown, the Contractor shall provide additional grounding as directed by the Engineer, without additional payment. The Contractor shall submit all grounding system test results to the Engineer for review.

END OF SECTION

SECTION 16476
DISCONNECTS AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 SCOPE

A. Circuit breakers for panelboards.

B. Molded case circuit breakers for panelboards.

C. Non-Fusible safety switches.

1.02 SUBMITTALS

A. Submit product data according to the Conditions of the Contract and Division 1 Specification Sections.

1.03 REFERENCES

A. Comply with NFPA 70 “National Electrical Code" for components and installation.

B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the “National Electrical Code," Article 100.

2. Listing and Labeling Agency Qualifications: A “Nationally Recognized Testing Laboratory” (NRTL) as defined in OSHA Regulation 1910.7.

PART 2 - PRODUCTS

2.01 Disconnect Switches:

A. Disconnect switches shall be heavy-duty, NEMA type H, quick-make, quick-break, visible blades, 600 volt, 3 pole with full cover interlock. All current carrying parts shall be copper.

B. Enclosure type shall be NEMA 4X, 316 stainless steel with copper lugs. Exterior hardware to be 316 SS.

C. NEMA 7 enclosures shall be cast aluminum.

D. Lugs shall be copper.

E. Exterior hardware to be 316 SS.

F. Switches shall be horsepower rated as manufactured by the EATON, Square D Co., or approved equal.

G. Control wiring shall not pass through any disconnect enclosure. A junction box shall be provided and constructed of the same material as the disconnect. The junction box is to be utilized to separate power and control wiring prior to the disconnect enclosure. Feeder wiring shall be fed from the disconnect and control wiring shall be wired from the junction box directly to the equipment being controlled.

H. Each disconnect shall be provided with a plastic nameplate, affixed to the enclosure without screws, identifying the equipment served, voltage, and circuit designation.

2.02 MANUAL MOTOR STARTERS:

A. Starters shall be furnished and installed for all typed of single-phase motors. Manual starters shall be non-reversing , reversing or two speed type as required. NEMA sizes shall be as required for the actual horsepower of the motor furnished. Manual starters shall have motor overload protection in each phase. Builton control ststions shall be firnished as required or as shown on the drawings.

B. NEMA 4x enclosures shall be 316 stainless steel.

C. NEMA 7 enclosures shall be cast aluminum.

D. Each enclosure/starter shall be provided with a plastic nameplate, affixed to the enclosure without screws, identifying the equipment served, voltage, and circuit designation.

E. Starters shall be as manufactured by the EATON, Square D Co., or approved equal.

2.03 COMBINATION MAGNETIC MOTOR STARTERS:

A. Motor starters shall be a combination motor circuit protector and contactor, 2 or 3 pole, single or 3 phase as required, 60 Hz, 600 Volt, magnetically operated, full voltage non-reversing unless otherwise shown on the drawings. NEMA sizes shall be as required for the horsepowers shown on the drawings. Motor circuit protectors shall be molded case with adjustable magnetic trip only. They shall be specifically designed for use with magnetic motor starters. Motor circuit protectors shall be current limiting type, with additional current limiters if required. Combination motor starters shall be fully rated for 22,000 Amps RMS symmetrical.

B. Two speed starters shall be for single or two winding motors as required by the actual motor furnished or as shown on the drawings.

C. Each motor starter shall have a 120 Volt operating coil, and control power transformer. Starters shall have motor overload protection in each phase. Auxiliary contacts shall be provided as required or as shown on the drawings. A minimum on one N.O. and one N.C. auxiliary contacts shall be provided in addition to the contacts shown on the drawings.

D. Overload relays shall be non-adjustable, ambient compensated and manually reset.

E. Control power transformers shall be sized for additional load where required. Transformer secondaries shall be equipped with time delay fuses.

F. Starters shall be as manufactured by the EATON, Square D Co., or approved equal.

2.04 **EQUIPMENT MOUNTING STANDS:**

A. Mounting stands shall be custom fabricated from ¼ inch 316 stainless steel plate and 3-inch stainless steel channel, unless otherwise shown on the drawings.

B. All hardware shall be 316 stainless steel.

2.05 CIRCUIT BREAKERS

A. Molded Case Circuit Breakers: The current interrupting capacity of the breaker shall be equal or greater to 22,000 amps, unless otherwise indicated.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install enclosed switches and circuit breakers in locations, as indicated, according to manufacturer's written instructions.

B. Install enclosed switches and circuit breakers level and plumb.

C. Install wiring between enclosed switches and circuit breakers and control/indication devices.

D. Connect enclosed switches and circuit breakers and components to wiring system and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals,including screws and bolts according to equipment manufacturer’s published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

END OF SECTION

SECTION 16709
SURGE PROTECTION DEVICES (SPD)

PART 1 – GENERAL

1.01 DESCRIPTION

A. The specified unit shall provide effective high energy transient voltage surge suppression, surge current diversion and high frequency noise attenuation in all electrical modes for equipment connected downstream from the facility's meter or load side of the main overcurrent device. The unit shall be connected in parallel with the facility's wiring system.

1.02 RELATED DOCUMENTS AND APPLICABLE STANDARDS

A. Systems shall be designed, manufactured, tested and installed in accordance with the following applicable documents and standards:

1. Underwriters Laboratories (UL1449 3rd Addition and UL 1283)
2. ANSI/IEEE (C62.41 and C62.45)
3. Military Standards (MIL – STD 220A)
4. National Electric Code (NEC)
5. Underwriter's Laboratories 248

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURER

Current Technologies
Power & Systems Innovations
PO Box 590223
Orlando, FL 32859-0223

Contact:	John West Sr.
Phone	(407) 380-9200
Phone	(800) 260-2259
FAX	(407) 380-3911 FAX
E-mail	jwest@psihq.com
Internet	www.psihq.com

Joslyn, AKA (Total Protection Solutions)
Total Protection Solutions

4366 LB McLeod Road
Orlando, FL 32804

Contact: Bob Levit
Phone 407-841-4405
FAX 407-841-4407
E-mail: bob@treborpowersystems.com
Internet www.treborpowersystems.com

Surge Suppression Inc
Surge Suppression Incorporated
P.O. Box 674
Destin, FL 32540-0674

Contact: Mike Barton
Phone (888) 987-8877
FAX (888) 900-8879
E-mail mbarton@surgesuppression.com

2.02 DEVICES

A. Surge Protection Devices (SPD's) shall be UL listed at or above the available fault current level at the point of SPD application by UL, Per UL 1449 latest edition.

B. The SPD shall be a parallel design using fast-acting energy protection that will divert and dissipate the surge energy.

C. Units shall have:

a. Minimum 10 mode operation for all 3 phase Y and high leg Delta configurations and six modes of protection for all 3 phase Delta "no Neutral" configurations.

b. One nanosecond or less response time for any individual component, and shall be self restoring and fully automatic.

c. Extended noise filtration with a 10 kHz to 100 MHz range.

d. LED indication of unit failure to indicate the continuous positive operational status of each protected phase.

e. System Voltage shall be as indicated on the drawings.

f. The fusing system shall be capable of allowing the rated maximum single

impulse surge current to pass through without fuse operation.

g. SPD's shall be installed with leads as shorts as possible (not to exceed 24 inches). SPD's may be mounted internally in Motor Control Centers, switchgear and switchboards. SPD's shall be mounted externally at panelboards and control panels.

h. All SPD panel units shall be guaranteed by the installing contractor and surge suppression manufacturer to be free of defects in materials and workmanship for a period of not less than 10 years from the date of substantial completion of the system to which the suppressor is installed.

i. For each SPD type or size used on this project provide the following submittal data:

1. Complete schematic data for suppressor, indicating part numbers, dimensional drawings and mounting arrangement.

2. Cut sheets which include Peak Surge Current "per mode", Let Through Current, UL tested voltage protection rating (VPR) and maximum Continuous Operating Voltage (MCOV).

3. Copy of Warranty Statement

2.03 APPLICATIONS

A. Surge Current RATING OF 40 kA PER MODE AT 208 or 240 Volt three phase or single phase branch panels.

2.04 FILTERING

A. The system shall provide a UL 1283 Listed Electromagnetic Interference Filter capable of attenuating noise levels produced by electromagnetic interference and radio frequency interference.

2.05 FUSING

A. Fuse component(s) identification and surge rating. The manufacture shall provide documentation demonstrating the tested surge current rating (8x20µsec) of the fuse. The surge rating of the fuse shall be greater than the combined surge current rating of all downstream connected suppression elements.

B. Fusing: Suppression component(s) identification and surge rating. The manufacturer shall provide documentation identifying the suppression element(s) connected in

series with fuse element(s) and provide the suppression elements published 8x20µsec surge current rating. The rating of the suppression element(s) shall be less than the rating of upstream fusing element(s).

C. Fusing: Surge performance. All fusing shall be required to meet the single pulse surge current testing requirements of Section 2.2 above.

D. Fusing: Isolation. The unit shall have each MOV fused and designed to operate only in the event of an MOV failure within the SPD device.

E. Fusing Coordination: Units that can't demonstrate MOV-fuse coordination in 2.4.a and 2.4.d are not acceptable.

F. Fusing: UL Rating. All fusing shall be 200kAIC UL248 Recognized.

2.06 UL 1449 SUPPRESSED VOLTAGE RATING.

A. The unit shall be UL 1449 3rd Edition Listed and shall be as follows for L-N, L-G, N-G, and L-L, modes, inclusive of the disconnect switch: (Select appropriate product rating from below)

1. 40kA – 80kA rated products/120/208V units: L-N = 400V, L-G=500, N-G=500, and L-L=700
2. 100kA – 150kA rated products/120/208V units: L-N = 400V, L-G=500, N-G=500, and L-L=700
3. 200kA – 300kA rated products/120/208V units: L-N = 400V, L-G=500, N-G=500, and L-L=700

2.07 IN-FIELD TESTING

A. The unit shall be equipped with a performance data extraction protocol allowing unit performance data, including percent of protection remaining, to be transmitted to an internal, external status analyzer.

2.08 ENCLOSURE.

A. Outside - Units shall be provided in a NEMA type 4X plastic enclosure.

PART 3 – EXECUTION

3.01 SYSTEM TESTING

A. Upon completion of installation, a factory-authorized local service representative shall provide product startup testing services. The tests shall include:

1. On-line Testing: Verification that all suppression and filtering paths are operating with 100% protection as well as verification of proper facility neutral-to-ground bond by measuring neutral-to-ground current and voltage.

2. Off-line Testing: Impulse injection to verify the system tolerances as well as verification of proper facility neutral-to-ground bond. To be compared to factory benchmark test parameters supplied with each individual unit.

3.02 DOCUMENTATION AND REPORTING

A. A copy of the startup test results and the factory benchmark testing results shall be supplied to the engineer and the owner for confirmation of proper system function. This letter shall also clarify that the integrity of all neutral-to-ground bonds were verified through testing and visual inspection, and that all grounding bonds were observed to be in place.

3.03 SYSTEM WARRANTY

A. The TVSS system manufacturer shall warranty the entire system against defective materials and workmanship for a period of ten (10) years following substantial completion.

END OF SECTION

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Appendix A
Permits

- Orange County Building Permit (ready to issue letter)

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- **Building permit ready to issue letter will be included once received**

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Appendix D
List of Approved Products

APPENDIX D **LIST OF APPROVED PRODUCTS - TRANSMISSION SYSTEMS** **FEBRUARY 11, 2011**

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Air Release	ARV Enclosure	**All ARV above ground enclosures shall be vented with tamper proof locking device**						
		Water Plus Polyethylene Enclosure	131632 H30-B	Blue 44" Tall	131632 H30-P	Pantone 44"	131632 H30-G	Green 44" Tall
			171730 H40-B	Blue 30" Tall	171730 H40-P	Pantone 30"	171730 H40-G	Green 30" Tall
		Hot Box Vent Guard Fiberglass Enclosure	AVG2036 Encl GP3232 Base	Blue 36" Tall	AVG2036 Encl GP3232 Base	Pantone 36" Tall	AVG2036 Encl GP3232 Base	Green 36" Tall
			AVG2041 Encl GP3232 Base	Blue 41" Tall	AVG2041 Encl GP3232 Base	Pantone 41" Tall	AVG2041 Encl GP3232 Base	Green 41" Tall
		Safety-Guard/Hydro Guard	15100 Encl	Blue 34" Tall	15100 Encl	Pantone 34" Tall	15100 Encl	Green 34" Tall
	Air Release Valves	**Air Release Valves shall be Combination Type, 316 SS**						
		ARI	D-040SS	Combination	D-040SS	Combination	D-020 (SS)	Combination
		H-TEC	NA	NA	NA	NA	986 (316SS)	Combination
		Vent-O-Mat	Series RBX DN50	2"	Series RBX DN50	2"	RGX series	
	ARV Vault	**Air Release Valve Frame and Cover**						
		US Foundry	NA	NA	NA	NA	USF 7665-HH-HJ	
Blow Off	Auto Blow Off	**Automatic Blow Off Valve**						
		Hydro Guard	HG-1 Standard Unit	Automatic	NA	NA	NA	NA
	Blow Off Valve	**Blow Off Valve - Fits standard 5-1/4 inch Valve Box**						
		Kupferle Foundry Co	Truflo Series TF #550		Truflo Series TF #550		NA	NA
		Water Plus Corp	The Hydrant Plus Series VB 2000B		The Hydrant Plus Series VB 2000B		NA	NA
Casing Seals / Spacers	Casing End Seals	**Casing End Seals. Annular space between pipe and steel casing shall be brick and mortar with end seals to secure ends.**						
		Advance Products	Model AC and AW		Model AC and AW		Model AC and AW	
		BWM Company	Model WR and PO		Model WR and PO		Model WR and PO	
		Cascade Water Works	Model CCES		Model CCES		Model CCES	
		CCI Pipeline	Model ESW and ESC		Model ESW and ESC		Model ESW and ESC	
		Pipeline Seal & Insulator, Inc (PSI)	Model C and W		Model C and W		Model C and W	
		Power Seal	Model 4810ES		Model 4810ES		Model 4810ES	

APPENDIX D **LIST OF APPROVED PRODUCTS - TRANSMISSION SYSTEMS** **FEBRUARY 11, 2011**

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Casing Seals / Spacers	Casing spacer	**Casing spacers shall be a min. 8-inches wide for pipe 12" Dia or less or min. 12-inches wide for pipe 16 or greater , shall have a minimum 14 gauge 304 stainless steel shell/band, minimum 10 gauge 304 reinforced risers; minimum thickness of 0.090 EPDM or PVC interior liners, glass reinforces polymer or ultra high molecular weight polyethylene and 304 stainless bolts, nuts and washers.**						
		Advance Products	SSI8 / SSI12		SSI8 / SSI12		SSI8 / SSI12	
		BWM Company	BWM-SS-8 / SS-12		BWM-SS-8 / SS-12		BWM-SS-8 / SS-12	
		Cascade Water Works	Series CCS 8" / 12"		Series CCS 8" / 12"		Series CCS 8" / 12"	
		CCI Pipeline	Model CCS8 / CSS12		Model CCS8 / CSS12		Model CCS8 / CSS12	
		Pipeline Seal & Insulator, Inc (PSI)	Series S8G-2 / S12G-2		Series S8G-2 / S12G-2		Series S8G-2 / S12G-2	
Coatings	Exterior Coatings for Exposed Metal Assets	**Coatings: Aerial pipe, hydrants, above ground piping, fittings, valves and Appurtenances - System 1 Zinc / Urethane / Fluoropolymer application and color code per Section 3119 Coatings & Linings. Coating shall not be in contact with Potable water unless NSF 61 approved.**						
		Carboline	Carbozinc 621	3.0 - 8.0 mils	Carbozinc 621	3.0 - 8.0 mils	Carbozinc 621	3.0 - 8.0 mils
			Carbothane 133 HB	3.0 -5.0 mils	Carbothane 133 HB	3.0 -5.0 mils	Carbothane 133 HB	3.0 -5.0 mils
			Carboxane 950	2.0 - 3.0 mils	Carboxane 950	2.0 - 3.0 mils	Carboxane 950	2.0 - 3.0 mils
		Tnemec	Zinc Series 90-97	2.5 - 3.5 mils	Zinc Series 90-97	2.5 - 3.5 mils	Zinc Series 90-97	2.5 - 3.5 mils
			Typoxy Series 27WB	4.0 -14.0 mils	Typoxy Series 27WB	4.0 -14.0 mils	Typoxy Series 27WB	4.0 -14.0 mils
			EnduraShield Series73	2.0 - 3.0 mils	EnduraShield Series73	2.0 - 3.0 mils	EnduraShield Series73	2.0 - 3.0 mils
			Hydroflon Series 700	2.0 - 3.0 mils	Hydroflon Series 700	2.0 - 3.0 mils	Hydroflon Series 700	2.0 - 3.0 mils
	Exterior Coatings for Exposed Metal Assets	**Coatings: Aerial pipe, hydrants, above ground piping, fittings, valves and Appurtenances - System 2 Zinc / Epoxy / Urethane application and color code per Section 3119 Coatings & Linings. Coating shall not be in contact with Potable water unless NSF 61 approved.**						
		Carboline	Carbozinc 621	3.0 - 8.0 mils	Carbozinc 621	3.0 - 8.0 mils	Carbozinc 621	3.0 - 8.0 mils
			Carboguard 60	4.0 -6.0 mils	Carboguard 60	4.0 -6.0 mils	Carboguard 60	4.0 -6.0 mils
			Carboxane 950	2.0 - 3.0 mils	Carboxane 950	2.0 - 3.0 mils	Carboxane 950	2.0 - 3.0 mils
		Tnemec	Zinc Series 90-97	2.5 - 3.5 mils	Zinc Series 90-97	2.5 - 3.5 mils	Zinc Series 90-97	2.5 - 3.5 mils
			Typoxy Series 27WB	4.0 -14.0 mils	Typoxy Series 27WB	4.0 -14.0 mils	Typoxy Series 27WB	4.0 -14.0 mils
			Hi-Build Epoxoline II Series N69	4.0 - 10.0 mils	Hi-Build Epoxoline II Series N69	4.0 - 10.0 mils	Hi-Build Epoxoline II Series N69	4.0 - 10.0 mils
			EnduraShield Series73	2.0 - 3.0 mils	EnduraShield Series73	2.0 - 3.0 mils	EnduraShield Series73	2.0 - 3.0 mils
		PPG / Ameron	Amercoat 68HS	Min 3.0 mils	Amercoat 68HS	Min 3.0 mils	Amercoat 68HS	Min 3.0 mils
			Amercoat 385	4.0 - 6.0 mils	Amercoat 385	4.0 - 6.0 mils	Amercoat 385	4.0 - 6.0 mils
			Amercoat 450H	2.0 - 3.0 mils	Amercoat 450H	2.0 - 3.0 mils	Amercoat 450H	2.0 - 3.0 mils

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Fittings	Fittings	**Ductile Iron Fittings C153 SSB / C110 FLG: (Water & Reclaimed Water fittings shall cement lined or holiday free fusion bonded epoxy lined) (Wastewater fittings interior shall be Protecto 401 and holiday free)**						
		American	30" & up	FBE / Cement	30" & up	FBE / Cement	30" & up	Protecto 401
		Sigma		FBE / Cement		FBE / Cement		Protecto 401
		Star		FBE / Cement		FBE / Cement		Protecto 401
		Tyler Union & Clow		FBE / Cement		FBE / Cement		Protecto 401
Flow	Flow Meter	**Flow Meters With Replaceable Sensors**						
		EMCO	NA	NA	NA	NA	Unimag 4411E	
Hydrants	Hydrants	**Hydrants Shall open left, 1-1/2 Pentagon operating nut, NST hose & pumper thread, rotate 360 degrees, closed drains, epoxy on shoe in & out and 304 SS nuts & bolts below ground.**						
		American Flow Control	B-84-B (6 inch)		NA	NA	NA	NA
		Clow	Medallion 2545		NA	NA	NA	NA
		Mueller	Super Centurion 250		NA	NA	NA	NA
Joint Restraints	Ductile iron pipe MJ Restraints	**Mechanical Joint Wedge-action Restraining Gland, Epoxy Coated Restrain ductile iron pipe to mechanical joint fittings, pipe and appurtenances.**						
		EBAA Iron Inc	Megalug Series 1100		Megalug Series 1100		Megalug Series 1100	
		Ford / Uni-Flange	UFR-1400		UFR-1400		UFR-1400	
		Sigma	OneLok Series SLD/SLDE		OneLok Series SLD/SLDE		OneLok Series SLD/SLDE	
		Smith Blair	Cam Lok Series 111		Cam Lok Series 111		Cam Lok Series 111	
		Star	Star Grip Series 3000		Star Grip Series 3000		Star Grip Series 3000	
		Tyler Union	TufGrip Series TLD		TufGrip Series TLD		TufGrip Series TLD	
	DIP Bell Joint Restraints (4"-12") (New & Existing)	**Bell Joint Restraints for Ductile Iron Pipe (4"-12") (New & Existing) - All restraints split serrated on bell and spigot ends. Pipe 16" and greater shall have restraint gaskets or locking bells. (Wastewater only for restraint of existing DIP FM)**						
		EBAA Iron Inc	Tru-Dual Series 1500TD		Tru-Dual Series 1500TD		Tru-Dual Series 1500TD	
		Ford / Uni-Flange	Uni-Flange Series 1390C		Uni-Flange Series 1390C		Uni-Flange Series 1390C	
		Sigma	PV-Lok Series PWP-C		PV-Lok Series PWP-C		PV-Lok Series PWP-C	
		Smith Blair	Bell-Lock Series 165		Bell-Lock Series 165		Bell-Lock Series 165	
		Star	StarGrip Series 3100S		StarGrip Series 3100S		StarGrip Series 3100S	
		Tyler Union	TufGrip-Series 300C		TufGrip-Series 300C		TufGrip-Series 300C	
	DIP Bell Joint Restraints (16" & Greater)	**Ductile Iron Pipe Bell Joint Restraints for Ductile Iron Pipe (16" & Greater) - All restraints shall have a split back-up ring for the bell and a serrated or wedge action gland for the spigot end. New installation for water & reclaimed water piping 16" and greater shall have restraint gaskets or locking bells.**						
		EBAA Iron Inc	Series 1100HD	Existing Only	Series 1100HD	Existing Only	Series 1100HD	Existing Only
		Sigma	Series SSLDH	Existing Only	Series SSLDH	Existing Only	Series SSLDH	Existing Only
		Star	Series 3100S	Existing Only	Series 3100S	Existing Only	Series 3100S	Existing Only

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Joint Restraints	Ductile iron pipe Bell Joint Restraint Gaskets and Locking Bell (4" & Above)	**Bell Joint Restraint Gaskets and Locking Bell (4" & Above) Stainless Steel locking wedges built into the gasket-rubber. ANSI/AWWA C111/A21.11 Standard for Rubber-Gasket Joints for Ductile Iron Pressure Pipe. Ductile Iron Bell Joint Restraint for Push-On Pipe- Locking bell joint system that prevents joint separation and allows for joint deflection. Bells shall be painted red to verify restrained gasket.**						
		American	Fast Grip Gasket	Gasket	Fast Grip Gasket	Gasket	NA	NA
			Flex-Ring Joint	Bell Lock	Flex-Ring Joint	Bell Lock	NA	NA
			Lok-Ring Joint	Bell Lock	Lok-Ring Joint	Bell Lock	NA	NA
		Griffin	Talon RJ Gasket	Gasket	Talon RJ Gasket	Gasket	NA	NA
			Snap-Lok	Bell Lock	Snap-Lok	Bell Lock	NA	NA
		McWane Inc. DI Pipe Group	Sure Stop 350 Gasket	Gasket	Sure Stop 350 Gasket	Gasket	NA	NA
			Thrust-Lock	Bell Lock	Thrust-Lock	Bell Lock	NA	NA
			TR-Flex	Bell Lock	TR-Flex	Bell Lock	NA	NA
			Super-Lock	Bell Lock	Super-Lock	Bell Lock	NA	NA
		US Pipe	Field Lok 350 Gasket	Gasket	Field Lok 350 Gasket	Gasket	NA	NA
			Field Lok Gasket	Gasket	Field Lok Gasket	Gasket	NA	NA
			TR-Flex	Bell Lock	TR-Flex	Bell Lock	NA	NA
			HP Lok Restraint Joint	Bell Lock	HP Lok Restraint Joint	Bell Lock	NA	NA
	SS to DIP Transition Restraint	**SS to DIP Transition Restraint -Flanged stainless steel pipe from Wetwell to Valve box restrained joint transition (epoxy coated, SS hardware) Flg x PE RJ.**						
		EBAA Iron Inc	NA	NA	NA	NA	Megaflange 2100	
		Sigma	NA	NA	NA	NA	SigmaFlange with One Lock SLDE	
		Smith Blair	NA	NA	NA	NA	911 Flange - Lock Restrained FCA	
	PVC Pipe MJ Restraints	**Mechanical Joint Wedge-action Restraining Gland, Epoxy Coated Restrain PVC pipe to mechanical joint fittings, and appurtenances.**						
		EBAA Iron Inc	Mega-lug Series 2000PV		Mega-lug Series 2000PV		Mega-lug Series 2000PV	
			NA	NA	NA	NA	Megalug Series 2200	(42"-48")
		Ford / Uni-Flange	UFR 1500 Series		UFR 1500 Series		UFR 1500 Series	
		Sigma	One Lok Series SLC/SLCE		One Lok Series SLC/SLCE		One Lok Series SLC/SLCE	
		Smith Blair	Cam Lok Series 120		Cam Lok Series 120		Cam Lok Series 120	
		Star	Star Grip Series 4000		Star Grip Series 4000		Star Grip Series 4000	
		Tyler Union	TufGrip Series TLP		TufGrip Series TLP		TufGrip Series TLP	
	PVC Bell Joint Restraints (4" - 12") (New & Existing)	**PVC Bell Joint Restraints: PVC pipe Split Serrated on Bell End and Spigot End. (4" - 12") (New & Existing)**						
		EBAA Iron Inc	Tru-Dual Series 1500TD		Tru-Dual Series 1500TD		Tru-Dual Series 1500TD	
		Ford / Uni-Flange	Uni-Flange Series 1390		Uni-Flange Series 1390		Uni-Flange Series 1390	
		Sigma	PV-Lok Series PWP		PV-Lok Series PWP		PV-Lok Series PWP	
		Smith Blair	Bell-Lock Series 165		Bell-Lock Series 165		Bell-Lock Series 165	
		Star	Series 1100C		Series 1100C		Series 1100C	
		Tyler Union	TufGrip 300C		TufGrip 300C		TufGrip 300C	

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Joint Restraints	PVC Bell Joint Restraints (16" & Greater)	**PVC Bell Joint Restraints: (16" & Greater) PVC pipe Split Serrated on Bell End and Spigot End. Water & Reclaimed Water Existing pipe only. Wastewater shall be new and existing pipe.**						
		Ford / Uni-Flange	Series 1390	Existing Only	Series 1390	Existing Only	Series 1390	
		JCM	Sur-Grip Series 621	Existing Only	Sur-Grip Series 621	Existing Only	Sur-Grip Series 621	
		Sigma	PV-Lok PWP	Existing Only	PV-Lok PWP	Existing Only	PV-Lok PWP	
		Smith Blair	Bell-Lock Series 165	Existing Only	Bell-Lock Series 165	Existing Only	Bell-Lock Series 165	
		Star	Series 1100C	Existing Only	Series 1100C	Existing Only	Series 1100C	
Pipe	PVC C900 DR 18 Bell & Spigot (4" - 12")	**C900 Bell & Spigot PVC Pipe: 4 to 12-inch - AWWA C-900, Minimum DR18 for Water, Reclaimed and Wastewater. DR14 for Fire Lines. Manufacturers shall be members in good standing with Uni-Bell to maintain approval status.**						
		Certainteed 4" to 12"	Certa-Lok C900/RJ	Blue	Certa-Lok C900/RJ	Pantone Purple	Certa-Lok C900/RJ	Green
		Diamond Plastics Corp	C-900	Blue	C-900	Pantone Purple	Diamond C900	Green
		Ipex Inc	C-900 Blue Brute	Blue	C-900	Pantone Purple	C900 Blue Brute	Green
		JM Eagle	C-900	Blue	C-900	Pantone Purple	C-900	Green
		National Pipe & Plastics Inc	C-900 Dura- Blue	Blue	C-900	Pantone Purple	C-900 Pipe	Green
		North American Pipe Corp (NAPCO)	C-900	Blue	C-900	Pantone Purple	C-900	Green
		Sanderson Pipe Corp	C-900	Blue	C-900	Pantone Purple	C-900	Green
	PVC C905 DR 18 Bell & Spigot 16" and Larger	**C905 Bell & Spigot PVC Pipe 16" and Larger: AWWA C-905, Minimum DR18 for all Force Mains up to 24". Minimum DR21/DR25 for 30" and greater. Manufacturers shall be members in good standing with Uni-Bell to maintain approval status.**						
		Certainteed 16"	NA	NA	NA	NA	Certa-Lok C905/RJ	NA
		Diamond Plastics Corp	NA	NA	NA	NA	Trans-21 DR18	Green
		Ipex Inc	NA	NA	NA	NA	IPEX Centurion	Green
		JM Eagle	NA	NA	NA	NA	C905 Big Blue	Green
		National Pipe & Plastics Inc	NA	NA	NA	NA	C905	Green
		North American Pipe Corp (NAPCO)	NA	NA	NA	NA	C905 Big Blue	Green
	HDPE C906 DR11	**HDPE Pipe DR11 AWWA C906 shall be Ductile Iron Pipe Size, PE 3408/3608/4710 DIPS manufactured in accordance with ASTM F-714 and listed with NSF. Pipe shall be marked in accordance with either AWWA C901,AWWA C906. Compression type connections are not acceptable in new installations. Pipe joints shall be butt fusion or electro-fusion with flange or adapter. All HDPE shall be color coded to the Utility. Color identifications are in accordance with the APWA/ULCC Uniform Color Code. Manufacturers shall be members in good standing with PPI to maintain approval status.**						
		JM Eagle	HDPE	DR11 Blue	HDPE	DR11 Pantone	HDPE	DR11Green
		Performance Pipe(Chevron)	Driscoplex 4000	DR11 Blue	Driscoplex 4000	DR11 Pantone	Driscoplex 4300	DR11 Green
		PolyPipe, Inc.	EHMW Poly Pipe	DR11 Blue	EHMW	DR11 Pantone	EHMW	DR11Green

APPENDIX D **LIST OF APPROVED PRODUCTS - TRANSMISSION SYSTEMS** **FEBRUARY 11, 2011**

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Pipe	Ductile Iron Pipe	**Ductile iron/Cast iron: (4" to 12" = Class 350, 16" to 24" - Class 250, 30" to 64" = Class 200). Water and Reclaimed water shall be cement lined. Wastewater Piping shall be Protecto 401 and Holiday Free. Exterior coatings as specified. Wastewater DIP piping shall be for pump station piping only. Manufacturers shall be members in good standing with DIPRA to maintain approval status.**						
		American	Cement Lined	Blue	Cement Lined	Pantone Purple	Protecto 401	Pump Station
		Griffin	Cement Lined	Blue	Cement Lined	Pantone Purple	Protecto 401	Pump Station
		McWane Inc. DI Pipe Group	Cement Lined	Blue	Cement Lined	Pantone Purple	Protecto 401	Pump Station
		US Pipe	Cement Lined	Blue	Cement Lined	Pantone Purple	Protecto 401	Pump Station
Sample	Sample Station	**Sample Stations - Bacteriological Sample Station with built in flush system, all internal piping to be 2", brass and includes lockable green enclosures.**						
		Safety-Guard	SG-BSS-05 pedestal #77	green enclosure	NA	NA	NA	NA
		Water Plus Corp	Model 5000	green	NA	NA	NA	NA
Services	Brass Service Saddles	**Brass Service Saddles for 1" & 2" water & reclaimed water services on 4" through 12" Mains - Service saddles can be hinge or bolt controlled OD saddles to be used on C-900 and existing IPS OD PVC pipe.**						
		Ford	Series S-70, S-90	4"-12"	Series S-70, S-90	4"-12"	NA	NA
		AY McDonald	Model 3891 / 3895,3801 / 3805	4"-12"	Model 3891 / 3895,3801 / 3805	4"-12"	NA	NA
		Mueller	Series S-13000/H-13000	4"-12"	Series S-13000/H-13000	4"-12"	NA	NA
	Service Saddles	**Service Saddles for 1" (CC) & 2" (Iron pipe threads) Water & Reclaimed Water services on mains greater than 12". Service saddles for 2" taps (iron pipe threads) on 4" mains and greater for Waste Water. : Epoxy or nylon coated stainless steel 18-8-type 304 double straps, controlled O.D. saddles to be used on C-900 / C905 or DI for all 1-in and -2in taps on pipes over 12in.**						
		Ford	Series FC202	16" & greater	Series FC202	16" & greater	Series FC202	4" & greater
		JCM	Series 406	16" & greater	Series 406	16" & greater	Series 406	4" & greater
		Mueller	DR2S	16" & greater	DR2S	16" & greater	DR2S	4" & greater
		Romac	Series 202NS	16" & greater	Series 202NS	16" & greater	Series 202NS	4" & greater
		Smith Blair	Series 317	16" & greater	Series 317	16" & greater	Series 317	4" & greater
	Service Saddles for HDPE	**Service Saddles for 1" (CC) & 2" (Iron Pipe threads) Water and Reclaimed Water Services: Epoxy or nylon coated stainless steel 18-8-type 304 double straps, controlled O.D. saddles to be used on HDPE for all 1-in and -2in taps. Taps to HDPE pipe shall be approved on a case by case basis.**						
		Ford	Series FCP202		Series FCP202		Series FCP202	
		Romac	Series 202N-H		Series 202N-H		Series 202N-H	
		Smith Blair	Series 317-1 for HDPE		Series 317-1 for HDPE		Series 317-1 for HDPE	
	Corporation Stops Ball Type	**Corporation Stops Ball Type (1-inch with AWWA taper C threads only/pack joint outlet for CTS) 2" Corporation Stop Ball Type shall be 2" MIP X FIP threads.**						
		Ford	FB1000, FB1700-7		FB1000, FB1700-7		FB1700-7	2" ARV
		AY McDonald	4701B-22, 3149B2		4701B-22, 3149B2		3149B2	2" ARV
		Mueller	P25008, B-20046		P25008, B-20046		B-20046	2" ARV

APPENDIX D **LIST OF APPROVED PRODUCTS - TRANSMISSION SYSTEMS** **FEBRUARY 11, 2011**

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Services	Curb Stops	**Curb Stops - Straight Valves: Ball type compression 2" cts O.D. tubing by 2" FIP**						
		Ford	B41-777W		B41-777W		NA	NA
		AY McDonald	6102W-22		6102W-22		NA	NA
		Mueller	P25172		P25172		NA	NA
	Curb Stops	**Curb Stops - Straight Valves: ball type compression x compression**						
		Ford	B44-444W		B44-444W		NA	NA
		AY McDonald	6100W-22		6100W-22		NA	NA
		Mueller	P25146		P25146		NA	NA
	PE tubing	**Polyethylene tubing: AWWA C901. UV protection (SDR-9) 1-inch and 2-inch only. PE 3408 / PE 4710**						
		Charter Plastics	Blue Ice		Lav Ice		NA	NA
		Endot	Endopure Blue		Endocore Lavender		NA	NA
		JM Eagle	Pure-Core		NA	NA	NA	NA
Tapping Sleeves and Valves	Line Stops	**Line Stops**						
		JCM						
		Romac						
		Smith Blair						
	Tapping Sleeves	**Tapping Sleeves: (Mechanical joint for taps on cast iron, ductile iron, PVC & AC pipe, including size on size) with stainless steel nuts and bolts.**						
		American Flow Control	Series 2800		Series 2800		Series 2800	
			Series 1004		Series 1004		Series 1004	
		Clow	Series F-5205	DIP/PVC	Series F-5205	DIP/PVC	Series F-5205	DIP/PVC
			Series F-5207	A/C Pipe	Series F-5207	A/C Pipe	Series F-5207	A/C Pipe
		JCM	Series 414	FBE	Series 414	FBE	Series 414	FBE
		Mueller	Series H-615	DIP/PVC	Series H-615	DIP/PVC	Series H-615	DIP/PVC
			Series H-619	A/C Pipe	Series H-619	A/C Pipe	Series H-619	A/C Pipe
		Smith Blair	Style 623	FBE	Style 623	FBE	Style 623	FBE
	Tapping Valves: 12" and smaller	**Tapping Valves: 12" and smaller - Tapping Valves shall be furnished with an alignment lip and installed in the vertical position for Water and Reclaim Water. Wastewater shall be installed horizontally and abandoned in the open position. Tapping valves shall be resilient seated only and meet the requirements of AWWA C509 or C515**						
		American Flow Control	Series 2500	Alignment Lip	Series 2500	Alignment Lip	Series 2500	Alignment Lip
		Clow	Series F-6114	Alignment Lip	Series F-6114	Alignment Lip	Series F-6114	Alignment Lip
		Mueller	Series T2360 (4"-12")	Alignment Lip	Series T2360 (4"-12")	Alignment Lip	Series T2360 (4"-12")	Alignment Lip

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Tapping Sleeves and Valves	Tapping Valves: 16" and Larger	**Tapping Valves: 16" and Larger - Tapping valves shall be furnished with an alignment lip and be installed in the vertical position for Water and Reclaimed Water. No tapping valve shall be installed horizontally for Water and Reclaim Water unless approved by the engineer. Tapping Valves 16" and larger AWWA C515 resilient seated only (16" and 24" no gearing required) above 24" shall be installed vertically with a spur gear actuator unless noted by the engineer. All tapping valves above 24" shall be furnished with NPT pipe plugs for flushing the tracks when valves are installed horizontally. Tapping valves for Wastewater shall be installed horizontally and abandoned in open position.**						
		American Flow Control	Series 2500	Alignment Lip & flushing port	Series 2500	Alignment Lip & flushing port	Series 2500	Alignment Lip & flushing port
		Clow	Series F-6114	Alignment Lip & flushing port	Series F-6114	Alignment Lip & flushing port	Series F-6114	Alignment Lip & flushing port
		Mueller	Series T2361 (14"&up)	Alignment Lip & flushing port	Series T2361 (14"&up)	Alignment Lip & flushing port	Series T2361 (14"&up)	Alignment Lip & flushing port
Valves	Butterfly Valve 42" and Above	**Butterfly Valves 42"and above. AWWA C504. Actuators input torques based on 150 psi valve pressure and 16 fps velocity with a maximum input of 80 ft-lb on 2" nuts and shall withstand 250 ft-lbs. Valve seats shall be leak-tight in both directions at 150 psi.**						
		Clow	Style #1450		Style #1450		NA	NA
		Dezurik	BAW		BAW		NA	NA
		Mueller / Pratt	LINSEAL III / Groundhog		LINSEAL III / Groundhog		NA	NA
	Check Valves	**Valves (Check) 4-inch and Larger (8 mil epoxy lined)**						
		American Flow Control	NA		NA		Series 600 or 50 line	
		Clow / M&H / Kennedy	NA		NA		106	
		Mueller	NA		NA		Series 2600	
	Gate Valves 4" - 12"	**Gate Valves 12" and smaller - resilient seated only AWWA C509 or C515. Valve seat shall be leak-tight in both directions at 150 psi.**						
		American Flow Control	Series 2500		Series 2500		NA	NA
		Clow	Series F-6100		Series F-6100		NA	NA
		Mueller	Series A-2360		Series A-2360		NA	NA
	Gate Valves (Vertical) 16" and Up	**Gate Valves 16" and larger (Vertical Installation) AWWA C515 resilient seated only (16" and 24" no gearing required) above 24" shall be installed vertically with a gear actuator unless noted by the engineer. Valve seat shall be leak-tight in both directions at 150 psi.**						
		American Flow Control	Series 2500		Series 2500		NA	NA
		Clow	Series F-6100		Series F-6100			
		Mueller	Series A-2361		Series A-2361		NA	NA

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Valves	Plug Valves	**Plug Valves - Bi-directional, MJ & Flanged (min. 8mil fusion bonded epoxy with stainless steel bolts), gear operator to be sized for rated pressure of the valve. Valves 4"-20" shall be 80% Full Port and valves 24" and greater shall be minimum of 70% full port. Valve shall be factory tested to minimium 100 PSI in both directions.**						
		Clow	NA	NA	NA	NA	F-5412 FLG	4" & up
			NA	NA	NA	NA	F-5413 MJ	4" & up
		Dezurik	NA	NA	NA	NA	Series PEF or PEC	4"& up
		Millikan / Pratt	NA	NA	NA	NA	Eccentric / Ballcentric	4"& up
		Val-Matic	NA	NA	NA	NA	5600 or 5800 (FLG)	4" & up
			NA	NA	NA	NA	5700 or 5900 (MJ)	4" & up
Valve Boxes	Valve Boxes with Locking Lids (Cast Iron)	**Two piece standard screw type Heavy Duty Valve Boxes with Locking Lids (Cast Iron) and type of service cast in heavy duty traffic lid (H20 loading) ASTM A48**						
		Bingham/Taylor	Series 4905	Box	NA	NA	Series 4905	Box
			4905-X	Extension	NA	NA	4905-X	Extension
			4904-L	Blue Water Locking Lid	NA	NA	4904-L	Green Sewer locking Lid
		Sigma	Series VB 261X-267X	Box	VB-25031LK-VB-2612	Box	Series VB 261X-267X	Box
			VB 6302	Extension	VB-6302	Extension	VB 6302	Extension
			VB 4650W	Blue Water Locking Lid	VB2503LK	Purple Square Locking Lid	VB 4650S	Green Sewer locking Lid
		Star	Series VB-0002	Box	NA	NA	Series VB-0002	Box
			VBEX 12-24S	Extension	NA	NA	VBEX 12-24S	Extension
			VBLIDLOCK	Blue Water Locking Lid	NA	NA	VBLIDLOCK	Green Sewer locking Lid
		Tyler Union	Series 6850	Box	NA	NA	Series 6850	Box
			58, 59, 60	Extension	NA	NA	58, 59, 60	Extension
			Locking Lid	Blue Water Locking Lid	NA	NA	Locking Lid	Green Sewer locking Lid
	Valve Box	**For mains equal to, or greater than, 16" diameter or equal to greater than 6' feet deep**						
		American Flow Control	# 2A - 9A Retrofit Valve Box Insert	Fit inside std valve boxes	NA		2A - 9A Retrofit Valve Box Insert	Green Sewer locking Lid
		Mueller Company	MVB050C thru MVB130C with Extension Stem MVB875 Guide Plate	Blue Water Locking Lid	MVB050CR thru MVB130CR with Extension Stem MVB875 Guide Plate	Purple Square Locking Reclaim Lid	MVB050C thru MVB130C with Extension Stem MVB875 Guide Plate	Green Sewer locking Lid

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Coatings	Anti-Graffiti Paint	**Block Walls-Anti-Graffiti Paint per Section 3119 Coatings & Linings**						
		American Building Restoration Products	NA	NA	NA	NA	Polyshield Graffiti Preventer for Unpainted Masonry Type B	Super Bio Strip or Strip it all
		Tnemec / Chemprobe	NA	NA	NA	NA	626 DUR A PEL	680 Mark A Way
		Professional Products of Kansas, Inc	NA	NA	NA	NA	Professional Water Seal & Anti-Graffitiant (PWS-15 Super Strength)	Professional Phase II Cleaner
	Coatings for Existing Manholes	**Rehabilitation corrosion protection system per Section 3119 Coatings & Linings. Interior coating for force main connections to existing concrete manholes only. New precast structures and existing pump stations shall be lined.**						
		CCI Spectrum, Inc	NA	NA	NA	NA	Spectrashield	min of 500 mils
		Kerneos Aluminate Technologies	NA	NA	NA	NA	Sewpercoat	1" (1000mil)
		Raven Lining System	NA	NA	NA	NA	Raven 155 Primer Raven 405	min 8 mils min 125 mils
		Sauereisen	NA	NA	NA	NA	210 Series Topcoat Glaze 210G	min 125 mils min 20 mils
		Tnemec	NA	NA	NA	NA	Series 434 Topcoat Glaze 435	min 125 mils 15-20 mils
PVC Pipe and fittings	Pipe SDR 35 Gravity Mains	**PVC Pipe for Gravity SDR26/SDR 35 (Green in color) ASTM-D034. Manufacturers shall be members in good standing with Uni-Bell to maintain approval status.**						
		Certainteed	NA	NA	NA	NA	Gravity Sewer Pipe	
		Diamond Plastics Corp	NA	NA	NA	NA	Sani-21 SDR-35	
		JM Eagle	NA	NA	NA	NA	Gravity Sewer	
		National Pipe & Plastics, Inc.	NA	NA	NA	NA	Ever-Green Sewer Pipe	
		North American Pipe Corp (NAPCO)	NA	NA	NA	NA	Gravity Sewer	
		Sanderson Pipe Corp	NA	NA	NA	NA	Gravity Sewer	
	Locate Balls	**Locating Marker Systems - Wastewater Locator balls placed at all sanitary sewer cleanouts**						
		3M	NA	NA	NA	NA	3M™ EMS 4" Extended Range 5' Ball Marker 1404-XR	
	Fittings SDR 35	**Fittings, Adapters and Plugs - Gravity PVC ASTM-D3034, Min SDR26/ SDR 35**						
		GPK Products, Inc.	NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings	
		Harrington Corporation (HARCO)	NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings	
		Multi Fittings Corp.	NA	NA	NA	NA	SDR26/SDR 35 Trench Tough Sewer Fittings	
		JM Eagle	NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings	
		Plastic Trends Inc	NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings	
		TIGRE USA, Inc.	NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings	

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
PVC Pipe a	Flexible Pipe Connectors	**Flexible Pipe Connectors and Transitions**						
		Fernco	NA	NA	NA	NA	1002, 1051, 1056 Series	
		Indiana Seal	NA	NA	NA	NA	102, 151, 156 Series	
		Mission Rubber	NA	NA	NA	NA	MR02, MR51, MR 56 Series	
Precast Concrete Structures	MH Lids	**Frame and Cover**						
		USF Fabrication Inc.	NA	NA	NA	NA	USF 225-AS	
	Adj Ring	**Top Adjusting Rings - HDPE with heavy duty loading (H-20)**						
		Ladtech, Inc	NA	NA	NA	NA	24R, 24S with Rope Sealant CS2455	
	Hatches	**Wet Well and Valve Vault Access Frames and Covers (Include the term "Confined Space" etched or cast into the cover with recessed lock & hasp. Frames and covers per manufacturers specifications.**						
		Halliday Products	NA	NA	NA	NA	S1R or S2R Series	
		USF Fabrication Inc.	NA	NA	NA	NA	APS or APD Series	
	Precast Concrete Structures	**Precast Manhole and Wetwell Structures ASTM C478. Precast concrete shall be batched with concrete dyed crystalline waterproofing admixture with corrosion protection. Concrete without admixture or without color tint /tracer shall be rejected.**						
		Allied Precast	NA	NA	NA	NA	Dyed Admix	
		Atlantic Concrete Products, Inc.	NA	NA	NA	NA	Dyed Admix	
		Delzotto Products, Inc.	NA	NA	NA	NA	Dyed Admix	
		Dura Stress Underground Inc.	NA	NA	NA	NA	Dyed Admix	
		Hanson Pipe & Product	NA	NA	NA	NA	Dyed Admix	
		Mack Concrete	NA	NA	NA	NA	Dyed Admix	
		Oldcastle Precast	NA	NA	NA	NA	Dyed Admix	
		Standard Precast Inc.	NA	NA	NA	NA	Dyed Admix	
	Concrete Admix	**Crystalline Waterproofing Concrete Admix with color dye shall be added to all concrete structures (precast and cast-in-place) to provide waterproofing and corrosion resistance. Concrete without admixture or without color tint / tracer shall be rejected. % concentration of admix with colored dye added to the mix shall be based on weight of cement.**						
		Kryton International	NA	NA	NA	NA	KIM K-301R (with red dye)	2%
		Xypex Chemical Corp	NA	NA	NA	NA	Xypex Admix C-1000Red (with red dye)	3.0 - 3.5%
	Liners	**Interior Liner for New or existing Precast Manhole and Precast Wetwell Structures per Section 3119 Coatings & Linings**						
		AFE	NA	NA	NA	NA	Fiberglass Liner	
		AGRU Liner	NA	NA	NA	NA	HDPE Liner (Min 2 mm for Manhole / Min 5 mm for Pump Station)	
		Containment Solutions Inc. (Flowtite)	NA	NA	NA	NA	Fiberglass Liner	
		GSE Studliner	NA	NA	NA	NA	HDPE Liner (Min 2 mm for Manhole / Min 5 mm for Pump Station)	
		GU Liner	NA	NA	NA	NA	Reinforced Plastic Liner	
		L & F Manufacturing	NA	NA	NA	NA	Fiberglass Liner	

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Precast Concrete Structures	Heat Shrink Seal	**Heat Shrink Seal - Precast structures shall be primed with manufacturer approved primer prior to application of heat shrunk encapsulation.**						
		Canusa-CPS	NA	NA	NA	NA	Wrapid Seal with WrapidSeal Primer (Canusa G Primer)	
		Pipeline Seal & Insulator, Inc (PSI)	NA	NA	NA	NA	Riser Wrap with Polyken 1027 or 1039 primer	
	Jointing Material	**Jointing Material Min. 2" width for all products to ensure squeeze out with manufacturer approved primer.**						
		Henry Company	NA	NA	NA	NA	Ram-Nek	with Primer
		Martin Asphalt Company	NA	NA	NA	NA	Evergrip 990	with Primer
		Trelleborg Pipe Seals	NA	NA	NA	NA	NPC – Bidco C-56	with Primer
	Pipe Seals Gravity	**Resilient Connector Pipe Seals, Manhole - Gravity less than 12-inch and less than 15-ft deep**						
		Atlantic Concrete	NA	NA	NA	NA	A-Lok (cast-in-place)	
		Hail Mary Rubber	NA	NA	NA	NA	Star Seal (cast-in-place)	
		IPS	NA	NA	NA	NA	Wedge Style	
		NPC	NA	NA	NA	NA	Kor-N-Seal Model WS	
		Press seal gasket	NA	NA	NA	NA	PSX Direct Drive	
	Pipe Seals Gravity	**Cast in Place Pipe Seals, Manhole - Gravity Greater Than or Equal to 12-inch and all pipe sizes greater than 15-ft deep**						
		Atlantic Concrete	NA	NA	NA	NA	A-Lok	cast in place
		Hail Mary Rubber	NA	NA	NA	NA	Star Seal	cast in place
	FM Pipe Seals	**Modular Pipe Seals for Wet Well and Valve Box penetrations and all forcemain connections to existing and new precast concrete structures. EPDM Rubber with 316 SS Hardware**						
		CCI Pipeline Systems	NA	NA	NA	NA	Wrap-It Link WL-SS Series	
		Pipeline Seal & Insulator, Inc / Link Seal	NA	NA	NA	NA	Link-Seal S-316 Modular Seal	
		Proco Products, Inc	NA	NA	NA	NA	PenSeal ES-PS Series	

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Generator	Gen	**Generator Systems, Fixed Shall be UL 2200 Certified.**						
		Caterpillar	NA	NA	NA	NA	CAT Diesel Generator Set	
		Cummins Power Generation	NA	NA	NA	NA	Diesel Generator Set	
	Fuel Tanks	**Generator Fuel Tanks. Shall be UL2085 certified.**						
		Convault	NA	NA	NA	NA	CVT-3SF or CVT-3FF	
		Phoenix	NA	NA	NA	NA	Envirovault	
	GR	**Generator Receptacle (GR)**						
		Cooper Crouse-Hinds	NA	NA	NA	NA	AR2042 (230V, 200A, 3P, 4W)	With AJA1 Angle Adaptor
		Cooper Crouse-Hinds	NA	NA	NA	NA	AR2042-S22 (460V, 200A, 3P, 4W)	With AJA1 Angle Adaptor
		Pyle National	NA	NA	NA	NA	JRE-4100 (230V, 100A, 3P, 4W)	
	ATS	**Generator Transfer Switch**						
		Russelectric	NA	NA	NA	NA	RMTD Series with model 2000 controller	NEMA 12/3R 316SS Enclosure
Odor Control Units	Biotrickling Filters	**Biotrickling filters**						
		BioAir	NA	NA	NA	NA		
		Biorem	NA	NA	NA	NA	Biosorbens BTF	
		Envirogen	NA	NA	NA	NA	BTF	
		Siemens	NA	NA	NA	NA	Zabocs BTF	
	Carbon Adsorption Units	**Carbon Adsorption Units**						
		Calgon	NA	NA	NA	NA		
		Pure Air Filtration	NA	NA	NA	NA		
		Siemens	NA	NA	NA	NA		
Pressure Gauges	Pressure Gauges	**Pressure Gauges shall have Diaphragm Seals. Oil filled.**						
		Ashcroft	NA	NA	NA	NA	10 1008SL 02L 60# 25 200SS 02T XYTSE	Gauge Diaphragm Seal
		Trerice	NA	NA	NA	NA	D83LFSS4002LA100 - Gauge M51001SSSS - Diaphragm Seal D99100 Fill and Mount Charge	
		Winter Gauges	NA	NA	NA	NA	PFQ770 0-60 PSI D70950 top D70954 Bottom	
Pumps	Pumps	**Submersible Pumps**						
		ABS	NA	NA	NA	NA		
		Flygt	NA	NA	NA	NA		

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Pumps	Floats	**Float Regulator (FR) - Duplex and Triplex Pump Stations**						
		Atlantic Scientific	NA	NA	NA	NA		Roto-Float
	Radar	**Radar - Pulse Burst Radar Transmitter. Input 24 VDC and Output 4-20 mA**						
		Magnetrol	NA	NA	NA	NA		R82-520A-011
Pump Station Main Ser	Main Srvc Disconne	**Main Service Disconnect Breaker**						
		Square D	NA	NA	NA	NA		H or J Frame 3 Pole 600 Volt (HGL or JGL determined by amperage)
	Surge Protector Device	**Surge Protector - UL 1449, 3rd Edition listed and labeled, minimum 10 year warranty, NEMA LS-1 and IEEEC62, 41/45 tested with NEMA 4X enclosure, internal fusing, voltage and phase to match service. Rated 80,000 amps per mode for Duplex & Triplex stations and 150,000 Amperes per mode for Master Stations. All devices shall be provided with a NEMA 4X Plastic enclosure which is approved in lieu of stainless steel.**						
		Current Technology (Power & Systems	NA	NA	NA	NA		XN-80, TG-150 or CurrentGuard 150 Plus Series
		Josyln AKA (Total Protection Solutions)	NA	NA	NA	NA		TSS-ST 160 Series, ST 300 Series or JSP-300 Series
		Surge Suppressors, Inc	NA	NA	NA	NA		LSE Series or SHL Series
Sub Panel	Sub Panel	**Sub-Panel Enclosure - NEMA 12/3R Enclosure 316SS, white polyester Powder coated-finish inside and out, With 3 Point Pad lockable Handle, and Door Stop**						
		Hoffman	NA	NA	NA	NA		
		Schaefer	NA	NA	NA	NA		
		Universal enclosure systems	NA	NA	NA	NA		
Pump Station Control Panel	Control Panel	**Control Panel Supplier**						
		ECS	NA	NA	NA	NA		
		Sta-Con Inc	NA	NA	NA	NA		
	Enclosure	**Enclosure - NEMA 12/3R Enclosure 316SS, white polyester Powder coated finish inside and out, With 3 Point Pad lockable Handle, and Door Stop**						
		Hoffman	NA	NA	NA	NA		
		Schaefer	NA	NA	NA	NA		
		Universal enclosure systems	NA	NA	NA	NA		
	Mnts	**Mounting Channel for Enclosures**						
		Unistrut Stainless Steel	NA	NA	NA	NA		1" 5/8 x 1" 5/8 316 SS
	Seal-off	**Explosion-Proof Sealoff**						
		Cooper Crouse-Hinds	NA	NA	NA	NA		EYSR - 2 Inch Min.
	FL	**Flasher (FL)**						
		MPE	NA	NA	NA	NA		025-120-105
		SSAC	NA	NA	NA	NA		FS-126

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Pump Station Control Panel	AL	**Alarm Light / With Base and Globe (AL)**						
		American Electric	NA	NA	NA	NA	F32552	
		Red Dot Globe Red Dot Base	NA	NA	NA	NA	VGLR-01 VA-01	
	AH	**Alarm Horn (AH)**						
		Wheelock	NA	NA	NA	NA	3IT-115-R	
	Fuse	**Fuses (F)**						
		Bussmann	NA	NA	NA	NA	FNQ-R or KTK-R	
	HOA	**Hand-Auto-Off Selector (HOA)**						
		Square D	NA	NA	NA	NA	9001-SKS43B	
	HSS	**Horn Silence Button (HSS)**						
		Square D	NA	NA	NA	NA	9001-SKR1RH5	
	Inter-lock	**Mechanical Interlock**						
		Square D	NA	NA	NA	NA	S29354	
	Breakers	**Control Panel Main Circuit Breaker (MCB) With S29450 Circuit Breaker Auxiliary Switch**						
		Square D	NA	NA	NA	NA	H or J Frame 3 Pole 600 Volt (HGL or JGL determined by amperage)	
		Emergency Circuit Breaker (ECB) With S29450 Circuit Breaker Auxiliary Switch						
		Square D	NA	NA	NA	NA	H or J Frame 3 Pole 600 Volt (HGL or JGL determined by amperage)	
		Motor Circuit Breaker (MB)						
		Square D	NA	NA	NA	NA	H or J Frame 3 Pole 600 Volt (HGL or JGL determined by amperage)	
		Control Circuit Breaker/ GFCI Receptacle Breaker/ SCADA Breaker						
		Square D	NA	NA	NA	NA	QOU120	
	MS	**Motor Starter (MS)**						
		Square D	NA	NA	NA	NA	Type S Class 8536	
	OL	**Overload Heater(OL)**						
		Square D	NA	NA	NA	NA	Part number will vary with size needed	
	OR	**Overload Reset**						
		Square D	NA	NA	NA	NA	9066-RA1	
	Transformer	**Control Circuit Transformer (XMFR)**						
		Square D	NA	NA	NA	NA	9070TF75D23	120/24 Volt .075 KVA
		Main Circuit Transformer (MCT)						
		Square D	NA	NA	NA	NA	9070T2000D1	480/120 2KVA
	SPB	**Supplemental Protector Breaker - 3 pole, 1-amp for Phase Monitor**						
		Square D	NA	NA	NA	NA	MG24532	

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Pump Station Control Panel	PM	**Phase Monitor (PM)**						
		MPE 240 V.	NA	NA	NA	NA	001-230-118-OVG5	
		MPE 480 V.	NA	NA	NA	NA	002-480-123-OVG5	
	Pump Alternator	**Pump Automatic Alternator (PAA)**						
		Diversified Duplex	NA	NA	NA	NA	ARA-120-ACA	
		Diversified Triplex	NA	NA	NA	NA	ARA-120-AME	
		MPE Duplex	NA	NA	NA	NA	008-120-13SP	
		MPE Triplex	NA	NA	NA	NA	009-120-23P	
		MPE Triplex Socket	NA	NA	NA	NA	SD-12-PC	
	Alt. Test Switch	**Alt. Test Switch**						
		Carling Technologies	NA	NA	NA	NA	6GG5E-78	
		Honeywell	NA	NA	NA	NA	2TL1-50	
	Relay	**Relay**						
		Potter Brumfield 24 Volt	NA	NA	NA	NA	KRPA-11AN-24	
		Potter Brumfield 120 Volt	NA	NA	NA	NA	KRPA-11AN-120	
		Square D 24 Volt	NA	NA	NA	NA	8501KP12P14V14	
		Square D 120Volt	NA	NA	NA	NA	8501KP12P14V20	
	Relay Base	**Relay Base**						
		IEDC 8 Pin Relay Base 600 Volt	NA	NA	NA	NA	SR2P-06	
	Duplex Receptacle / GFCI	**Duplex Receptacle/GFCI (DR) Upgraded to 20 Amp**						
		Hubbell	NA	NA	NA	NA	GFTR20BK	
		Pass & Seymour	NA	NA	NA	NA	2095TRBK	
	ETM	**Elapse Time Meter (ETM)**						
		Reddington	NA	NA	NA	NA	711-0160	
	Grounding	**Grounding System**						
		Marathon	NA	NA	NA	NA	Neutral Isolation Block 1421570	
		Panduit	NA	NA	NA	NA	Ground Lug LAM2A 1/0 - 014 -6Y	
		Square D	NA	NA	NA	NA	Ground Buss PK7GTA	
	TS	**Terminal Strip (TS)**						
		Marathon	NA	NA	NA	NA	Series 200	
		Square D	NA	NA	NA	NA	9080GR6	
	TS	**Terminal Strip End Blocks and End Clamps**						
		Square D	NA	NA	NA	NA	9080GM6B & 9080GH10	

APPENDIX D **LIST OF APPROVED PRODUCTS - PUMP STATION SYSTEMS** **FEBRUARY 11, 2011**

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Pump Station Control Panel	PL	**Pilot Light (PL) 24 Volt with 1819 Bulb**						
		Dialight	NA	NA	NA	NA	803-1710	
		Lighting Components & Design	NA	NA	NA	NA	Littlelight 930507X	
	RL	**Run Indicator Light (RL) 120 Volt**						
		Dialight	NA	NA	NA	NA	803-1710	
		Lighting Components & Design	NA	NA	NA	NA	Littlelites 930507X With 120MB Bulb	
	MT	**Moisture and Temperature Failure Light (MT) 120 Volt with 120MB Bulb**						
		Dialight	NA	NA	NA	NA	803-1710	
		Lighting Components & Design	NA	NA	NA	NA	Littlelites 930507X	
Sluice	Sluice Gate	**Sluice Gate for Wet Well with Motorized Operator**						
		BNW	NA	NA	NA	NA	Model 77 - 316 SS	
		Fontaine	NA	NA	NA	NA	Model 20 - 316 SS	
VFD	VFD	**Variable Frequency Drives**						
		Square D	NA	NA	NA	NA		

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